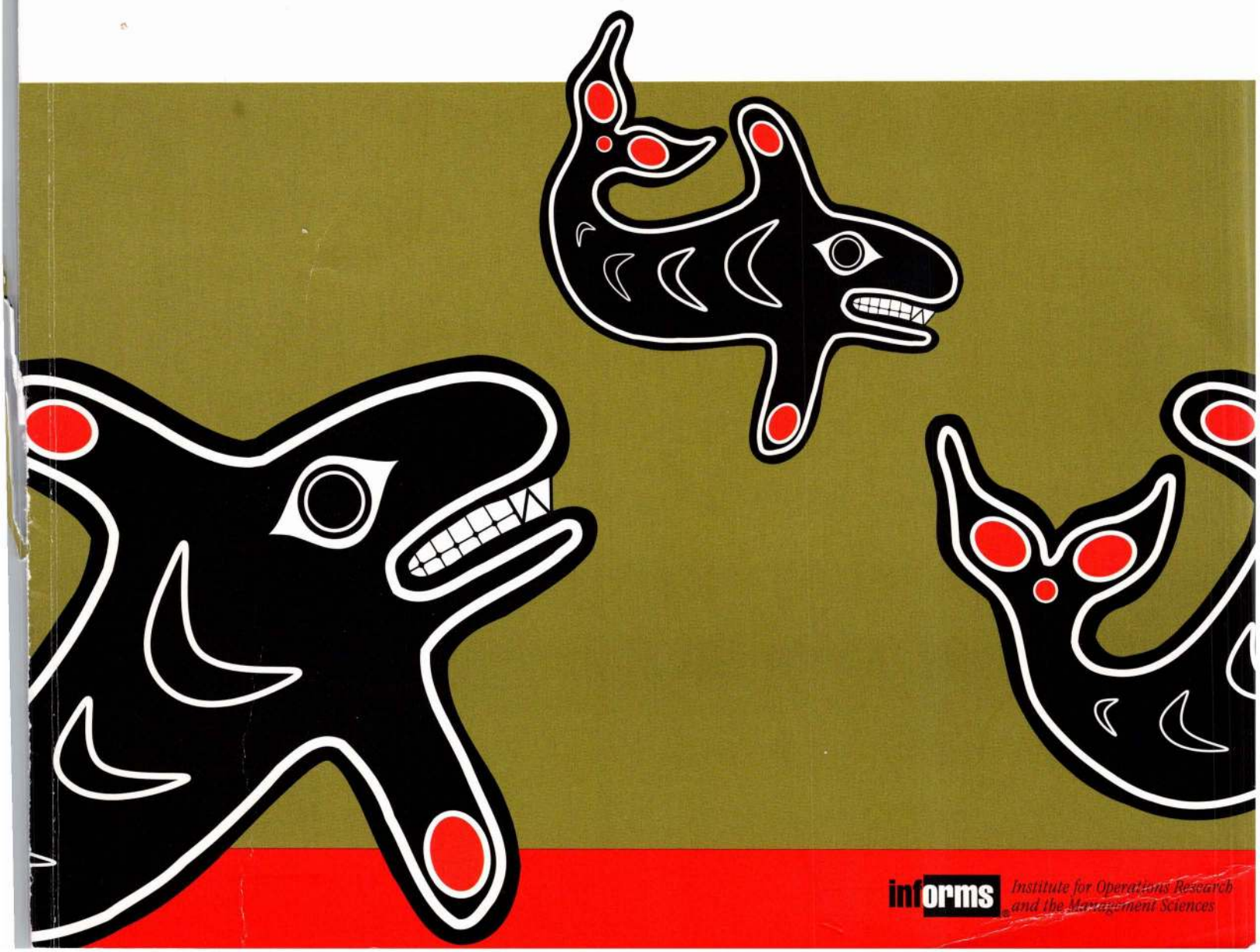
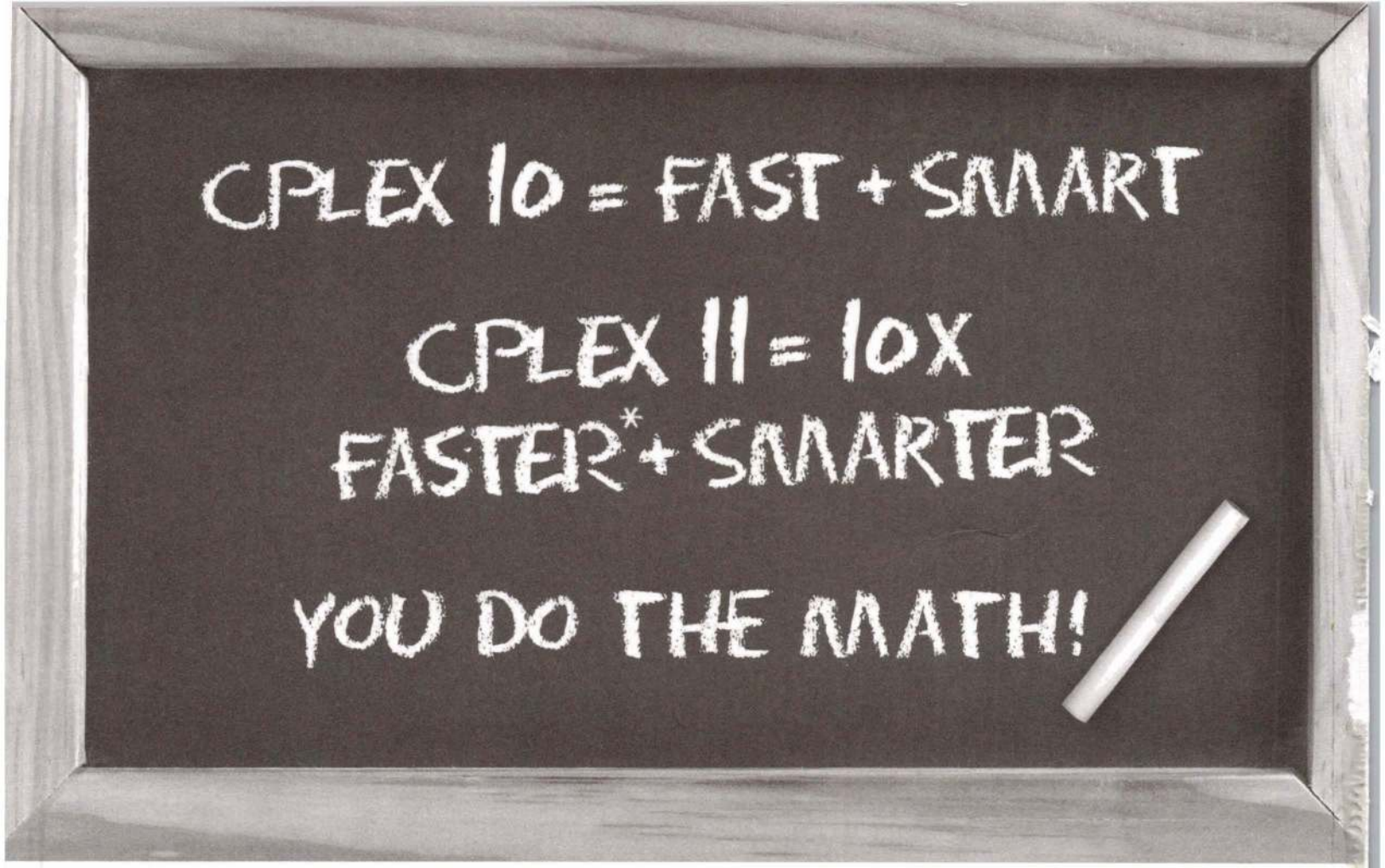


INFORMS Annual Meeting Seattle 2007

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Table of Contents

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Sponsors 2
Welcome from the General Chair 3
Program at a Glance 4
Schedule of Special Events 6
INFORMS Hotels 9
Schedule of Subdivision Business Meetings 11
Speaker Information 13
Guest Program & Tours, Plant Tours 15
Special Receptions 16
Networking & Social Events 19
Saturday Workshops 20
For Practitioners 21
Special Programs 22
Technical Program
Plenary & Keynote Presentations 23
Tutorials 29
Software Demonstrations 32
Interactive Sessions 36
Exhibitors 38
Maps & Floor Plans 42
Master Track Schedule 44
Invited Cluster Chairs 49
Sponsored Cluster Chairs 51
INFORMS Future Meetings 52
Technical Sessions
Sunday 53
Monday 134
Tuesday 213
Wednesday 296
Session Chair Index 375
Author Index 379
Session Index 401

INDEX OF ADVERTISERS

ILOG, Inc. ..... Inside Front Cover
Wiley-Blackwell 8
INFORMS Subdivisions 10
McGraw-Hill/Irwin 12
TutORials in OR 14
South-Western, Cengage Learning 18
INFORMS Practice Conference 2008 21
Stanford University Press 27
Wiley 30
Aptech Systems 34
Palgrave Macmillan 37
Springer 48
Palisade Corporation 50
Frontline Systems, Inc. ..... Inside Back Cover
Paragon Decision Technology ..... Back Cover

Copies of papers abstracted in the meeting program are available only from the authors. Requests for papers should be sent to the authors at the addresses shown in the program. Published annually prior to the meeting by the Institute for Operations Research and the Management Sciences. Individual issues of the program are available for $20US per copy. Orders must be prepaid and sent to INFORMS, PO Box 631704, Baltimore, MD 21263-1704.

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Welcome from the General Chair

UW

UNIVERSITY OF WASHINGTON

Industrial Engineering

Dear Colleagues and Friends,

It is my great pleasure to welcome you to Seattle for the 2007 INFORMS Annual Meeting. There is something for everyone in this jam-packed, 60-parallel session meeting over four days. I hope you can also enjoy what Seattle and the region have to offer in terms of restaurants, ferry rides, espresso and flying fish.

The Spirit of Technology is a very fitting theme for Seattle, where high-tech blends with nature. If you don't get to enjoy the vistas of Mt. Rainier, at least you will bring home an umbrella, compliments of ILOG and INFORMS. The Orca killer whale in our logo symbolizes a powerful spirit. Killer whales are symbols of longevity and constancy, since they are believed to mate for life. They are also regarded as guardians and rulers of the sea due to their excellent hunting ability and sheer power.

This year's program offers an incredible group of plenary and keynote speakers, world-renowned tutorial speakers, a CD with selected tutorial papers, local plant tours and excursions, and great social events. We have a few special sessions I would like to call to your attention:

To the memory of Frank Bass,
To the memory of Peter L. Hammer;
The Applied Probability Society Markov lecture.

These are in addition to a wonderful collection of sessions with applications in homeland security, medicine, logistics and many other fields of operations research and management science.

I would like to thank the Organizing Committee–Kathryn Stecke, Grace Lin, Ted Klastorin, Frieda Granot, Daniel Granot, Leyuan Shi, Jeff Arthur, Alan King, Evangelos Triantaphyllou, Laura Kang and Archis Ghate–for their hard work in putting this program together. Special appreciation goes to the INFORMS staff for their efficient and effective style of ensuring top quality in all aspects of the conference. Thanks goes to our generous academic sponsors, including the University of Washington, University of British Columbia, University of Oregon, and the University of Texas at Dallas and corporate sponsors, including SmartOps, ILOG, Microsoft Research, IBM, Boeing, Hewlett-Packard, AIMMS-Paragon, SAS and Areva.

Don't miss the great social and networking opportunities throughout the conference, starting with the Sunday Welcome Reception followed by the Awards Ceremony, individual receptions on Monday night, the General Reception on Tuesday at the unique Seattle Experience Music Project, and for those fortunate to be in Seattle on Wednesday afternoon, a final fun reception with H-umOR in OR."

Enjoy INFORMS in Seattle, and take a bit of our spirit home with you.

Zelda Zabinsky
General Chair
INFORMS Seattle 2007

Box 352650 Seattle, Washington 98195-2650 206-543-1427 FAX: 206-685-3072

Program at a Glance

NOTE:
Technical sessions are held at the Convention Center and Sheraton. Check the Master Track Schedule on pages 44-47 for specific room locations.

KEY
CC-Convention Center
S - Sheraton

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Annual Meeting 2007 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; the fee is $5.

SATURDAY, NOVEMBER 3

8:00am-8:30am	AI/DM Workshop Breakfast/Welcome	S – Metropolitan A, Level 3
8:00am-5:00pm	CIST Conference	S – Aspen & Juniper, Level 2
8:30am-5:00pm	AI/DM Workshop	S – Ballard & Capitol Hill, Level 3
9:00am-5:00pm	Organization Science Program	S – Issaquah, Level 3
12:00pm-6:00pm	Vendor (Exhibitor) Workshops	S – Levels 3 & 4
3:00pm-7:00pm	Registration	CC – East Lobby, Level 6
5:00pm-6:00pm	INFORMS Membership Meeting	CC – Room 603

SUNDAY, NOVEMBER 4

7:00am-5:00pm	Registration	CC – East Lobby, Level 6
8:00am-4:30pm	CIST Conference	S – Aspen & Juniper, Level 2
8:00am-9:30am	Technical Sessions (SA)	Convention Center & Sheraton
9:30am-10:00am	Coffee Break	CC – East & West Lobbies S – Metropolitan Foyer, Level 3
10:00am-11:30am	Technical Sessions (SB)	Convention Center & Sheraton
11:40am-12:30pm	Plenary Presentation	CC – Ballroom 6E
12:00pm-5:00pm	Job Fair & Email Center	CC – Ballroom 6A
12:30pm-1:30pm	Lunch Break (on your own) Lunch available for purchase, Exhibit Hall.	
1:30pm-3:00pm	Technical Sessions (SC)	Convention Center & Sheraton
3:10pm-4:00pm	Keynote Presentations	CC – Ballroom 6E & Room 608
4:00pm-4:30pm	Coffee Break	CC – East & West Lobbies
4:30pm-6:00pm	Technical Sessions (SD)	Convention Center & Sheraton
6:15pm-7:15pm	Subdivision Business Meetings	See p. 11
7:30pm-9:00pm	Welcome Reception-Exhibits Open	CC – Ballroom 6B
8:30pm-9:45pm	Awards Ceremony & Dessert Reception	CC – Ballroom 6E

MONDAY, NOVEMBER 5

7:00am-5:00pm	Registration	CC – East Lobby, Level 6
8:00am-9:30am	Technical Sessions (MA)	Convention Center & Sheraton
9:00am-5:00pm	Exhibits, Job Placement, Email Center	CC – Ballroom 6B
9:30am-10:00am	Coffee Break	CC – Ballroom 6B S – Metropolitan Foyer, Level 3
10:00am-11:30am	Technical Sessions (MB)	Convention Center & Sheraton
11:40am-12:30pm	Plenary Presentation	CC – Ballroom 6E
12:30pm-1:30pm	Interactive Session	CC – Exhibit Hall Entrance
12:30pm-1:30pm	Lunch Break (on your own) Lunch available for purchase, Exhibit Hall.	
1:30pm-3:00pm	Technical Sessions (MC)	Convention Center & Sheraton
3:10pm-4:00pm	Keynote Presentations	CC – Ballroom 6E & Room 608
4:00pm-4:30pm	Coffee Break	CC – Ballroom 6B
4:30pm-6:00pm	Technical Sessions (MD)	Convention Center & Sheraton
6:15pm-7:15pm	Subdivision Business Meetings	See p. 11

TUESDAY, NOVEMBER 6

7:00am-5:00pm	Registration	CC – East Lobby, Level 6
8:00am-9:30am	Technical Sessions (TA)	Convention Center & Sheraton
9:00am-5:00pm	Exhibits, Job Placement, Email Center	CC – Ballroom 6B
9:30am-10:00am	Coffee Break	CC – Ballroom 6B S – Metropolitan Foyer, Level 3
10:00am-11:30am	Technical Sessions (TB)	Convention Center & Sheraton
11:40am-12:30pm	Plenary Presentation	CC – Ballroom 6E
12:30pm-1:30pm	Interactive Session	CC – Exhibit Hall Entrance
12:30pm-1:30pm	Lunch Break (on your own) Lunch available for purchase, Exhibit Hall.	
1:30pm-3:00pm	Technical Sessions (TC)	Convention Center & Sheraton
3:10pm-4:00pm	Keynote Presentations	CC – Ballroom 6E & Room 608
4:00pm-4:30pm	Coffee Break	CC – Ballroom 6B
4:30pm-6:00pm	Technical Sessions (TD)	Convention Center & Sheraton
6:15pm-7:15pm	Subdivision Business Meetings	See p. 11
7:30pm-9:30pm	General Reception Buses depart Convention Center beginning at 7:15pm. See p. 17.	Experience Music Project

WEDNESDAY, NOVEMBER 7

7:00am-5:00pm	Registration	CC – East Lobby, Level 6
8:00am-9:30am	Technical Sessions (WA)	Convention Center & Sheraton
9:00am-3:30pm	Exhibits, Job Placement, Email Center	CC – Ballroom 6B
9:30am-10:00am	Coffee Break	CC – Ballroom 6B S – Metropolitan Foyer, Level 3
10:00am-11:30am	Technical Sessions (WB)	Convention Center & Sheraton
11:40am-12:30pm	Plenary Presentation	CC – Ballroom 6E
12:30pm-1:30pm	Lunch Break (on your own) Lunch available for purchase, Exhibit Hall.	
1:30pm-3:00pm	Technical Sessions (WC)	Convention Center & Sheraton
3:00pm-3:30pm	Coffee Break	CC – Ballroom 6B S – Metropolitan Foyer, Level 3
3:30pm-5:00pm	Technical Sessions (WD)	Convention Center & Sheraton
5:10pm-7:00pm	Plenary/Reception: OR HumOR	CC – Ballroom 6E

WHERE TO GO FOR LUNCH?

Convention Center-Exhibit Hall
Purchase a quick lunch right in the Exhibit Hall – sandwiches, salads, snacks and drinks. Sunday to Wednesday, 12:30pm-1:30pm.

At the Convention Center
Bambuza Bistro – international cuisine, lunch & dinner. Quick sandwich service Mon.-Fri. 10am to 3pm. Happy hour with appetizer specials 4pm to 6pm.

Crêpes Voilá – European-style fast food. Mon.-Thurs. & Fri. 8am to 8:30pm; Sat. 9:30am to 9:30pm; Sun. 9:30am to 8:30pm.

Cyber Dogs Internet Café – gourmet hot dogs. Daily, 10am-midnight.

Espresso Caffé Dior – specialty coffee, tea, pastries, sandwiches. Mon-Fri. 7am to 5pm; Sat. 8am to 2pm; check Sunday schedule.

Juice It Café – fresh fruit and vegetable juice, rice bowls, salads, sandwiches, soup. Mon.-Fri. 8am to 7pm; Sat. 10am to 4pm.

Moby's Restaurant & Lounge – full service featuring grilled steaks, burgers, seafood and microbrews. Mon. 11am to 3pm; Tues.-Fri. 11am to 8pm; weekends noon to 8pm.

Subway Sandwiches – sandwiches, salads, breakfast items. Daily 8am to 5:30pm.

Taco Del Mar – burritos made to order. Mon.-Sat. 10am to 8pm; Sun. noon to 6pm.

Tully's Coffee – coffee, tea, pastries, ice cream. Mon.-Fri., 7am to 5pm.

Unconventional Pizza & Salad – Pizza, salads, calzone, pasta. Mon-Sat 10am to 6pm.

At the Sheraton
Daily Grill – Modeled after the great America grill of the 1930s; steaks, seafood, favorites like chicken pot pie, fresh desserts. Daily 6am to 10pm.

Lobby Lounge – daily 2pm to midnight.

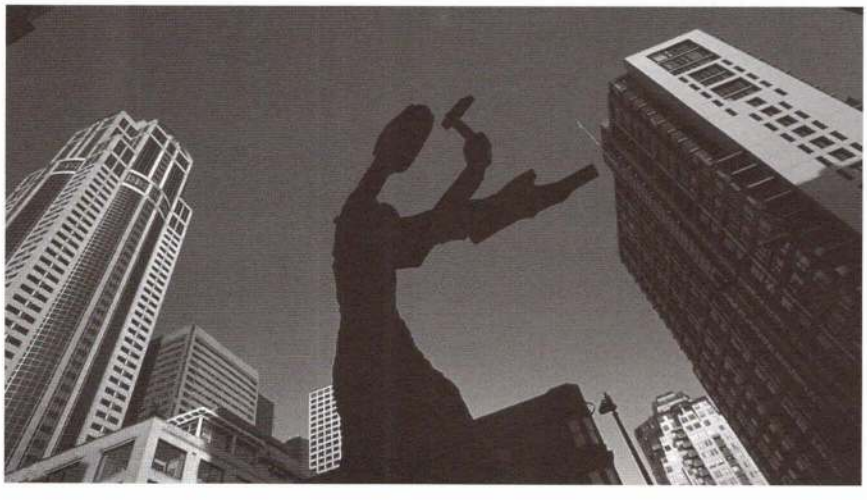
Schedule of Special Events

FRIDAY, NOVEMBER 2

Colloquia Registration & Dinner	S – Metropolitan B, Level 3	4:30pm-9:00pm

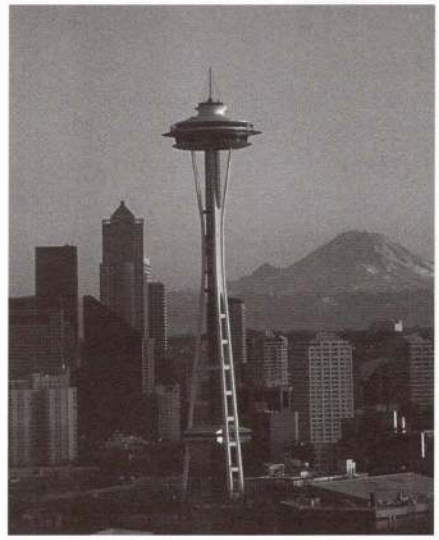
SATURDAY, NOVEMBER 3

Combined Colloquia		
Breakfast	S – Grand Ballroom C, Level 2	7:30am-8:15am
Future Academician Colloquium	S – Grand Ballroom D, Level 2	8:15am-4:30pm
Future Practitioner Colloquium	S – Cedar, Level 2	8:15am-4:30pm
Teaching Effectiveness Colloquium	S – Douglas, Level 2	8:15am-4:30pm
Plenary	S – Grand Ballroom D, Level 2	4:45pm-5:45pm
AI/DM Workshop Breakfast/Welcome	S – Metropolitan A, Level 3	8:00am-8:30am
INFORMS Executive Committee	S – Alki Boardroom, Level 4	8:00am-11:30am
CIST Conference	S – Aspen & Juniper, Level 2	8:00am-5:00pm
ISR Editors	S – Dashpoint, Level 4	8:30am-3:00pm
AI/DM Workshop	S – Ballard & Capitol Hill, Level 3	8:30am-5:00pm
Organization Science Competition	S – Wallingford, Level 3	8:30am-5:00pm
Meetings Committee	S – 3415-Pike St. Tower	9:00am-12:00pm
Vendor Workshops – Session I		
Frontline Systems, Inc.	S – Jefferson, Level 4	12:00pm-3:00pm
GAMS Development Corp.	S – Ravenna, Level 3	12:00pm-3:00pm
GoldSim Technology	S – Seneca, Level 4	12:00pm-3:00pm
Lumima Decision Systems	S – Leschi, Level 3	12:00pm-3:00pm
Maximal Software, Inc.	S – Kirkland, Level 3	12:00pm-3:00pm
Responsive Learning Technologies	S – Pike, Level 4	12:00pm-3:00pm
Vose Consulting	S – Greenwood, Level 3	12:00pm-3:00pm
INFORMS Board	S – Metropolitan B, Level 3	12:00pm-5:00pm
Vendor Workshops – Session II		
AIMMS/Ziena Optimization	S – Kirkland, Level 3	3:00pm-6:00pm
AMPL Optimzation	S – Leschi, Level 3	3:00pm-6:00pm
Dash Optimization	S – Greenwood, Level 3	3:00pm-6:00pm
ILOG, Inc.	S – Jefferson, Level 4	3:00pm-6:00pm
Imagine That, Inc.	S – Pike, Level 4	3:00pm-6:00pm
Salford Systems	S – Ravenna, Level 3	3:00pm-6:00pm
SAS	S – Seneca, Level 4	3:00pm-6:00pm
Meeting Registration	CC – East Lobby, Level 6	3:00pm-7:00pm
INFORMS Membership Meeting/Reception	CC – Room 603	5:00pm-6:00pm
Roundtable Reception	S – Metropolitan A, Level 3	5:00pm-6:00pm
Meetings Committee	S – 3415 Pike St. Tower	5:00pm-7:00pm
ISR Senior & Associate Editors	S – Willow B, Level 2	6:00pm-7:30pm
Roundtable Meeting & Dinner	S – Metropolitan A, Level 3	6:00pm-10:00pm



KEY
CC-Convention Center
S-Sheraton

For subdivision business meetings, see page 11.



25+ Year Member Ribbon

If you have been an ORSA-TIMS-INFORMS member for 25 or more years, please stop by the INFORMS booth (# 114-116 in the Exhibit Hall) to pick up a special ribbon designating your 25+ year membership. We salute our long-time members!

Thank You

Coffee Break Sponsors

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COFFEE BREAKS

Afternoon coffee breaks in Convention Center ONLY. Morning breaks in Center and Sheraton.

Sunday, Nov. 4
9:30am-10:00am
CC – East & West Lobbies
S – Metropolitan Foyer

4:00pm – 4:30pm
CC – East & West Lobbies
Sponsored by Boeing

Monday, Nov. 5
9:30am – 10:00am
CC – Exhibit Hall 6B
S – Metropolitan Foyer

4:00pm – 4:30pm
CC – Exhibit Hall 6B
Sponsored by AREVA T&D Inc.

Tuesday, Nov. 6
9:30am – 10:00am
CC – Exhibit Hall 6B
S – Metropolitan Foyer

4:00pm – 4:30pm
CC – Exhibit Hall 6B
Sponsored by Hewlett Packard

Wednesday, Nov. 7
9:30am – 10:00am
CC – Exhibit Hall 6B
S – Metropolitan Foyer

3:00pm – 3:30pm
CC – Exhibit Hall 6B

SUNDAY, NOVEMBER 4

New Member Breakfast	S – Grand Ballroom C, Level 2	7:00am-8:00am
Meeting Registration	CC – East Lobby, Level 6	7:00am-5:00pm
JPS Breakfast	S – Grand Ballroom D, Level 2	7:30am-9:00am
Guest Breakfast	S – Cedar, Level 2	7:30am-9:00am
INFORMS Board	S – Metropolitan B, Level 3	7:30am-3:30pm
CIST Conference	S – Aspen & Juniper, Level 2	8:00am-4:30pm
Roundtable	S – Metropolitan A, Level 3	8:00am-4:30pm
Junior Faculty Interest Group Lunch	S – Grand Ballroom D, Level 2	11:30am-1:00pm
Colloquia Committee	S – Douglas, Level 2	11:30am-1:00pm
Plenary: Seth Bonder	CC – Ballroom 6E	11:40am-12:30pm
IPC Alumni Meeting	CC – Room 603	12:00pm-1:00pm
O.R. Editors Lunch/Meeting	S – Madrona, Level 2	12:00pm-1:00pm
Job Fair/Email	CC – Ballroom 6A	12:00pm-5:00pm
Roundtable/Board Lunch/Meeting	S – Grand Ballroom C, Level 2	12:15pm-1:30pm
JoC Editors Lunch/Meeting	S – Diamond A, Level 1	12:30pm-1:30pm
Omega Rho Lunch/Meeting	S – Dashpoint, Level 4	12:45pm-2:45pm
M.S. Editors Meeting	S – Alki Boardroom, Level4	2:00pm-3:00pm
Keynote: Ervin Kapos	CC – Ballroom 6E	3:10pm-4:00pm
Keynote: 2007 Edelman Reprise	CC – Room 608	3:10pm-4:00pm
Chapters/Fora Committee	S – Willow A, Level 2	4:00pm-5:00pm
Section/Societies Committee	S – Willow A, Level 2	5:00pm-6:00pm
President's Reception-Roundtable	S – Grand Ballroom A, Level 2	5:00pm-6:00pm
IOL Reception	S – Juniper, Level 2	6:00pm-7:00pm
MSOM Reception	S – Grand Ballroom C, Level 2	6:15pm-7:15pm
Welcome Reception-Exhibits Open	CC – Ballroom 6A-B-C	7:30pm-9:00pm
Minority Issues Forum Reception	S – Willow B, Level 2	8:00pm-9:00pm
Awards Ceremony & Dessert Reception	CC – Ballroom 6E	8:30pm-9:45pm

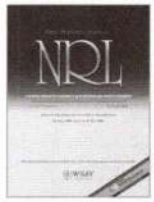
MONDAY, NOVEMBER 5

Board/Editors/Committee Chair Breakfast	S – Aspen, Level 2	7:00am-8:00am
Decision Analysis Editors	S – Alki Boardroom, Level 4	7:00am-8:30am
Meeting Registration	CC – East Lobby, Level 6	7:00am-5:00pm
ACORD Breakfast/Meeting	S – Madrona, Level 2	7:30am-9:00am
Guest Breakfast	S – Cedar, Level 2	8:00am-9:00am
Seattle Area Math Teachers Program	S – Willow A, Level 2	8:00am-5:00pm
Exhibits/Job Placement/Email	CC – Ballroom 6B	9:00am-5:00pm
Subdivisions Council	S – Willow B, Level 2	9:30am-11:30am
Education Committee	S – Cedar, Level 2	10:00am-11:00am
TMS Workshop Committee	S – Cedar, Level 2	11:00am-12:00pm
Plenary-IFORS: Ralph Keeney	CC – Ballroom 6E	11:40am-12:30pm
COIN-OR Members & Users	CC – Room 613	12:15pm-1:15pm
Publications/Editors in Chief	S – Aspen, Level 2	12:30pm-3:30pm
Fellows Lunch	S – Grand Ballroom D, Level 2	12:45pm-2:30pm
Committee on Diversity	S – Diamond B, Level 1	1:30pm-3:00pm
Keynote: Gang Yu	CC – Ballroom 6E	3:10pm-4:00pm
Keynote: Reuven Rubinstein	CC – Room 608	3:10pm-4:00pm
CPMS Isolated Practitioners Workshop	S – Admiral, Level 3	6:15pm-7:15pm
Technology Management Social	S – Seneca, Level 4	7:00pm-8:00pm
Decision Analysis-Celebration of Ward Edward's Contributions to DA	CC – Room 204	7:15pm-8:30pm
Student Reception	S – Grand Ballroom C, Level 2	7:30pm-9:00pm
Women in OR/MS Forum Reception	Offsite-Triple Door 216 Union St.	8:00pm-10:00pm

PLEASE VISIT US AT THE BLACKWELL BOOTH #103

Look at What Everyone's Reading

Naval Research Logistics (NRL)



Founded in 1954, **NRL** has a distinguished history of publication of both seminal methodological contributions and innovative applications. While retaining its interest in naval and other military applications, **NRL** has for decades been a broad-based journal devoted to operations and analysis problems in business, industry and government.

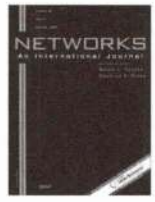
Top accessed papers include:

- **Analysis of decentralized multi-product pull systems with lost sales**
  Cigdem Z. Gurgur, Tayfur Altiok (Vol. 54, No. 4)
- **Integrated capacity, demand, and production planning with subcontracting and overtime options**
  Yasemin Merzifonluoğlu, Joseph Geunes, H.E. Romeijn (Vol. 54, No. 4)
- **Performance evaluation of a production/inventory system with periodic review and endogenous lead times**
  Robert N. Boute, Marc R. Lambrecht, Benny Van Houdt (Vol. 54, No. 4)
- **Outbound supply chain network design with mode selection and lead time considerations**
  Erdem Eskigun, Reha Uzsoy, Paul V. Preckel, George Beaujon, Subramanian Krishnan, Jeffrey D. Tew (Vol. 54, No. 3)

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Networks



Providing a central forum for the distribution of timely information about network problems, their design and mathematical analysis, as well as efficient algorithms for carrying out optimization on networks. The nonstandard modeling of diverse processes using networks and network concepts is also of interest. Disciplines useful in studying networks are varied, including applied mathematics, operations research, computer science, discrete mathematics, and economics.

Top accessed papers include:

- **Route 2005: Recent advances in vehicle routing optimization**
  Daniele Vigo, Paolo Toth, Aristide Mingozzi (Vol. 49, No. 4)
- **The bridges of Königsberg – A historical perspective**
  Irina Gribkovskaia, Øyvind Halskau Sr., Gilbert Laporte (Vol. 49, No. 3)
- **Metaheuristics for the vehicle routing problem with loading constraints**
  Karl F. Doerner, Guenther Fuellerer, Richard F. Hartl, Manfred Gronalt, Manuel Iori (Vol. 49, No. 4)
- **A branch & cut algorithm for the windy general routing problem and special cases**
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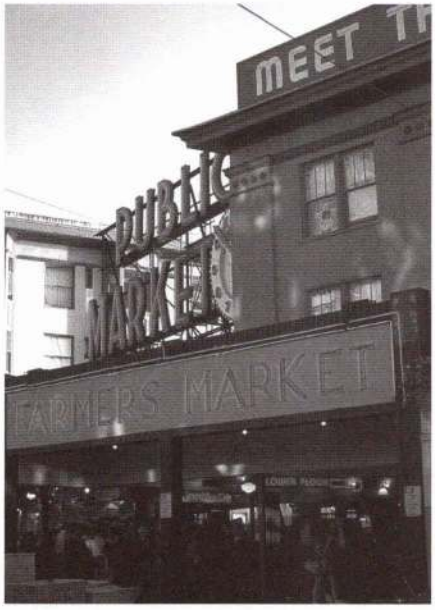
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TUESDAY, NOVEMBER 6

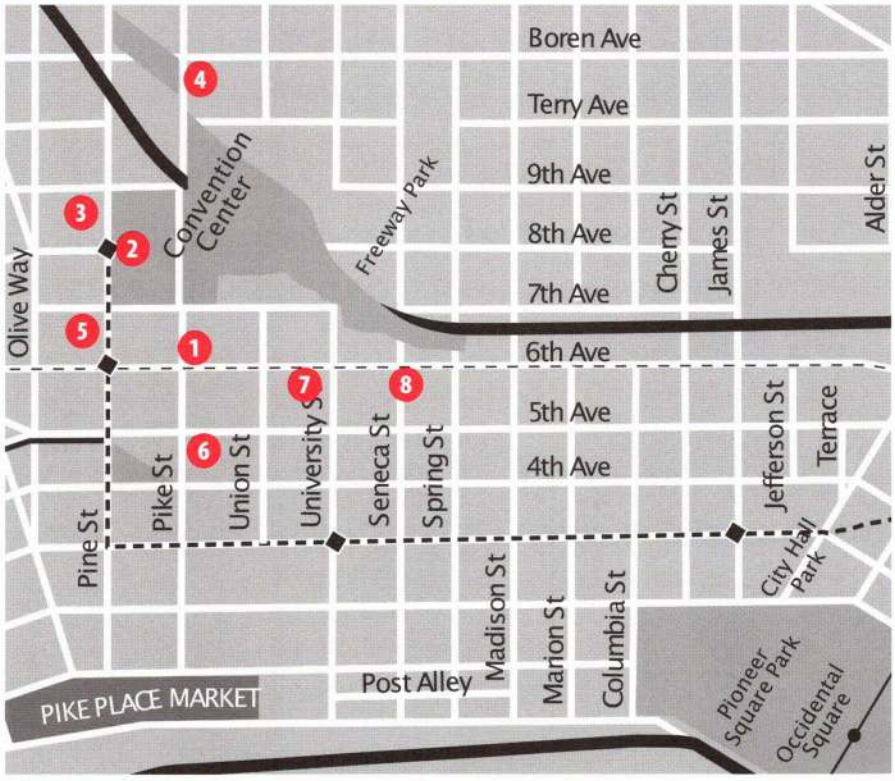
Chapters/Fora Officers Breakfast	S – Willow, Level 2	7:00am-8:00am
Meeting Registration	CC – East Lobby, Level 6	7:00am-5:00pm
Transportation Science Editors	S – Madrona, Level 2	7:30am-8:30am
Student Chapter Officers	S – Willow, Level 2	8:00am-8:45am
Practitioner & Practice Activities Committee	S – Dashpoint	8:00am-9:00am
Guest Breakfast	S – Cedar, Level 2	8:00am-9:00am
Meetings Comm./Future Org. Committees	S – 3415-Pike St. Tower	8:30am-5:00pm
Exhibits/Job Placement/Email	CC – Ballroom 6B	9:00am-5:00pm
Franz Edelman Selection Committee	S – Aspen, Level 2	11:00am-2:30pm
Plenary: Robert Moffat, Jr.	CC – Ballroom 6E	11:40am-12:30pm
Sections/Societies Officers Lunch	S – Willow, Level 2	12:00pm-1:30pm
Academic/Practitioner Interface Lunch	CC – Room 4C	12:30pm-1:30pm
Women in OR/MS Meeting/Lunch	S – Grand Ballroom D, Level 2	12:30pm-1:30pm
Isolated Academicians	S – Madrona, Level 2	3:00pm-4:00pm
Keynote: John Garstka	CC – Room 608	3:10pm-4:00pm
Keynote: Sridhar Tayur	CC – Ballroom 6E	3:10pm-4:00pm
Future Organizing Committee Reception	S - 3415-Pike St. Tower	5:00pm-6:00pm
Interfaces Editors	S – Juniper, Level 2	6:00pm-7:00pm
General Reception	Experience Music Project Buses depart Convention Center beginning at 7:15pm. See p. 17.	7:30pm-9:30pm

WEDNESDAY, NOVEMBER 7

Meeting Registration	CC – East Lobby, Level 6	7:30am-5:00pm
Exhibits/Job Placement/E-mail	CC – Ballroom 6B	9:00am-3:30pm
Plenary-Omega Rho: Robert Bixby	CC – Ballroom 6E	11:40am-12:30pm
Plenary & Reception: OR HumOR & HistORy	CC – Ballroom 6E	5:10pm-7:00pm

INFORMS HOTELS

1. Sheraton
2. Hyatt
3. Paramount
4. Pike Street Suites
5. Roosevelt
6. Red Lion
7. Hilton
8. Crowne Plaza





:: Societies :: Sections :: Fora :: Chapters :: Student Chapters::

INFORMS communities - also known as subdivisions - are important, independent bodies that unite members into local regional groups, focus on special technical interests, and provide the backbone for the organization. Many members belong to more than one group. Communities sponsor conferences, regular meetings, sessions at annual meetings, educational programs, and awards; some provide professional journals and resource publications.

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At this meeting: Check out the schedule of subdivision business meetings and special events. Open to all attendees and a great opportunity to meet people who share your interests.

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Schedule of Subdivision Business Meetings

KEY
CC-Convention Center
S-Sheraton

QUICK REFERENCE
including the Master Track Schedule

Don't miss this handy reference. It's a separate flyer that came with your program. The Master Track Schedule is also printed on pages 44-47.

SUNDAY, NOVEMBER 4

Information Systems	S – Aspen, Level 2	5:30pm-6:30pm
Service Science	CC – Room 210	6:00pm-8:00pm
Artificial Intelligence	CC – Room 212	6:15pm-8:00pm
Aviation Applications	S – Ravenna, Level 3	6:15pm-7:15pm
Data Mining	CC – Room 211	6:15pm-7:15pm
Energy, Natural Resources & the Environment	S – Ballard , Level 3	6:15pm-7:15pm
Forum on Education (INFORM-ED)	S – Grand Ballroom B, Level 2	6:15pm-7:15pm
Location Analysis	S – Medina, Level 3	6:15pm-7:15pm
Military Applications Society Council	S – Dashpoint, Level 4	6:15pm-7:15pm
Minority Issues Forum	S – Ravenna, Level 3	6:15pm-7:15pm
Optimization	CC – Room 619	6:15pm-7:15pm
Railway Applications	S – Leschi, Level 3	6:15pm-7:15pm
Revenue Management & Pricing	S – Issaquah, Level 3	6:15pm-7:15pm
Simulation	S – Greenwood, Level 3	6:15pm-7:15pm
Telecommunications	S – Columbia, Level 4	6:15pm-7:15pm
Transportation Science & Logistics Board	S – Eagle, Level 1	6:15pm-7:15pm
Decision Analysis Society Council	CC – Room 204	6:15pm-7:30pm
Revenue Management & Pricing Board	S – Issaquah, Level 3	7:15pm-8:15pm

MONDAY, NOVEMBER 5

Decision Analysis Society	CC – Room 204	6:00pm-7:15pm
Technology Management	S – Seneca, Level 4	6:00pm-8:00pm
Applied Probability	S – Queen Anne, Level 3	6:15pm-7:15pm
Computing Society	CC – Room 201	6:15pm-7:15pm
Financial Services	S – Capitol Hill, Level 3	6:15pm-7:15pm
Health Applications	CC – Room 310	6:15pm-7:15pm
Manufacturing & Service Operations Mgt	CC – Room 608	6:15pm-7:15pm
Military Applications Society	CC – Room 307	6:15pm-7:15pm
Public Programs & Processes	S – Greenwood, Level 3	6:15pm-7:15pm
Quality, Statistics & Reliability	CC – Room 2B	6:15pm-7:15pm
Spreadsheet Productivity Research	S – Pike, Level 4	6:15pm-7:15pm
Transportation Science & Logistics	CC – Room 303	6:15pm-7:15pm
Behavioral Process Management	CC – Room 613	7:15pm-8:15pm

TUESDAY, NOVEMBER 6

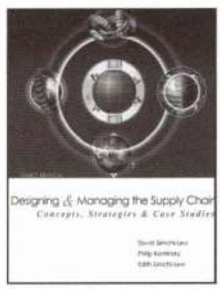
CPMS Council	S – Aspen, Level 2	7:00am-8:30am
Women in OR/MS Meeting/Lunch	S – Grand Ballroom D, Level 2	12:30pm-1:30pm
SpORts in OR	S – Columbia, Level 4	6:00pm-7:00pm

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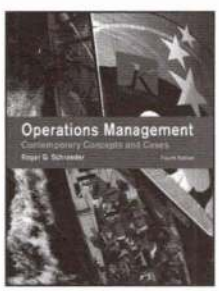
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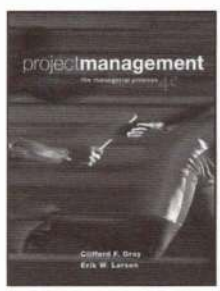
Supply Chain Science, 1e
Wallace Hopp,
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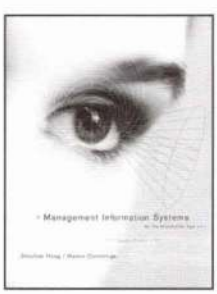
Designing and Managing the Supply Chain, 3e
David Simchi-Levi
Massachusetts Institute of Technology
Philip Kaminsky,
University of California–Berkeley
Edith Simchi-Levi,
Logic Tools, Inc.
ISBN 0073341525



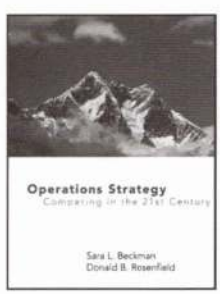
Operations Management: Contemporary Concepts and Cases, 4e
Roger G. Schroeder,
University of Minnesota
ISBN 0073377864



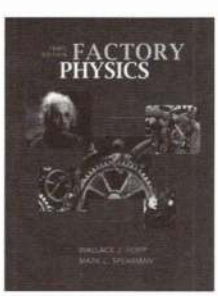
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Erik Larson,
Oregon State University
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SPEAKER GUIDELINES

Audio/Visual Equipment

Every room will be equipped with an LCD (data) projector and an overhead. Please follow these guidelines to ensure a successful presentation using the LCD projector:

- Bring your laptop PC to your session. We supply the projector, but we DO NOT supply the computer.
- Bring your AC power adaptor with you. There will be convenient AC power in every session room.
- Arrive at your session at least 30 minutes before it begins. All presenters in a session should set up and test the connection to the projector before the session begins.
- Do NOT attempt to run your presentation off the laptop battery, no matter how trustworthy.
- Produce and bring overhead transparencies as a backup.

Speaker Ready Room

There will be a special Speaker Ready Room available in the Convention Center (Level 6, East Lobby) 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. Bring copies of your paper to distribute or provide a handout with information relating to your oral presentation. 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 one of the Program Information Desks . Desks are located in the Convention Center (Level 6, next to INFORMS Registration) and the Sheraton (Level 3, foyer). 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. The Program Desks are staffed by students from the University of Washington and INFORMS staff members.

For Assistance During Your Session: Session Monitor Desks

Session Monitor Desks are located in several areas in both the Convention Center and the Sheraton (see hotels maps for specific locations). Students from the University of Washington staff these desks. 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 each 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, Level 6, Ballroom 6B during the following hours:

Sunday, Nov. 4	7:30pm-9:00pm*
Monday, Nov. 5	9:00am-5:00pm
Tuesday, Nov. 6	9:00am-5:00pm
Wednesday, Nov. 7	9:00am-3:30pm

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

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INTERNET & BUSINESS SERVICES

Email Center-Wireless Areas

Convention Center, Level 6, Ballroom 6B

There are several options for Internet access available in the Email Center. If you bring your laptop, you can use a wired connection or the wireless access available. If you do not have a laptop, a limited number of computers are also available. Name badges must be worn for admittance. The Email Center will be open during the following hours:

Sunday, Nov. 4	12:00pm to 5:00pm
Monday, Nov. 5	9:00am to 5:00pm
Tuesday, Nov. 6	9:00am to 5:00pm
Wednesday, Nov. 7	9:00am to 3:30pm

Business Centers

- Convention Center: FedEx Kinko's is located on Level 1. It is a full-service business center with Internet access. Open continuously 7:00am-9:00pm Monday-Friday; Saturday and Sunday 9:00am-6:00pm.
- Sheraton Seattle: located on Level 2 at the top of the escalator. Open Monday-Friday, 7:30am-5:30pm; Saturday, 10:00am-2:00pm.

Speaker Information

REGISTRATION

Badges Required for Technical Sessions

INFORMS Annual Meeting 2007 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 at a fee of $5.

Professional Registration

Your registration fee covers admittance to the complete technical program, the exhibit hall, email center and most special programs. The following social/food events are also included: Sunday evening Welcome Reception, Sunday evening Awards Ceremony, Tuesday evening General Reception, Wednesday afternoon plenary/reception, and 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) which covers admission to the Sunday Welcome Reception, Sunday Awards Ceremony, Tuesday General Reception and Wednesday plenary/reception. Continental breakfasts on Sunday, Monday and Tuesday are also included (guest breakfasts are held at the Sheraton, Level 2, Cedar Room). 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 (# 114-116 in the Exhibit Hall) to pick up a special ribbon designating your 25+ year membership. We salute our long-time members!

OTHER SERVICES

Luggage/Coat Check

Convention Center – East Lobby, Level 6
There is no charge for this service.

Sunday	7:00am to 10:00pm
Monday	7:00am to 7:30pm
Tuesday	7:00am to 6:30pm
Wednesday	7:00am to 7:00pm

Seattle Visitor Information

Convention Center – East Lobby, Level 6
Sunday – Tuesday, 9:00am to 5:00pm
Stop by the booth for information on what to see and do in Seattle. The Convention & Visitors Bureau staff will assist you with restaurant reservations and tickets for cultural events.

Lunch in Exhibit Hall

Convention Center – Exhibit Hall, Level 6
Sunday – Wednesday, 12:00pm-1:30pm
You can purchase from a lunch buffet – sandwiches, salads, snacks and drinks – right in our Exhibit Hall.
See page 5 for a list of other nearby lunch options.

FREE! 2007 TutORials CD Will be given as a free gift to all INFORMS Annual Meeting Attendees!

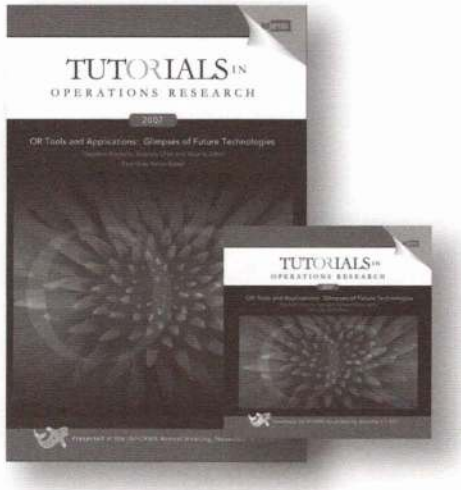
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Guest Program & Tours, Plant Tours

PLANT TOURS

You may still be able to register for the following plant tours. Go to the INFORMS registration desk for information on availability. ***Meet in the Convention Center, Level 1, Convention Place. Walk from the Center main entrance past the retail shops, fountain and escalators to the back of the building for plant tour departures. Buses will leave at the beginning time listed for each tour, and will return to the Convention Center at the ending time listed.***

Boeing Everett Plant – SOLD OUT

Monday, November 5
12:00pm-4:00pm $35

The Boeing 747, 767, 777 and 787 airplanes are manufactured in Everett, Washington, 30 miles (48 kilometers) north of Seattle. This special walking tour (not the same as a public tour) of the main assembly building, the largest building in the world by volume, will provide a look at how Boeing assembles its wide-body passenger jets that lead the way in innovation, design and manufacturing.

Requirements:

- All attendees must bring picture ID for security processing.
- Wear comfortable shoes - this will be a walking tour of the factory floor.
- Following items are not allowed on the tour: food or drink, shorts or skirts, open toe shoes or shoes with high heels, cameras (including cell phone cameras), personal items (purses, backpacks, binoculars, etc.).

Port of Seattle – SOLD OUT

Tuesday, November 6
10:30am-1:30pm $35

Learn how the Port of Seattle's cargo systems and infrastructure maintain the smooth operation of one of North America's commercial gateways. You will board a 90-foot covered, heated tour vessel for a narrated waterside tour of the working container facilities. This will last approximately one hour. Afterward you will take a bus to public viewpoints for more of a bird's-eye view of container operations.

Requirements:

- Outdoor clothing and rain gear
- Comfortable walking shoes

SeaTac Airport

Wednesday, November 7
12:30pm-3:30pm $35

Get a behind-the-scenes look at what makes Seatac Airport a success. The tour will include a one-hour narrated airport bus tour of the airfield itself, and then a one-hour guided indoor tour of the new concourses, architecture and artwork.

Requirements:

- Photo identification
- Comfortable walking shoes

GUEST PROGRAM

The program for registered guests includes a continental breakfast on Sunday, Monday and Tuesday mornings; the Welcome Reception and Awards Ceremony on Sunday evening; the General Reception on Tuesday evening; and Wednesday afternoon plenary/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 Registration Desk to register your guest.

Guest Breakfasts

Sunday, Nov. 4	7:30am – 9:00am
Monday, Nov. 5	8:00am – 9:00am
Tuesday, Nov. 6	8:00am – 9:00am

Sheraton, Cedar, Level 2
Identify yourself as an INFORMS guest and present your ticket when you arrive. Tickets are included in your registration packet.

SEATTLE VISITOR INFORMATION

Convention Center – East Lobby, Level 6
Sunday–Tuesday, 9:00am-5:00pm

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 Sheraton, Union St. entrance at Lobby Level for guest tour departures. Buses will leave at the beginning time listed for each tour, and will return to the Sheraton at the ending time listed.***

Seattle City Tour – SOLD OUT

Sunday, November 4
9:00am-1:00pm $29

An informative guide will provide historical background, point out interesting landmarks and give insider tips on special shopping and sightseeing areas. The tour begins with a drive by Seattle's Waterfront to historic Pioneer Square, Seattle's oldest residential area with restaurants, galleries and lively clubs. A stop at the Hiram M. Chittenden Locks shows how the area's fresh and salt waters meet. Underwater viewing at the adjoining salmon ladders is featured. The tour finishes with a scenic drive through Seattle's best neighborhoods.

Lakes and Lifestyles Cruise

Monday, November 5
12:30pm-3:30pm $49

This two-hour cruise treats you to spectacular glimpses of Seattle's unique inner-city shoreline. The cruise starts in Lake Union where you will pass kayakers, sailors and the famous houseboat from *Sleepless in Seattle*. Cruise into Lake Washington and pass the University of Washington's football stadium and Seattle's famous floating bridge. Washington State has three of the world's six floating bridges including the Evergreen Point Floating Bridge. You will also see million dollar mansions including the homes of Bill Gates, Kenny G, the Nordstrom family and Steve Miller, as well as many handcrafted houseboats–some even with basements!

Winery and Microbrewery Tour

Tuesday, November 6
12:30pm-4:00pm $54

The tour begins at beautiful Redhook Brewery for a private tour and tasting of Redhook ales. See the dramatic Bavarian inspired rooflines and technologically advanced brewing equipment on the brewery tour. The tour continues to Chateau Ste. Michelle Winery, Washington's oldest winery. Situated on the same latitude as the French wine country, Washington State has a growing wine industry that is winning prestigious awards throughout the world. Get a romantic yet technologically accurate view of the art and science of winemaking, followed by wine tasting. Stroll the grounds and visit the extensive wine and accessory shop.

Special Receptions

YOUR BADGE IS YOUR TICKET

Wear your badge for admission to these events. Your meeting registration fee covers 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 Welcome Reception, Awards Ceremony, Tuesday General Reception, Wednesday "HumOR in OR" and continental breakfasts on Sunday, Monday and Tuesday (breakfasts held at the Sheraton Hotel).

SUNDAY

WELCOME RECEPTION & OPENING OF EXHIBITS

The Spirit of Seattle
7:30pm-9:00pm
Convention Center
Ballroom 6B, Exhibit Hall

INFORMS and the Seattle Organizing Committee welcome you to the 2007 Annual Meeting with an evening of fellowship and fun. We'll have an array of entertainers on hand–from stilt-walkers to jugglers and mimes–to help celebrate the unique "Spirit of Seattle." The Welcome Reception is the perfect venue to meet with colleagues, visit the exhibits and enjoy some great food. 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
Convention Center
Ballroom 6E

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

The society's 2007 awards will be bestowed on these deserving individuals:

Philip McCord Morse Lectureship Award
Lawrence M. Wein

INFORMS Prize for the Teaching of OR/MS Practice
Paul A. Jensen

INFORMS Expository Writing Prize
Paul H. Zipkin

John von Neumann Theory Prize
Arthur F. Veinott, Jr.

George E. Kimball Medal
Thomas M. Cook
Marshall Fisher

Frederick W. Lanchester Prize
David L. Applegate, Robert E. Bixby, Vašek Chvátal, William J. Cook

INFORMS President's Award
Lawrence M. Wein

Two student paper awards will also be announced during the ceremony: the George E. Nicholson Student Paper Competition and the George B. Dantzig Dissertation Award. In addition, the winners of the Bonder Scholarships for Applied Operations Research in Health Science and in Military Applications will be presented.

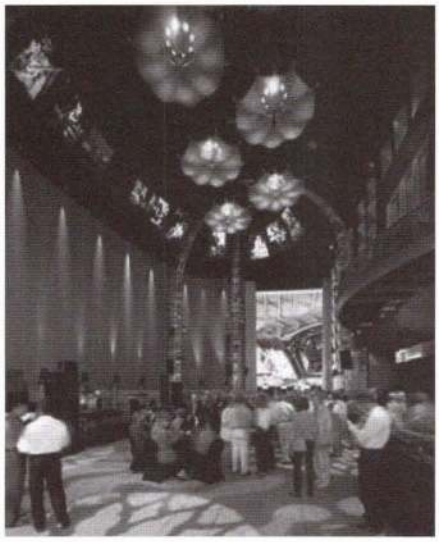
Thank You

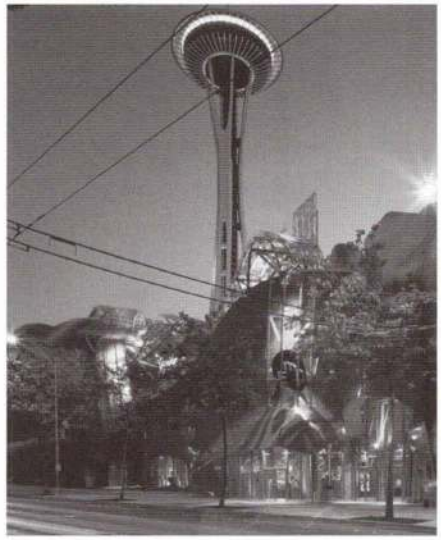
LUNDQUIST COLLEGE OF BUSINESS
University of Oregon

IBM



Awards Ceremony





SEATTLE SPACE NEEDLE

Seattle's most famous landmark – the Space Needle – is located just across the plaza from EMP. You might want to take the opportunity to ride up to the observation deck to enjoy the panorama of the city at night. Show your INFORMS badge and you'll receive a $2 discount off regular fares.

Special INFORMS rates are: adult $14; youth, age 4-13, $6; child under 3, free. The Space Needle is open until 11:00pm. Remember that the **last INFORMS bus returning to the Convention Center departs at 9:45pm.**

TUESDAY

GENERAL RECEPTION
EXPERIENCE MUSIC PROJECT

7:30pm-9:30pm (buses leave Convention Center beginning at 7:15pm)
Experience Music Project Museum (EMP)

See important bus information below.

You'll be inspired by this one-of-a-kind museum, housed in a stunning Frank Gehry-designed building. EMP combines interactive and interpretive exhibits that tell the story of the creative, innovative and rebellious expression that defines American popular music. The museum's grand hall, called Sky Church (based on a concept proposed by Jimi Hendrix) features the world's largest video screen, a 48,000-watt JBL surround-sound system and amazing computer controlled lighting. Another wing of the museum is devoted to fascinating science fiction displays.

You can try out performing on the On-Stage exhibit, create your own music in the Sound Lab and tour the extensive collection of music artifacts. A popular Seattle DJ will provide music perfect for dancing. All of this is open to INFORMS attendees for our dazzling General Reception. We'll be serving great food throughout the evening. Soft drinks and water are complimentary, with a cash bar available for other beverages.

Thank You
SmartOps®

WEDNESDAY

PLENARY & RECEPTION

HumOR in OR
5:10pm-6:00pm: Plenary and Reception
6:00pm-7:00pm: Reception
Convention Center-Ballroom 6E

OR is Everywhere!
(Some OR HumOR and HistORy)
Peter Norden, Columbia University

Even if you are not a formidable time-series extrapolatOR or comfortable with ORthogonal algORithms, do join our discussion to create a cORnucopia of a plethORa of "embedded OR" in this short panel session. Bring along any memories or examples of your experiences with our community's histORy of OR research and practice. This will be followed by a casual reception, with fun food, snacks and beer/wine (stopping just shORt of a snORt of pORt!).

BUS INFORMATION

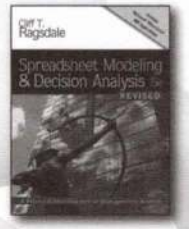
Convention Center to EMP and Return to Center

Buses will leave from the Convention Center beginning at 7:15pm. The bus pick-up location is at Convention Place on the entrance level (walk from the Center main entrance, past the retail shops, fountain and escalators to the back of the building). The drive to EMP is approximately 15 minutes. Buses will run continuously between the Center and EMP. For the return trip, buses will begin leaving EMP for the Center beginning at 8:15pm and run continuously. **The last returning bus will leave EMP at 9:45pm.**

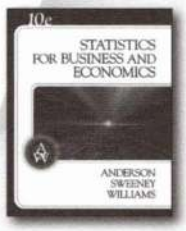
Please note that all buses depart from and return to the Convention Center; buses do not go to INFORMS hotels.

THOMSON
SOUTH-WESTERN

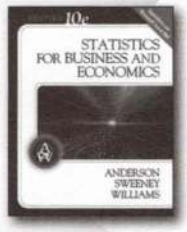
THOMSON SOUTH-WESTERN IS YOUR PREMIER PUBLISHER FOR DECISION SCIENCES



RAGSDALE **Excel 2007**
Spreadsheet Modeling and Decision Analysis, Revised, 5e
©2008. 0-324-65663-7.



ANDERSON/SWEENEY/WILLIAMS
Statistics for Business and Economics, 10e
©2008. 0-324-36068-1.



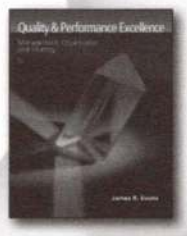
ANDERSON/SWEENEY/WILLIAMS **Excel 2007**
Statistics for Business and Economics, Revised 10e
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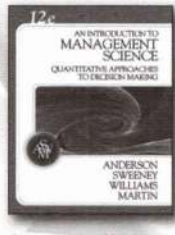
WISNER/STANLEY
Process Management: Creating Value Along the Supply Chain
©2008. 0-324-29157-4.



EVANS/LINDSAY
Management for Quality and Performance Excellence, 7e
©2008. 0-324-38227-8.



EVANS
Quality & Performance Excellence: Management, Organization, and Strategy, 5e
©2008. 0-324-38132-8.



ANDERSON/SWEENEY/WILLIAMS/MARTIN
An Introduction to Management Science: Quantitative Approaches to Decision Making, 12e
©2008. 0-324-39980-4.

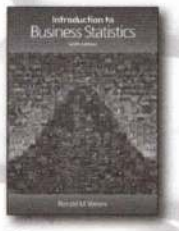


COLLIER/EVANS
Operations Management: Goods, Service, and Value Chains, 2e
©2007. 0-324-17939-1.

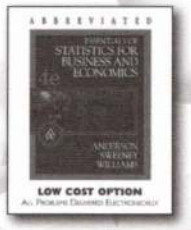


HANNA/NEWMAN
Integrated Operations Management: A Supply Chain Perspective, 2e
©2007. 0-324-37787-8.

BE SURE TO VISIT OUR CONVENTION BOOTH!



WEIERS
Introduction to Business Statistics, 6e
©2008. 0-324-38143-3.



ANDERSON/SWEENEY/WILLIAMS
Essentials of Statistics for Business and Economics, Abbreviated Edition, 4e
©2007. 0-324-64995-9.

OPERATIONS/PRODUCTION MANAGEMENT

RATURI/EVANS
- **Principles of Operations Management**

METTERS/KING-METTERS/PULLMAN/WALTON
- **Successful Service Operations Management, 2e**

COYLE/BARDI/LANGLEY
- **The Management of Business Logistics**

COYLE/BARDI/NOVACK
- **Transportation, 6e**

CUTRIGHT/MARTIN
- **Operations Management Learning Simulation**

GIDO/CLEMENTS
- **Successful Project Management, 3e**

LAWRENCE/JENNINGS/REYNOLDS
- **E-Distribution**
- **ERP in Distribution**

MONCZKA/TRENT/HANDFIELD
- **Purchasing and Supply Chain Management, 3e**

BUSINESS STATISTICS

ANDERSON/SWEENEY/WILLIAMS
- **Essentials of Statistics for Business and Economics, 4e**
- **Essentials of Modern Statistics, 3e**
- **Modern Business Statistics, 2e**

KELLER
- **Statistics for Management and Economics, 7e**
- **Statistics for Management and Economics, Abbreviated Edition, 7e**

KLIBANOFF/SANDRONI/MOSELLE/SARANITI
- **Managerial Statistics: A Case-Based Approach**

KVANLI/PAVUR/KEELING
- **Concise Managerial Statistics**

WEIERS
- **Essentials of Business Statistics, 5e**

MANAGEMENT SCIENCE

ANDERSON/SWEENEY/WILLIAMS
- **Quantitative Methods for Business, 10e**
- **The Management Scientist: Version 6.0**

ALBRIGHT/WINSTON/ZAPPE
- **Data Analysis and Decision Making with Microsoft® Excel, 3e**

WINSTON/ALBRIGHT
- **Practical Management Science, 3e**

www.thomsonedu.com/decisionsciences

Networking & Social Events

SATURDAY, NOVEMBER 3

INFORMS Membership Meeting & Reception
5:00pm-6:00pm
Convention Center – Room 603
The INFORMS Board of Directors encourages all members to bring their ideas, opinions and suggestions to this annual membership meeting. Current business and future directions for INFORMS are on the agenda. Wine and cheese will be served.

SUNDAY, NOVEMBER 4

Breakfast for New Members
7:00am-8:00am (Ticket Required)
Sheraton – Grand Ballroom C, Level 2
The INFORMS Membership Committee will host this breakfast to welcome and orient people who are new to INFORMS. Representatives from several INFORMS subdivisions will be on hand to provide information about their member services. Continental breakfast will be served. New members will receive a ticket for the breakfast with their registration materials.

Sponsored by IBM Research

IBM

Junior Faculty Interest Group Luncheon
11:30am-1:00pm
Sheraton – Grand Ballroom D, Level 2
$15.00 – *A limited number of tickets will 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.

Luncheon and JFIG paper competition are sponsored by the University of Maryland, Robert H. Smith School of Business, Department of Decision and Information Technologies; University of Southern California, Marshall School of Business; Texas A&M University, Department of Industrial and Systems Engineering; and University of Virginia, Darden School of Business.

INFORMS Online Reception
6:00pm-7:00pm
Sheraton – Juniper, Level 2
What's your online strategy for yourself or for your INFORMS subdivision? How can INFORMS Online (IOL) help you advance that? Come and tell us over refreshments and drinks. We are your IOL team.

Minority Issues Forum Reception
8:00pm-9:00pm
Sheraton – Willow B, Level 2
Come meet old friends and make new ones while talking about minority issues and other intellectual issues and opportunities. Also, enjoy poster presentations from minority doctoral students from different departments from across the United States.

Sponsored by Cornell University, School of Operations Research and Industrial Engineering; and Northwestern University, Department of Industrial Engineering and Management Science.

MONDAY, NOVEMBER 5

COIN-OR Members & Users Meeting & Bag Lunch
12:15pm-1:15pm
Convention Center – Room 613
Anyone interested in open-source software tools, open standards, and data and model repositories for any aspect of O.R. is encouraged to attend the Members and Users Meeting of the Computational Infrastructure for O.R. (COIN-OR). Bring your own lunch and ideas. For more information, visit www.coin-or.org.

CPMS Isolated Practitioner Workshop & Reception
6:15pm-7:15pm
Sheraton – Admiral, Level 3
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 24th workshop in this series will address timely issues that affect the isolated practitioner community. All are welcome to participate in the workshop, discussion and reception. Wine and cheese will be served.

Student Reception
7:30pm-9:00pm
Sheraton – Grand Ballroom C, Level 2
All students registered for the meeting are encouraged to attend this special reception for an opportunity to socialize and network with other students in your own field as well as those with different specialties and interests. Students will receive a ticket for the reception with their registration materials

Sponsored by Boeing Commercial Airplane Material & Process Technology

BOEING

Women in OR/MS Forum Reception
8:00pm-10:00pm
Triple Door – 216 Union Street
All those interested in encouraging women in the OR/MS profession are invited to join us for a reception at the Triple Door, located 4 blocks from the Convention Center at the corner of Union Street and 2nd Avenue. Hors d'oeuvres, beer and wine will be served.

Sponsored by: ILOG, Inc.; University of Pittsburgh, Department of Industrial Engineering; University of Massachusetts, College of Engineering; Virginia Commonwealth University, Department of Statistical Sciences and Operations Research; University of Washington, College of Engineering; Georgia Institute of Technology, H. Milton Stewart School of Industrial and Systems Engineering; Penn State Berks.

TUESDAY, NOVEMBER 7

Women in OR/MS Forum Business Meeting & Luncheon
12:30pm-1:30pm
Sheraton – Grand Ballroom D, Level 2
All those interested in issues related to women professionals in OR/MS are invited to join us for lively conversation at our business meeting. The third annual Award for the Advancement of Women in OR/MS will be presented.

Sponsored by: SAS Institute, Inc.; ILOG, Inc.; Georgia Institute of Technology, H. Milton Stewart School of Industrial and Systems Engineering.

Academic/Practitioner Interface Luncheon
12:30pm-1:30pm
Convention Center – Room 4C
$30 – *Ticket required - sign up at the INFORMS registration desk.*
Don't miss this opportunity to network with colleagues, both in the practice and academic arenas. Facilitated roundtable discussions will focus on academic-practitioner collaboration during this sit-down luncheon.

Sponsored by the Microsoft Research.

Microsoft Research

SaturDay Workshops

ARTIFICIAL INTELLIGENCE & DATA MINING WORKSHOP

Seattle Sheraton

Breakfast/Welcome Session
8:00am-8:30am – Metropolitan A, Level 3

Workshop
8:30am-5:00pm – Ballard & Capitol Hill, Level 3

The Artificial Intelligence (AI) and Data Mining (DM) subdivisions of INFORMS are jointly organizing this pre-conference workshop. Both the College of AI and the DM Section are interdisciplinary subdivisions that bring together researchers and practitioners in engineering and business that are interested in the theory, application and methodologies of AI, DM and knowledge discovery.

The 2007 workshop highlights the frontiers of new knowledge and applications of AI and DM in operations research. The workshop will consist of two parallel tracks--one on artificial intelligence and the other on data mining. Each track will consist of two morning and two afternoon sessions, with each session consisting of two to three presentations. At lunch, our sponsors, Salford Systems and SAS, will make two presentations. A session is planned in the afternoon for participants to discuss their research in breakout groups.

Thank You

SALFORD SYSTEMS

SAS

VENDOR WORKSHOPS

AMPL Optimization LLC
Software Tools and Components: Linear, Nonlinear and Stochastic Programming Using AMPL and Its Extensions
3:00pm-6:00pm
Sheraton – Leschi, Level 3

Dash Optimization
Fast Track Modeling and Optimization for OR Practitioners
3:00pm-6:00pm
Sheraton – Greenwood, Level 3

Frontline Systems, Inc.
Optimal Decisions for Uncertain Models: Robust Optimization, Stochastic Programming and Simulation Optimization Made Easy
12:00pm-3:00pm
Sheraton – Jefferson, Level 4

GAMS Development Corporation
Application Prototyping with GAMS
12:00pm-3:00pm
Sheraton – Ravenna, Level 3

GoldSim Technology
A Hybrid Probabilistic Simulation Environment
12:00pm-3:00pm
Sheraton – Seneca, Level 4

ILOG, Inc.
The New ILOG CPLEX 11, OPL-CPLEX Development System and Optimization Decision Manager
3:00pm-6:00pm
Sheraton – Jefferson, Level 4

Imagine That, Inc.
ExtendSim 7
3:00pm-6:00pm
Sheraton – Pike, Level 4

Lumina Decision Systems
Introduction to Analytica
12:00pm-3:00pm
Sheraton – Leschi, Level 3

Maximal Software, Inc.
Optimization Modeling with MPL: Integrating Optimization in Real-World Business Applications
12:00pm-3:00pm
Sheraton – Kirkland, Level 3

Paragon Decision Technology & Ziena Optimization
A Collaborative AIMMS/KNITRO Workshop
3:00pm-6:00pm
Sheraton – Kirkland, Level 3

Responsive Learning Technologies
Online Games for Operations Management and Supply Chain Courses
12:00pm-1:30pm: The Supply Chain Game
1:30pm-3:00pm: Managing Operations at Littlefield Technologies
Sheraton – Pike, Level 4

Salford Systems
Data Mining with Salford Systems
3:00pm-6:00pm
Sheraton – Ravenna, Level 3

SAS
Building and Solving Optimization Models with OPTMODEL
3:00pm-6:00pm
Sheraton – Seneca, Level 4

Vose Consulting
Frontiers of Applied Quantitative Risk Analysis
12:00pm-3:00pm
Sheraton – Greenwood, Level 3

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

For Practitioners

Focus on Practice
Sunday-Tuesday
Sheraton, Grand Ballroom A, Level 2

Real-world applications are the focus of practice-oriented sessions, including presentations on applications of text mining, financial engineering and portfolio analytics at GE, and real-world applications at the US Army, SAS and the San Francisco Fire Department. Two sessions focus on careers in O.R. Three of the 2007 Edelman Award finalists will reprise their presentations: DaimlerChrysler/J.D. Power, Hewlett-Packard and the US Coast Guard. You can also find practice-oriented talks in many of the 60 tracks including sessions on decision analysis, supply chain, manufacturing/service operations management, revenue management and military applications.

2007 Franz Edelman Award Reprise
Sponsored by CPMS, The Practice Section of INFORMS
Sunday, November 4
3:10pm-4:00pm
Convention Center – Room 608
Memorial Sloan-Kettering Cancer Center: 2007 First Place Winner
Keynote: Operations Research Advances Cancer Therapeutics

CPMS Isolated Practitioner Workshop & Reception
Monday, November 5
6:15pm–7:15pm
Sheraton – Admiral, Level 3
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. The 24nd workshop in this series will address timely issues that affect the isolated practitioner community. All are welcome to participate in the workshop, discussion and reception. Wine and cheese will be served.

Tutorials
Sunday-Wednesday
Track 4
Convention Center – Room 606
These 90-minute sessions offer an in-depth look at current methodologies. INFORMS will publish nine of the tutorials in a CD to be given to all attendees. A book and extra CDs will be available for purchase at the INFORMS booth in the exhibit hall (114/116). Topics include community-based OR, OR and homeland security, safe scheduling, business engineering and other key topics.

Software Demonstrations
Sunday–Wednesday
Track 24
Convention Center – Room 209
See new product releases, case studies and software presented by leading vendors and solution providers.

Academic/Practitioner Interface Luncheon
Tuesday, November 7
12:30pm-1:30pm
Convention Center – Room 4C, Level 4
$30 – *Ticket required, sign up at the INFORMS registration desk.*
Don't miss this opportunity to network with colleagues, both in the practice and academic arenas. Facilitated roundtable discussions will focus on academic-practitioner collaboration during this sit-down luncheon.

Thank You
Microsoft Research

2008 INFORMS CONFERENCE ON O.R. PRACTICE

APPLYING SCIENCE TO THE *Art of Business*

Save the Dates!
April 13-15, 2008
Marriott Waterfront
Baltimore, Maryland



Call for Select Presentations

Submit a proposal to speak and attend the conference at a 40-50% discount!

You are invited to submit a proposal to present at the 2008 INFORMS Conference on OR Practice. Selected speakers can register for the meeting at a discounted fee of $495, a 40-50% discount off regular rates.

This prestigious conference has earned a reputation for high-quality presentations that emphasize real-world business topics and applied academic work. The Selection Committee is looking for case studies, best practice examples, applications reports and tutorials with a practice orientation to round out the 2008 program.

We welcome submissions from both practitioners and academics.

Submit a proposal today! Submission deadline: December 1, 2007

Complete submission requirements: www.informs.org/Conf/Practice08

Special Programs

2007 Combined Colloquia
Friday: Sheraton – Metropolitan B, Level 3
Saturday: Sheraton – Grand Ballroom C & D
Cedar, Douglas - Level 2
The 2007 Combined Colloquia will feature the 9th Teaching Effectiveness Colloquium and the Future Academician and Future Practitioner Colloquia. Participants in the various colloquia will join together for a welcome dinner on Friday evening, as well as breaks and meals on Saturday. Participation in the colloquia is by nomination only.

Sponsored by Omega Rho, ILOG, INFORM-ED, McGraw-Hill/Irwin and Wiley.

Organization Science Dissertation Proposal Competition
Saturday, 8:30am-5:00pm
Sheraton – Wallingford, Level 3
Now in its 16th year, this competition is one of the most prestigious available to doctoral students studying organizations. Finalists present their dissertation proposals in a workshop on Saturday, and receive detailed feedback from a panel of respected organizational scholars who act as judges for the competition. The all-day workshop also provides an opportunity for attendees to interact with a small group of future colleagues.

Organization Science Program
Saturday, Sheraton – Issaquah, Level 3
9:00am-12:00pm: Teaching Entrepreneurship and Technology Innovation
Presentations by noted entrepreneurship educators and roundtable discussions will be used to share teaching techniques and discuss the challenges of teaching entrepreneurship and technology innovation. Topics will include: teaching mixed student bodies, stimulating idea generation for new businesses, working with technology transfer offices, engaging in economic development with little community support, asynchronous learning, and more.

1:00pm-5:00pm: Editor's Panel and Paper Development Workshop
Presented by the Editorial Board of *Organization Science* and the College of Organization Science, the panel will feature *Organization Science* Editor Linda Argote and others who will discuss issues related to publishing in the journal. The panel will begin at approximately 4:00pm following the paper development workshop. The workshop is structured to provide detailed feedback from researchers working in similar areas and generate suggestions for developing the participants' work prior to journal submission. Workshop participants will discuss drafts of their papers in small discussion groups with Senior Editors, members of the *Organization Science* Editorial Board, and other workshop participants.

CIST 2007 – Conference on Information Systems and Technology
Saturday-Sunday
Sheraton – Aspen and Juniper, Level 2
The theme of the 2007 conference is *Interdisciplinary Information Systems Research.* The goal of this conference is to engage academic and industry researchers in a dialogue that examines a broad range of topics consistent with the main thrust of this theme.

Sponsored by the University of Connecticut, Dept. of Operations and Information Management; the University of Texas at Dallas, School of Management; and IBM.

INFORMS Applied Probability Society Markov Lecture
Monday - MB54, 10:00pm-11:30am
Sheraton – Queen Anne, Level 3
The third annual APS Markov Lecture features Ruth J. Williams, University of California-Department of Mathematics, who will present *Stochastic Networks with Resource Sharing*. Further discussion by Kavita Ramanan, Carnegie Mellon University, and Mark Squillante, IBM Research, will follow.

To the Memory of Frank M. Bass
Sunday - SD38, 4:30pm-6:00pm
Convention Center – Room 308
The session will be introduced by key members of the INFORMS marketing community. Presentations will address Frank M. Bass's major achievements in the areas of diffusion modeling, stochastic processes, applications of the scientific method to business data, and more.

To the Memory of Peter L. Hammer
Monday - MC05, 1:30pm-3:00pm
Convention Center – Room 607
In addition to presentations about Peter Hammer's research contributions, colleagues will recall personal memories and episodes from his life.

Seattle Area Math Teachers Program
Monday
8:00am-4:00pm
Sheraton – Willow A, Level 2
This program, geared to middle/high school/community college math and science teachers, will consist of introductory O.R. and computer application presentations followed by hands-on participation. Participants are also welcome to attend technical sessions, and will receive copies of all program materials.

JOB PLACEMENT SERVICES

Job Fair
Sunday, November 4
12:00pm-5:00pm
Convention Center – Ballroom 6A
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 conference, giving them the chance to set up interviews during the conference.

INFORMS Job Placement Service
Monday-Tuesday, 9:00am-5:00pm
Wednesday, 9:00am-3:30pm
Convention Center – Ballroom 6B
This service provides employers and applicants 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
THE INDUSTRY JOB SEARCH
Monday - MB05, 10:00am-11:30am
Convention Center – Room 607

The panel will discuss the industry interview process and the do's and don'ts associated with the job search. Participants include current and former industrial recruiters.

THE ACADEMIC JOB SEARCH
Tuesday - TB05, 10:00am-11:30am
Convention Center – Room 607

This panel will discuss the academic interview process and the do's and don'ts associated with the job search. Participants include current and former search chairs.

SUNDAY

PLENARY

11:40am-12:30pm
Convention Center, Ballroom 6E

Some Thoughts on Our Profession: "So what is it you do?"

Seth Bonder
Founder and Former Chairman/CEO
Vector Research, Incorporated (VRI)

Our profession has a wonderful history with roots to the "Scientific Management" work of Taylor in the 1800s, industrial engineering in the 1900s and the heroic age of World War II. And in the last six decades, we have made substantial contributions to the effectiveness and efficiency of many public and private sector enterprises. Yet we are an invisible profession to the population at large, and many in our profession still have a difficult time answering the question: "so what is it you do?" In this talk I will suggest reasons for this difficulty; look at sister professions to see why they don't have this problem; propose a definition of our profession that indicates what we do and highlights its inherent content; and present some recommendations for changes in our profession related to its science, practice, education and professional dimensions.



Throughout his distinguished career, **Seth Bonder** has been a leader in applying operations research to national defense operational, planning and policy issues, and subsequently to healthcare delivery re-engineering and disease management practices. He is the founder and former CEO of Vector Research, Incorporated and was a Professor of Industrial Engineering at the University of Michigan. Bonder served as the 27th President of the Operations Research Society of America, President of the Military Operations Research Society, and Vice-President of the International Federation of Operational Research Societies. He has been the recipient of numerous awards, including the Patriotic Service Award from the Secretary of the Army, the George E. Kimball Medal, the Jacinto Steinhardt Award, and the INFORMS President's Award. He is an INFORMS Fellow and a member of the National Academy of Engineering. Bonder is currently working on approaches to mitigate the improvised explosive device problem in Iraq.

KEYNOTE

3:10pm-4:00pm
Convention Center, Ballroom 6E

Homeland Security Science and Technology: Missions, Structures and the Role of Analysis

Ervin Kapos
Director, Operations Analysis
Department of Homeland Security, Science and Technology Directorate

The Department of Homeland Security is the Johnny-come-lately of the U.S. federal government system, in temporal terms (barely over 4 years) if not exactly in numerical terms (over 220,000 people). Its struggles to make sense of the structure demanded by departmental functions and by 22 separate operating "services" thrown together in what has been the largest case of governmental "fusion" in quite a while have been echoed by the efforts of the Science and Technology Directorate (S&T) to reorganize itself for true user-responsiveness. The results of a look at the S&T directorate's missions in relation to its multiple usership have given rise to a comparatively simple matrix organization for the S&T world. This involves six divisions in which practically all of the substantive work of the directorate is accomplished, and three "portfolio" managers who own the funds required for those projects–transition, innovation, and research.

The mechanism by which program plans and priorities are established is the Integrated Process Team (IPT) chaired by the user representative and including the end-user in its membership. The rest of the IPT includes the S&T division representative and the acquisition sponsor, but all other interested parties are encouraged to attend the sessions and to participate. The directorate publishes a Five-Year S&T Plan and a list of high-priority S&T objectives as additional outputs of the IPT process. The place of operations analysis in this scheme will be discussed, as well as the contributions it will be looking for from the operations research and management science community.



Ervin Kapos was previously the Director of the Operations Analysis Program in the Office of Naval Research (ONR). The ONR program established operations analysis (OA) as a tool for management decision making in ONR and provided solutions to problems in analytical methodology that obstruct the application of OA in key areas such as readiness assessment, command and control and experimentation. Kapos was the founding principal and President of Kapos Associates Inc. (KAI) from 1984-2000. At KAI, he evolved a complex, integrated program structure of policy studies, operational analysis and executive level gaming that, while initially focused on naval issues, also served clients up to Cabinet level, including various interagency bodies, executive departments, military services and regional commands, as well as the private sector. Prior to KAI, Kapos had a career with Ketron, Inc, where he was President from 1980-1984. He began his career at the Navy's Operations Evaluation Group (later an element of the Center for Naval Analysis), first serving several tours as an analyst primarily with the Pacific Fleet commands, then successively director of CNA's Southeast Asia Combat Analysis Division, Marine Corps Operations Analysis Group and Operations Evaluation Group. He has a BA in mathematics and completed PhD course work in mathematics, both at Indiana University.

Plenary & Keynote Presentations

SUNDAY

Reprise Presentation
EDELMAN COMPETITION 2007 AWARD WINNER

3:10pm-4:00pm
Convention Center, Room 608

Operations Research Advances Cancer Therapeutics

Eva K. Lee, Georgia Institute of Technology, School of Industrial and Systems Engineering; Health Systems Institute, Georgia Institute of Technology and Emory University

Marco Zaider, Memorial Sloan-Kettering Cancer Center

As the world's oldest, largest and the best private cancer center, Memorial Sloan-Kettering Cancer Center (MSKCC) seeks next-generation cancer treatment advances to treat its patients in the best possible ways. The MSKCC and Georgia Tech team devised sophisticated optimization modeling and computational techniques to implement an intra-operative 3D treatment planning system for brachytherapy (the placement of radioactive "seeds" inside a tumor) that offers a much safer and more reliable treatment. The system eliminates pre-operation simulation and post-implant imaging, saving an estimated 459 million dollars per year on prostate cancer alone. Quality of life is improved through drastic reduction (45-60%) of complications due to plans that deliver less radiation to healthy structures. This has a profound impact on the cost for interventions to manage side effects. The system removes the operator-dependent quality associated with planning, and has the potential to establish "standard" quality-assurance guidelines.

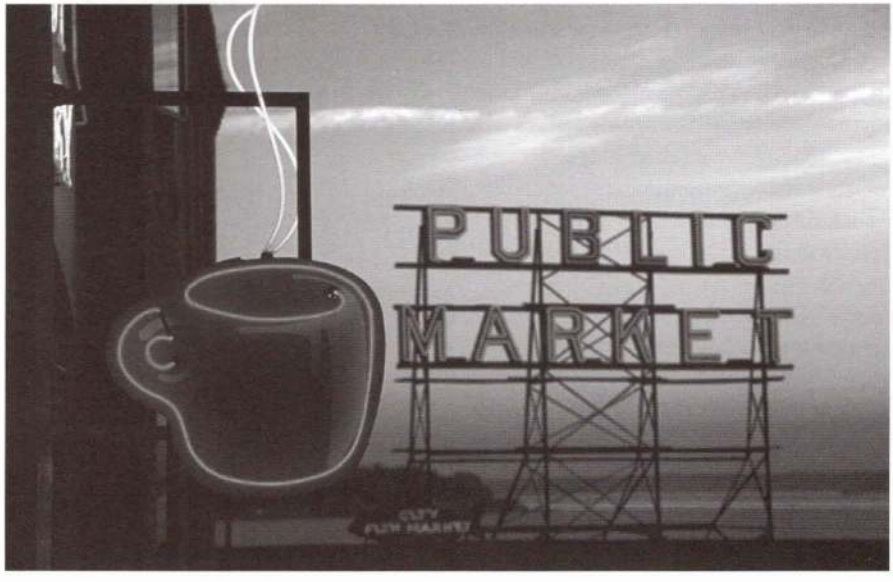
The Franz Edelman Award for Achievement in Operations Research and the Management Sciences calls out, recognizes and rewards outstanding, high-impact applications of OR/MS. Each year, five to seven finalists compete in the "Super Bowl" of O.R. in practice. The 2007 finalists include Coca-Cola Enterprises, the U.S. Coast Guard, Hewlett-Packard and DaimlerChrysler. In this keynote, the first place Memorial Sloan-Kettering Cancer Center team will reprise their winning presentation.



Eva Lee is an Associate Professor in the H. Milton Stewart School of Industrial and Systems Engineering at Georgia Institute of Technology, where she is Director of the Center for Operations Research in Medicine and HealthCare. Lee received her MS and PhD degrees in Computational and Applied Mathematics from Rice University in 1993. Upon graduation, she received an NSF postdoctoral fellowship in the area of parallel computation, followed by an NSF/NATO postdoctoral scholarship on scientific computing. In 1996, she received the NSF CAREER Young Investigator Award in integer programming and parallel algorithms and their applications to medical diagnosis and cancer treatment. She was the first IE/OR recipient for the prestigious Whitaker Foundation Biomedical Grant for Young Investigators, awarded for her work on a novel approach for combining biological imaging and optimal treatment design for prostate cancer. In 2004, Lee was selected as one of the Extraordinary Women Engineers. In 2005, she received the INFORMS Pierskalla Best Paper Award for research excellence in healthcare and management science for her work on emergency response and planning, large-scale prophylaxis dispensing, and resource allocation for bioterrorism and infectious disease outbreaks. In 2006, she was chosen by the American Mathematical Society as the mathematician ambassador to speak and discuss individually to congressional leaders on her research advances in the medical and healthcare domain, and the importance of mathematics in scientific advances. She has edited three books and published over 70 papers in peer-reviewed journals.



Marco Zaider received his PhD from Tel-Aviv University (1976). As a post-doctoral fellow and then staff member at Los Alamos National Laboratory, he worked on the treatment of cancer with pions. In 1979 Zaider joined the College of Physicians and Surgeons (Columbia University) where he rose through the academic ranks to become Professor of Clinical Radiation Oncology, Public Health and Applied Physics, and Director of the Graduate Program in Medical Physics. In 1998 he was appointed Attending and Head of Brachytherapy Physics at MSKCC and Professor of Physics in Radiology at Cornell University Medical School, positions which he currently holds. He served in leadership positions with NCRP, ICRP and AAPM. Zaider is currently Councilor In Physics for the RRS and Member of the Main Council (NCRP). He is board certified by the ABMP in radiation oncology. He has published two books and over 120 papers in peer-reviewed journals.



MONDAY

IFORS DISTINGUISHED LECTURE

11:40am-12:30pm
Convention Center, Ballroom 6E

Using OR to Improve the Quality of Your Life

Ralph L. Keeney
Research Professor of Decision Sciences
Fuqua School of Business, Duke University

Most operations researchers are concerned with helping companies, governments, organizations and other individuals make better decisions. We should also use our OR concepts, techniques and tools for the important decisions in our own lives. This presentation outlines guidelines for systematic thinking and analysis to help you improve the quality of your life. Since individuals can purposefully influence the quality of their lives only by their decisions, an individual first needs to define what he or she means by quality of life. This can be done by creating a coherent set of life objectives. Using these, the individual should recognize decision opportunities, create alternatives and make decisions that further these life objectives. The presentation includes procedures to help one examine life-changing decisions, personal policy choices and fundamental life tradeoffs, such as time, health and money. Several examples using the ideas presented are included.



Ralph L. Keeney has a BS in engineering from UCLA and a PhD in operations research from MIT. His research interests concern models of decisions involving multiple objectives, application of decision analysis for complex corporate and governmental problems, risk analysis involving life-threatening risks, structuring decisions and creating innovative alternatives. He is the author of numerous published articles and several books on various aspects of decision-making. His recent book *Smart Choices* (Harvard Business School Press, 1999), coauthored with John Hammond and Howard Raiffa, brings the basic knowledge from the decision science field to individuals interested in making better decisions in their professional and personal lives. Keeney received the Frank P. Ramsey medal for distinguished contributions in decision analysis and is a member of the National Academy of Engineering.

KEYNOTE

3:10pm-4:00pm
Convention Center, Ballroom 6E

Gaining Competitive Advantage through the Deployment of Advanced Decision Support Systems

Gang Yu
Vice President of Worldwide Procurement
Dell Inc.

Advanced information technology through global networks drives today's business to be more competitive, boundless and informative. To succeed or even just survive in this new era requires a commitment to scientific and effective management of all available resources. The deployment of advanced decision support systems can help enterprises gain competitive advantage through effective usage of resources, timely decisions and efficient operations. These in turn will result in improved customer experience and increased profits. In this talk, Gang Yu will illustrate the key elements for successfully defining, designing, developing and deploying decision support systems. He will call on his experiences in managing airline real-time operations at CALEB Technologies, in managing global supply chain at Amazon.com and in managing worldwide procurement at Dell Inc.



Before assuming his position at Dell, **Gang Yu** served as Vice President of Worldwide Supply Chain Operations, Amazon.com. Prior to Amazon.com, he was the Jack G. Taylor Professor of Business at the McCombs School of Business at The University of Texas at Austin. He is also the Founder and former Chairman/CEO of CALEB Technologies Corporation (now a subsidiary of Accenture). The real-time decision support systems developed by CALEB have been deployed at many major US airlines. Yu has published over 70 journal articles, three patents and four books. He won the 2002 Franz Edelman Management Science Achievement Award from INFORMS and the 2003 Outstanding IIE Publication Award from the Institute of Industrial Engineers, in addition to many other awards. He received his MS from Cornell University and his PhD from the Wharton School of Business, University of Pennsylvania.

KEYNOTE

3:10pm-4:00pm
Convention Center, Room 608

Fast Cross-Entropy Methods for Solving NP-Hard Combinatorial Optimization and Counting Problems

Reuven Y. Rubinstein
Professor Emeritus, Faculty of Industrial Engineering and Management
Technion - Israel Institute of Technology

We present a survey on the cross-entropy methods to approximate the solutions of a broad class of NP-hard combinatorial optimization problems (COPs) including integer programs and for counting, like counting the number of Hamiltonian cycles. The main idea of our approach is to associate with each COP and each counting problem an auxiliary generic convex minimum cross-entropy program that is easy to solve analytically. For counting problems, we use the optimal pdf obtained from the solution of the minimum cross-entropy program as an importance sampling pdf to estimate from simulation the desired counting quantity. For COPs (with a unique optimal solution), we show that the optimal pdf of the minimum cross-entropy program converges to its associated degenerated counterpart. This allows us to approximate the solution of COPs deterministically, that is, without resorting to simulation. We present extensive numerical results for many interesting applications and show that our method allows us to approximate fast and quite accurately COPs and counting problems with hundreds of variables and hundreds of constraints.



Reuven Rubinstein is a world-known expert in stochastic modeling, applied probability and Monte Carlo simulation methods. He has written over 100 articles and published six books with Wiley and Springer. His citation index is in the top 5% among the scientists in OR and applied probability worldwide. Rubinstein spent most of his sabbatical years at top universities in the world including Columbia, Harvard, Michigan and Stanford University. He is a consultant to many leading firms, including IBM, Motorola and NEC. Rubinstein is the inventor of the popular score-function method in simulation analysis and the generic cross-entropy methods for combinatorial optimization and counting. For details on this method, which includes over 100 publications, go to http://en.wikipedia.org/wiki/Cross-entropy_method.

Plenary & Keynote Presentations

TUESDAY

PLENARY

11:40am-12:30pm
Convention Center, Ballroom 6E

Reinventing Operations for a Globally Integrated Economy

Robert W. Moffat, Jr.
Senior Vice President, Integrated Operations
IBM Corporation

When it comes to managing operations and improving the flow of goods and services, every institution in the world is grappling with the reality of globalization. The barriers that used to block the flow of work, capital and ideas are weakening–in many cases, disappearing. New business models are being built on the notion that work can and will flow from anywhere to anywhere in an interconnected world. Competing in this new environment requires fundamentally new approaches to operations–dissolving the boundaries between business process, how and where they are performed and creating a capacity to integrate vast capabilities globally. This presentation will cover how companies must reinvent operations to make more informed decisions about how to:

- Deploy people, processes and assets to optimize production globally.
- Manage human capital as one global asset to connect the best ideas.
- Involve customers, partners and employees to collaborate and innovate on offerings, business processes and business models.



Robert W. Moffat, Jr. is responsible for managing operations that support IBM's product and most of its service offerings worldwide. His mission is to integrate these operations globally, using new business process designs and advanced technology to achieve greater levels of efficiency while improving IBM's market responsiveness. In this role, he leads IBM's Integrated Supply Chain (including procurement, manufacturing, logistics and customer fulfillment), global delivery for strategic outsourcing and delivery operations for IBM's Managed Business Process Services business, which includes Business Transformation Outsourcing services.

Moffat joined IBM in 1978 and has held several executive positions, including senior vice president and group executive of IBM's Personal and Printing Systems Group. Prior to that, he ran manufacturing, fulfillment and procurement for the PC business. He led the team that pioneered the Advanced Fulfillment Initiative and channel collaboration initiatives, which was awarded the 1999 Franz Edelman Award. He is a member of the IBM Performance Team and the IBM Corporate Operations Team. He serves as a member of the Board of Trustees for The Manufacturing Institute and is a non-voting observer on the Board of Directors of Lenovo Group Limited. Moffat graduated from Union College in Schenectady, New York, with a BS degree in Economics and holds an MBA in Management Information Systems from Iona College.

KEYNOTE

3:10pm-4:00pm
Convention Center, Room 608

Organizational Transformation - Insights and Challenges

John J. Garstka
Director, Forces Transformation
Forces Transformation & Resources
Office of the Undersecretary of Defense (Policy)
US Department of Defense (DoD)

Strategic leaders, when faced with a challenge or opportunity that cannot be effectively dealt with by employing existing leadership or management approaches, must often turn to the methodologies of organizational transformation. This keynote address will describe key insights relating to organizational transformation from both the public and private sectors. Insights developed from an examination of military transformation will be shared and a generalized model for large-scale organizational transformation that focuses on technology, process, organizational and people innovation will be presented.



John Garstka works in the office of the Deputy Assistant Secretary of Defense for Forces Transformation and Resources in the Office of the Undersecretary of Defense (Policy). In this capacity, he is responsible for the development and oversight of policy relating to the transformation of DoD forces. He is a recognized thought leader in the area of network centric operations and has written extensively and lectured globally on the impact of networking on the operational effectiveness of military organizations. Garstka has 23 years of experience working in positions of increased responsibility in the DoD and the commercial sector. From 1996 to 2002 he worked on the Joint Staff in the Directorate for Command, Control, Communications and Computer Systems as a Chief Technology Officer and Science and Technology Advisor. From 2002 to 2006 he worked in the DoD Office of Force Transformation as Assistant Director for Concepts and Operations. He is a Distinguished Graduate of the US Air Force Academy, where he earned a BS degree in Mathematics in 1983. He also holds an MS degree in Engineering-Economic Systems from Stanford University, where he studied as a Hertz Fellow.

TUESDAY

KEYNOTE

3:10pm-4:00pm
Convention Center, Ballroom 6E

Publishing in Operations Research and Making Money

Sridhar Tayur, Founder and CEO
SmartOps Corporation
Ford Distinguished Research Professor
Carnegie Mellon University

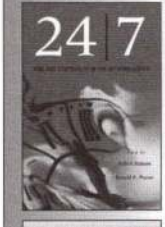
This talk will describe a feasible solution to the following "problem": can one publish academic papers in top INFORMS journals while also making O(10^6) (and sometimes even O(10^7)) dollars annually? Four elements form the core of the solution: (1) choosing high impact avenues for providing OR applications; (2) identifying appropriate executive buyers; (3) negotiating a check-list of requirements that allow for publishing good papers expediently; and (4) avoiding the poor behavior that is typically associated with many corporate OR professionals. A by-product of this solution is improved teaching ratings with far less effort. Current efforts seek to find a solution that allows one to earn O(10^8) dollars/year while publishing in top INFORMS journals.



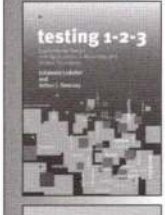
Sridhar Tayur is the founder and Chief Executive Officer of SmartOps, a supply chain optimization software company that is the first Endorsed Business Solution of SAP AG, the largest provider of enterprise software in the world. SmartOps is rapidly growing its client list of Fortune 1000 and other top manufacturers and retailers. Tayur's expertise in designing and applying algorithms provides SmartOps with software offerings that fill a persistent market need that current ERP, APS and procurement systems do not address. Since 2000, SmartOps has worked closely in a variety of supply chain optimization problems, and has imbedded the software as part of everyday use that currently manages and optimizes over 10B$ of inventory worldwide. Over 2B$ of value has been created at these companies. Over the past 15 years, Tayur has been a sought-after supply chain consultant and has helped implement supply chain optimization systems for Caterpillar, Intel, IBM, John Deere and General Electric. His project work has been reported in business periodicals, including an article in *FORTUNE*. Tayur has published in many scholarly publications (*Operations Research, Management Science, Mathematical Programming,* and more) and is co-editor of *Quantitative Models for Supply Chain Management*. He has won the Undergraduate Teaching Award and the George Leland Bach teaching award. He has been named a "Top Professor" in *Business Week*. He received his PhD in Operations Research and Industrial Engineering from Cornell University and his undergraduate degree from the Indian Institute of Technology at Madras.

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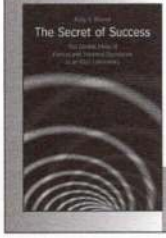
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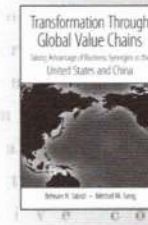
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Plenary & Keynote Presentations

WEDNESDAY

OMEGA RHO DISTINGUISHED LECTURE

11:40am-12:30pm
Convention Center, Ballroom 6E

The Evolution of Optimization in Business

Robert Bixby
Chief Science Officer, ILOG, Inc.
Noah Harding Professor Emeritus of Computational and Applied Mathematics
Research Professor of Management
Jones School of Management, Rice University

In his 1993 Morse Lecture at the TIMS/ORSA National Meeting in Chicago, George Nemhauser spoke on the topic of "The Age of Optimization." By "optimization" he meant linear and mixed-integer programming–a reasonable definition in the context of business applications. Mixed-integer programming in particular plays an increasingly dominant role in this domain; indeed, the range of integer-programming applications to key business issues is essentially limitless. In the early 1990s there was a great deal of optimism about linear programming, and a sense that the solvability of linear programs was beginning to disappear as a roadblock. Combined with greatly improved data availability, the emergence of modern modeling languages, and improvements in computing hardware, there was among many, including this speaker, a belief that optimization had entered into a new age. But had it?

The optimism about linear programming turned out to be justified. Given massive performance improvements in linear programming solvers, it is now rarely a roadblock. Around 1998, general-purpose integer programming codes also began acceleration in performance that continues unabated. But what has this meant about the real role of optimization in the management sciences? What has changed, where have we seen successes, and what are the primary hurdles to optimization's becoming one of the standard approaches in addressing core business problems? In this talk I will attempt to give at least one person's view on these issues.



Robert Bixby
co-founded CPLEX Optimization, Inc., in 1987. CPLEX was acquired by ILOG, Inc., in 1997, and Bixby has since served in various capacities at ILOG. He is currently Chief Scientific Officer of ILOG and General Manager of the ILOG Semiconductor Business Division. He was Chairman of the Mathematical Programming Society, and was formerly editor-in-chief of the journal *Mathematical Programming*. Bixby has authored over 50 scholarly publications. He became a member of the National Academy of Engineering in 1997, received the Humboldt Senior Scientist Award in 1992 and the Mathematical Programming Society Beale-Orchard-Hayes Prize for Computational Mathematical Programming in 2000. He earned a BS in Industrial Engineering and Operations Research from the University of California-Berkeley and a PhD from Cornell University.

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 37 active collegiate chapters and more than 5,000 student and faculty members. It 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 and to its local chapters.

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, Robert Bixby will be inducted as the 41st Honorary Member of Omega Rho.

PLENARY & RECEPTION

Convention Center, Ballroom 6E
5:10pm-6:00pm: Plenary and Reception
6:00pm-7:00pm: Reception

OR is Everywhere!
Some OR HumOR and HistORy



Peter nORden
Adjunct Professor
Columbia University

Even if you are not a formidable time-series extrapolatOR or comfortable with ORthogonal algORithms, do join our discussion to create a cORnucopia of a plethORa of "embedded OR" in this short panel session. Bring along any memories or examples of your experiences with our community's histORy of OR research and practice. This will be followed by a casual reception, with fun food, snacks and beer/wine (stopping just shORt of a snORt of pORt!).

Convention Center – Room 606

■ SA04
8:00am-9:30am
Community-Based Operations Research*
Michael Johnson, University of Massachusetts Boston
Karen Smilowitz, Northwestern University

Community-based operations research is the application of decision models to social issues of a local nature. The goal of this field is to design policies and tactics that have the potential to improve individual life outcomes and neighborhood-level outcomes by addressing welfare, equity and administrative efficiency simultaneously. Community-based OR problems tend to be "messy" and dependent on political and social considerations. This tutorial defines community-based OR in the context of public sector OR/MS, highlights current research in a variety of domains and identifies a number of new research opportunities. Two case studies in food security and affordable housing emphasize the commonality of problem attributes and the diversity of modeling and solution methods.

■ SB04
10:00am-11:30am
Operations Research and Homeland Security: From Models to Implementation
Lawrence Wein, Stanford University

We give an overview of our research in two areas of homeland security: catastrophic biological events (preparing and responding to a smallpox attack, an airborne anthrax attack, a botulinum toxin attack on the food supply and assessing infection control measures for pandemic influenza) and border control (preventing nuclear weapons from entering the country on a shipping container and from entering a city, using biometrics to prevent terrorists from entering the country, and analyzing U.S. immigration strategy from a homeland security viewpoint). We focus on the modeling, the policy recommendations and the implementation of these recommendations.

TutORials CD
As a Seattle registrant, you received a free CD of *TutORials 2008* with a selection of nine noteworthy tutorials being presented at the meeting. You can purchase *TutORials 2008* in book form or an extra copy of the CD at our special conference rate – just $25. Stop by the INFORMS booth (#114/116) for complete information.

* These tutorials are included in *TutORials 2008*.

■ SC04
1:30pm-3:00pm
When More is Better
David Simchi-Levi, Massachusetts Institute of Technology

A supply chain setting is inherently characterized by interactions between multiple products and agents seeking to maximize their own utility. In this presentation we use an axiomatic approach to explore the impact of product variety on customer demand, product price, system revenue and inventory levels. These results are applied to two supply chains. The first is a decentralized multi-retailer system where each retailer sells a single product and retailers compete on price. The second supply chain is a single retailer selling multiple competitive products. We use the insight from our analysis to answer the question of whether more consumer choices are better for the customers or the seller.

■ SD04
4:30pm-6:00pm
A Tutorial on Safe Scheduling*
Kenneth Baker, Dartmouth College
Dan Trietsch, American University of Armenia

Safe scheduling augments the traditional approach to sequencing and scheduling models by recognizing safety times explicitly. In this paper, we give a brief review of the basic results in scheduling theory, describe how these results have been extended to stochastic cases, and demonstrate how safe scheduling models sharpen our ability to formulate stochastic problems. Although scheduling theory has historically been driven by optimization methods, we demonstrate how stochastic scheduling problems can be approached with a powerful spreadsheet-based heuristic procedure.

■ MA04
8:00am-9:30am
Approximation Algorithms for Stochastic Inventory Control Models
David Shmoys, Cornell University

We consider stochastic inventory control models in which we wish to coordinate a sequence of orders for stochastic demand over a finite time horizon with minimum expected overall holding and backlogging costs. Recent results develop new algorithms, aiming to prove guarantees for their performance. We shall survey several recent papers in this area, presenting results of three separate flavors: algorithms that combine a new amortization approach with a cost balancing technique; the analysis of the sample average approximation; and new ways to build on traditional DP techniques.

■ MB04
10:00am-11:30am
Generating Robust Project Baseline Schedules*
Willy Herroelen, Katholieke Universiteit Leuven

Most research efforts in resource-constrained project scheduling assume a static and deterministic environment within which the pre-computed baseline schedule will be executed. Project activities, however, may be subject to considerable uncertainty that may lead to schedule disruptions during project execution. We discuss proactive project scheduling procedures for generating robust baseline schedules that are sufficiently protected against anticipated time and resource disruptions and reactive policies that may be deployed to repair the schedule during project execution.

■ MC04
1:30pm-3:00pm
Approaches to Risk in Optimization Under Uncertainty*
R. Tyrrell Rockafellar, University of Washington

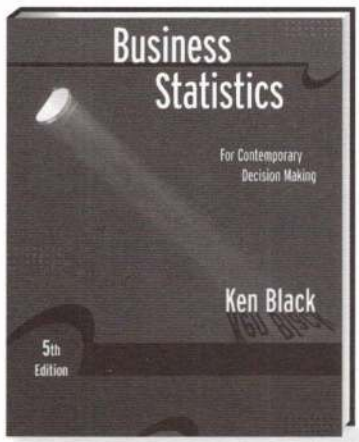
Decisions often need to be made before all the facts are in. Essentially then, the outcomes are random variables that have to be quantified with respect to their inherent "risk." Constraints may need to be viewed in a probabilistic manner, perhaps with the introduction of safety margins. This tutorial concerns the methodology for dealing with such issues. Questions of whether a particular approach is "coherent" or not are addressed, in particular.

■ MD04
4:30pm-6:00pm
The Coordination of Pricing and Production Decisions
Nicholas G. Hall, The Ohio State University

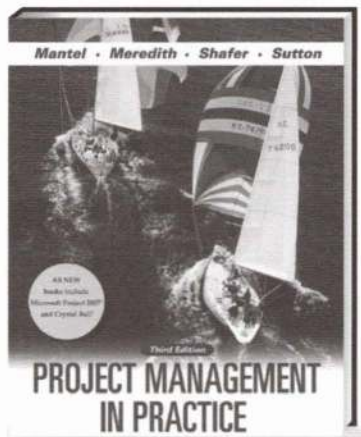
We review the literature on deterministic models for the coordination of pricing and production decisions. We present recent research results on the coordination of pricing and job-by-job scheduling decisions. We also discuss a competitive, multiple player environment where available capacity is auctioned and resulting schedules are thus determined. Promising directions for future research are identified.

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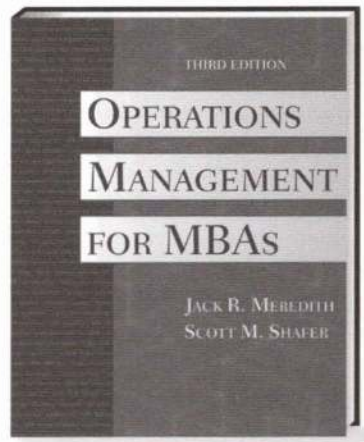
Please visit the Blackwell booth [#103] to see our latest offerings in Decision Sciences and Information Systems.



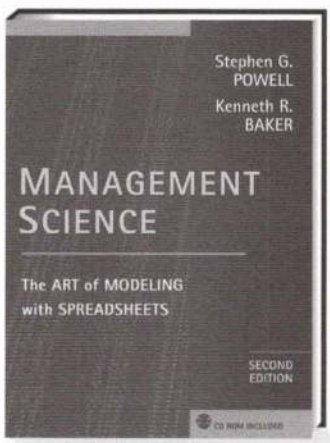
Business Statistics: For Contemporary Decision Making, 5th Edition
Ken Black, University of Houston, Clear Lake, TX
978-0-471-78956-7



Core Concepts: Project Management in Practice, 3rd Edition
Samuel J. Mantel, University of Cincinnati
978-0-470-12164-1



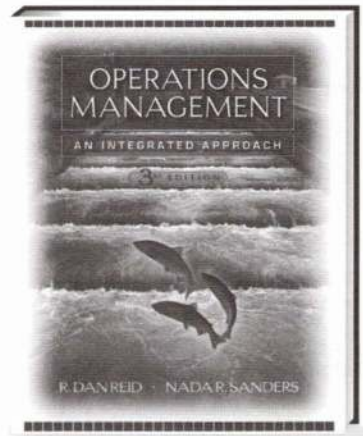
Operations Management for MBAs, 3rd Edition
Jack R. Meredith, Wake Forest University
Scott M. Shafer, Wake Forest University
978-0-471-35142-9



Management Science: The Art of Modeling with Spreadsheets, 2nd Edition
Stephen G. Powell, Dartmouth College
Kenneth R. Baker, Dartmouth College
978-0-470-03840-6



Operations Management, 6th Edition
Roberta (Robin) Russell, Virginia Tech
Bernard W. Taylor, Virginia Tech
978-0-470-09515-7



Operations Management: An Integrated Approach, 3rd Edition
R. Dan Reid, University of New Hampshire
Nada R. Sanders, Wright State University
978-0-471-79448-6

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■ TA04
8:00am-9:30am
Empirical Methods in Operations Management
Christian Terwiesch, The Wharton School

The last couple of years have witnessed an increased interest in empirical research in operations management. However, unlike other management disciplines, operations management does not have a strong record of connecting theory development and empirical analysis. The objective of this tutorial is to address this disconnect. We will discuss several forms in which theoretical (modeling) research can be combined with empirical (econometric) research, including structural estimation, micro-level productivity studies and instrumental variable estimation.

■ TB04
10:00am-11:30am
Solving Large-Scale Discrete Optimization Problems: Introduction to the Nested Partitions Method*
Leyuan Shi, University of Wisconsin-Madison
Sigurdur Olafsson, Iowa State University

The Nested Partitions (NP) method is a relatively recent metaheuristic that has been found very effective for solving large-scale discrete optimization problems. Such problems are common in a broad range of practical applications and the NP method is therefore applicable to many operational and planning problems in both manufacturing and service industries. In this tutorial we introduce how to implement the NP method, demonstrate its key convergence properties, show how to integrate other exact and heuristic optimization methods into the very general framework the NP method provides, and evaluate its performance relative to other comparable methods. We also present several case studies from application areas that include supply chain management, health care delivery and data mining.

■ TC04
1:30pm-3:00pm
Computational Global Optimization*
Leon Lasdon, University of Texas
Janos D. Pinter, Pintér Consulting Services, Inc

The objective of global optimization (GO) is to find the best possible solution in highly nonlinear models that possess multiple–local and global–optima. In this tutorial we state the general GO model and discuss some of its important special cases. Next, we review (theoretically and computationally) exact and heuristic solution approaches, and discuss software implementations. We also highlight illustrative applications and GO case studies, and point towards present and future challenges.

■ TD04
4:30pm-6:00pm
Supply Chain Management in the Context of Humanitarian Disasters
Luk N. Van Wassenhove, INSEAD

This presentation will introduce supply chain management in the humanitarian context, and outline the need for better preparedness and response to disasters. We also discuss opportunities for more effective collaboration among humanitarian organizations, as well as between humanitarians and private organizations. The presentation uses a number of real cases to highlight opportunities to do interesting research with a high potential impact.

■ WA04
8:00am-9:30am
Social Networks: Theory and Applications
Yong Tan, University of Washington

A social network is a map of formal/informal relationships among people, organizations or other entities. It plays an important role in information dissemination and knowledge sharing, and is becoming increasingly popular in business research. This tutorial aims to cover social networks theory from the perspective of economics, sociology and physics. Empirical methods and models will be introduced. Related work in the areas of operations management, information systems, management, marketing and finance will be discussed.

■ WB04
10:00am-11:30am
Trends in OR and MS Education at the Introductory Level*
Frederick S. Hillier, Stanford University
Mark S. Hillier, University of Washington

The last 40 years have seen major changes in OR and MS education at the introductory level. This tutorial traces the changes that have occurred, describes what subjects are currently being taught and assesses the changes that can be expected in the near future.

■ WC04
1:30pm-3:00pm
Differential Game Models in Marketing Science*
Gary Erickson, University of Washington Business School

Markets are dynamic and involve oligopolistic competition, so the fit between differential games and marketing science is a natural one. This tutorial presents an overview of differential games, and discusses examples of differential game models used in marketing science, focusing on models involving advertising. The challenge of applying differential games empirically is also discussed, and example applications are presented.

■ WD04
3:30pm-5:00pm
Business Engineering: A Practical Approach to Valuing High-Risk High-Return Projects Using Real Options*
Scott Mathews and Jim Salmon, The Boeing Company

Options technology when applied within a corporation for strategic decision-making is called real options. These leading-edge risk and valuation mathematical methods more accurately determine effective investment strategies to reduce risk and shape project value outcome. A new airplane business case is used to illustrate various valuation techniques with modeling and simulation enhancements. Business engineering extends real options into systems engineering for comprehensive project management.

Software Demonstrations

Convention Center – Room 209

SUNDAY, NOVEMBER 4

■ SA24
8:00am–8:45am
JMP Division – SAS Institute
Curt Hinrichs, curt.hinrichs@jmp.com
Melodie Rush, melodie.rush@jmp.com

JMP 7.0 for Interactive Data Analysis
JMP is a state-of-the-art data analysis and visualization package from SAS. Developed for those who desire to explore data easily with modern graphics, JMP offers elementary and advanced statistics, business visualization and exploratory data mining. Only JMP offers two-way integration with SAS. The demo highlights JMP's key capabilities.

8:45am–9:30am
statistics.com
Peter Bruce, peter.bruce@statistics.com

Data Mining in Excel - XLMiner
XLMiner (data mining add-in for Excel) offers database sampling, stratified sampling, partitioning into training, validation and test samples, missing data imputation, and database scoring. Plus classification/regression trees, logistic regression, neural networks, Bayesian classifier, k-nearest neighbors, multiple linear regression with subset selection, association rules, principal components, hierarchical and k-means clustering.

■ SB24
10:00am–10:45am
Ziena Optimization, Inc.
Richard Waltz, waltz@ziena.com

Recent Developments in the KNITRO Optimization Solver
This software demonstration will highlight recent developments in the KNITRO optimization solver. Particular attention will be paid to new techniques being developed for handling mixed-integer nonlinear programs (MINLP). The demo will also provide an overview of how to effectively use KNITRO in a variety of environments and applications.

10:45am–11:30am
Lumina Decision Systems, Inc.
Max Henrion, henrion@lumina.com

Analytica: What It Does That Spreadsheets Can't
A rare chance to see Analytica demonstrated by its originator: users prefer Analytica to spreadsheets because of its transparency, flexibility for multiple dimensions, efficient Monte Carlo, scalability and its powerful new Optimizer. Analytica models are typically 10 to 100 times more compact than equivalent spreadsheets, and correspondingly easier to build, understand and audit.

■ SC24
1:30pm–2:15pm
GAMS Development Corporation
Steven Dirkse, sdirkse@gams.com

Rapid Application Prototyping with GAMS
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: a Sudoku calculator sure to impress friends and family!

2:15pm–3:00pm
AMPL Optimization LLC
Robert Fourer, 4er@ampl.com

Enhanced Solver Support in the AMPL® Modeling Language
AMPL has set the standard for optimization modeling languages that handle complex models naturally and large models efficiently. AMPL's co-developer will give a quick but lucid tour of AMPL's current solver support, with emphasis on less well-known enhancements for global optimization and for constructs such as logical constraints, discrete and semi-continuous variable domains, and piecewise-linear functions.

■ SD24
4:30pm–5:15pm
ATEJI
Patrick Viry, patrick.viry@ateji.com

Object-Oriented Modeling and Integration with OptimJ
The OptimJ object-oriented modeling language provides a radical new approach to integrating optimization techniques in general IT environments. See how easy it is to integrate your models in web-based database-enabled applications. Discover OptimJ bulk processing operators for data feeding and cleaning. Understand how OptimJ can significantly improve collaboration between software developers and OR experts.

5:15pm-6:00pm
Responsive Learning Technologies, Inc.
Sam Wood, wood@responsive.net

Online Games for Operations Courses
See a demonstration of online games that are used in operations management courses and supply chain management courses in more than 100 undergraduate and MBA-level programs to teach topics like capacity management, lead time management, inventory control, and supply chain design and logistics.

MONDAY, NOVEMBER 5

■ MA24
8:00am–8:45am
Vose Consulting US LLC
Huybert Groenendaal
huybert@voseconsulting.com
Greg Nolder, greg@voseconsulting.com

Building Sophisticated Risk Analysis Models with ModelRisk
ModelRisk for Insurance and Finance allows users to quickly build sophisticated probabilistic models in Excel without resorting to custom programming. The tool provides users easy access to advanced quantitative methods and techniques that were previously difficult or impossible to implement in a spreadsheet environment such as Copula correlations; aggregate distributions; fitting and simulating times series models including mean-reversion and GARCH; the use of distribution objects; and many others. Please stop by to pick up a trial copy and see a demonstration of ModelRisk.

8:45am–9:30am
Palisade Corporation
David Doran, ddoran@palisade.com

@RISK 5.0 in Operations Research
Palisade, a world leader in risk and decision analysis software for over 20 years, has just released an all-new version of its flagship risk analysis add-in to Microsoft Excel, @RISK 5.0. Using Monte Carlo simulation, @RISK 5.0 is used to solve a wide variety of operations research problems, from modeling cash flows of a new product to bidding models.

■ MB24
10:00am-10:45am
LINDO Systems, Inc.
Mark Wiley, mwiley@lindo.com

Efficient Tools for Optimization Modeling
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. Find out how easy it is to: quickly build complex optimization models; effortlessly access data in Excel and databases; seamlessly embed optimization into your own applications.

10:45am-11:30am
Maximal Software, Inc.
Bjarni Kristjansson
bjarni@maximalsoftware.com

Introducing New Release of MPL Modeling System for Optimization with New and Enhanced Features
We will be demonstrating the newest release of MPL, one of the fastest and most scalable modeling languages on the market today. The innovative OptiMax 2000 Component Library, which allows MPL models to be easily embedded into end-user applications, has been augmented to include several new objects and methods. The speed and scalability of the model generation has been greatly enhanced, and with the new 64-bit Itanium version capable of solving much larger models than ever before. Several new solvers have been added and existing solvers updated. Data access has been improved with new native drivers and now offers full XML/SOAP support for Internet connectivity.

■ MC24
1:30pm–2:15pm
AIMMS by Paragon Decision Technology
Gertjan de Lange, g.de.lange@aimms.com
Ming Fang, m.fang@aimms.com

AIMMS, How to Enhance and Improve OR Usability
AIMMS 3.8 allows you to take another step towards using and deploying OR. The already available sophisticated features are extended with Benders Decomposition techniques, NLP Multi-start and Pre-solve options, and extended GUI capabilities. We introduce the AIMMS Viewer, a freely distributable version of AIMMS. All–again–to enhance and improve the user experience.

2:15pm–3:00pm
ILOG, Inc.
Irvin Lustig, ilustig@ilog.com

Introducing ILOG CPLEX 11
Join us for an overview of the new ILOG CPLEX, which delivers the most significant performance gains to date and leverages the full power of multi-core machines. Learn how CPLEX's algorithmic innovations and parallel search can solve your most challenging MIP problems. Learn how to make the most of the new features. Come and see why CPLEX is better than ever!

■ MD24
4:30pm–5:15pm
SAS Institute, Inc.
Ed Hughes, ed.hughes@sas.com
Trevor Kearney, trevor.Kearney@sas.com

Versatile, Extensible Optimization Modeling with OPTMODEL
OPTMODEL from SAS unifies linear, mixed-integer, quadratic and general nonlinear optimization modeling and provides solvers for each type of model. We'll show several examples of the use of OPTMODEL, with a focus on how you can use its flexibility and extensibility to build algorithms that fit challenging optimization problems.

5:15pm–6:00pm
Salford Systems
Mikhail Golovnya, golomi@salford-systems.com

Introducing New Release of CART 6.0 PRO EX
Salford Systems is unveiling CART 6.0 PRO EX, our most robust version of our award winning CART software including substantive patent pending technology. The new version includes innovative tools and diagnostics for assessing the quality and reliability of a CART model and extensive modeling automation to accelerate the process of finding high performance models. CART 6.0 PRO EX also includes new methods for uncovering "hotspots"–segments of extraordinarily high value or risk– and new controls for shaping and structuring trees to reflect the needs of the researchers and modelers.

TUESDAY, NOVEMBER 6

■ TA24
8:00am–8:45am
Syncopation Software
Chris Dalton, cdalton@syncopation.com

DPL 7.0 Preview: Portfolio Analysis and More!
Learn about the powerful new features in DPL 7.0! See how you can glean more insights with the Initial Decision Alternatives Tornado and Option Value Diagram. Save time in the pre-presentation crunch with the new endpoint replay capability. Go beyond project-level analysis by analyzing a portfolio of opportunities.

8:45am–9:30am
GoldSim Technology Group
Rick Kossik, rkossik@goldsim.com

A Hybrid Probabilistic Simulation Environment
An introduction to building probabilistic simulation models using GoldSim, a hybrid simulator that can simultaneously represent continuous and discrete dynamics. GoldSim provides powerful probabilistic simulation capabilities to support representation of uncertain and/or stochastic systems. The session will provide an overview of GoldSim's features and capabilities.

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■ TB24
10:00am–10:45am
Imagine That, Inc.
Dave Krahl, davek@extendsim.com

ExtendSim Demonstration
See how quickly you can build robust, intuitive models with the power tool for simulation - ExtendSim. Revolutionary new simulation technology and 3D animation in ExtendSim is paired with core ExtendSim features such as hierarchical model building, user interface creation and interactive modeling to make it the tool to watch in the simulation industry. Don't miss this demo!

10:45am–11:30am
Dash Optimization
Gabriel Tavares
gabriel.tavares@dashoptimization.com

Building Optimization Applications in Xpress-MP
This tutorial focuses on developing and deploying complete optimization applications using Dash's array of tools. These tools can be used for modeling, solving, analyzing, and visualizing optimization problems, and integrating them seamlessly in business applications. The proven technologies offered by Dash can be used in range of applications such as supply chain management, transportation, finance, energy, manufacturing, retail operations, manufacturing industries, etc.

■ TC24
1:30pm–2:15pm
Frontline Systems, Inc.
Daniel H. Fylstra, dfylstra@frontsys.com

Robust Optimization, Stochastic Programming, and Simulation Optimization Made Easy
What's the best way to optimize models with uncertainty? Simulation optimization is flexible, but not scalable to large models. Stochastic programming is less flexible but more scalable, and supports recourse decisions. Robust optimization is very scalable to large models, but has been hard to implement. See how Premium Solver Platform makes all of these methods easily usable in Microsoft Excel, in one unified framework.

2:15pm–3:00pm
SAS Higher Education Consulting
Susan Walsh, susan.walsh@sas.com

Turning Data into Information with SAS Enterprise Miner
It has been estimated that the amount of data in the world has been doubling every 18 to 24 months. Multi-gigabyte databases are now commonplace. In order to turn this data into information, data mining is used in industry in a number of areas, including but not limited to credit scoring, customer churn, fraud detection and donations analysis. This presentation will introduce SAS Enterprise Miner with an emphasis on its use for predictive modeling.

■ TD24
4:30pm–5:15pm
StatPoint, Inc.
Neil Polhemus, neil@statgraphics.com

STATGRAPHICS .NET Web Services
This talk will demonstrate the new STATGRAPHICS .NET Web Services, which allow users to perform statistical calculations from within a web browser. The web services reside on a server and may be called using the STATGRAPHICS interface or from user-written web applications using XML scripts. Output is returned as HTML with imbedded images.

5:15pm–6:00pm
Oracle-Crystal Ball Global Business Unit
Michael Franden, michael.franden@oracle.com

Crystal Ball Software
Take a tour of Crystal Ball software, the easiest tool available for performing Monte Carlo simulations and risk analysis within your own spreadsheets. Utilizing one integrated toolset, Crystal Ball allows you to automate "what if" analysis and build accurate models to understand any uncertainty and identify the best possible solution.

WEDNESDAY, NOVEMBER 7

■ WA24
8:00am–8:45am
XJ Technologies
Timofey Popkov, tim@xjtek.com

AnyLogic - Multi-Approach Simulation Tool
AnyLogic is a simulation tool supporting process-centric (discrete event), system dynamics and agent-based modeling approaches. The flexibility of the modeling language enables the user to capture the complexity and heterogeneity of business, economy and social systems at any desirable level of details. AnyLogic set of primitives and library objects allows you to model manufacturing, logistics, business processes, human resources, and consumers' and patients' behavior in their natural interaction. AnyLogic object-oriented model design paradigm provides for modular and incremental construction of large models.

8:45am–9:30am
DecisionWare Ltda.
Camilo Valero, camilo.valero@decisionware-ltd.com
Jesus Velasquez, jesus.velasquez@decisionware-ltd.com

Optex Mathematical Modeling System Design Implementation and Set up of Optimization Models
Optex is a software tool for design and implementation of DSS systems. It provides visual interfaces based on MS-Windows, information systems integrated with optimization models, as well as model formulation with database and algebraic computer languages. Optex can generate models in GAMS, AMPL, MathProg and C ANSI. It can also link to libraries such as: CoinMP, GLPK, LPSOLVE, SYMPHONY, CPLEX and XPRESS. Finally, Optex provides automatic design and development of data models and visual interfaces.

Interactive Sessions

MONDAY AND TUESDAY

12:30pm-1:30pm
Convention Center – Ballroom Foyer

Researchers, practitioners and students share their work in OR/MS in these sessions presented as poster displays, laptop demonstrations or other creative formats. Authors will be on hand to present their work. Two awards will recognize the best Interactive Presentations with a first-place award of $1,000 and second-place award of $500.

A panel of judges will review each presentation and announce the award-winners on Tuesday at 1:15pm. Judges are: Cynthia Barnhart, Professor and Associate Dean in the School of Engineering, MIT, President-Elect INFORMS; Jeffrey Camm, Professor and Department Head, Quantitative Analysis and Operations Management, College of Business, University of Cincinnati, Editor-in-Chief *INTERFACES*; Theodore Klastorin, Professor of Operations Management, Burlington Northern/Burlington Resources Professor in Manufacturing Management, University of Washington Business School; Archis Ghate, Assistant Professor, Industrial Engineering, University of Washington, Chair of Interactive Sessions.

MONDAY, NOVEMBER 5

Risk Averse Selective Newsvendor with All-or-Nothing Orders
Kiran Chahar, Clemson University; Kevin Taaffe

On the Use of Hidden Markov Models for Animal Speech Recognition
Ivan Guardiola, Texas Tech University; Aaron Phillips

Using a Genetic Algorithm and Mixed Integer Program to Solve Concave Cost Supply Scheduling Problem
Xia Wang, University of Maryland; Bruce Golden, Edward Wasil

Reliability, Failure Characterization and Intensity Function Estimates of Nanosystems
Geoffrey Okogbaa, University of South Florida; Wilkistar Otieno

Understanding Team Development Through Survival Analysis
Deanna M. Kennedy, University of Massachusetts Amherst; Sara A. McComb

An Ant Colony Based Heuristic for the Vehicle Routing Problem with Simultaneous Pickup and Delivery
Emrah Cimren, Ohio State University; Elif Ilke Gokce

Allocation of War Fighters into Strategic Compact Units: Picking Teams Beyond the Playground
Nicole Scholtz, Denison University; Nina Fefferman

Improving Regularity of Crew Schedules in Ex-Urban Public Transit
Leena Suhl, University of Paderborn

The Financial Costs of Entrepreneurial Errors in Launch Timing
David Croson, SMU Cox School of Business

Algorithm of Finding Hereditarily Minimax Matrices and Functions
Vladimir Tsurkov, Dorodnicyn Computing Center of RAS; Anatoly Mironov

Optimization of Multi-Echelon Supply Chains Using Piecewise Linear Cost Functions
Metin Turkay, Koc University; Ugur Kaplan

Data Mining: A Definition of Patient Compliance
Christiana Petrou, University of Louisville; Patricia Cerrito

Generalized Trade Reductions: The Role of Competition in Designing Budget-Balanced Mechanisms
Rica Gonen, Yahoo! Research; Elam Pavlov, MIT

Revenue Sharing, Disposal Allowance to Coordinate Two Period Newsboy Supply Chain with Mid Disposal
Linh Cao, POSTECH; Yu-Shin Hong

Text and Data Mining to Investigate Expenditures of Prescribed Medicines
Guoxin Tang, University of Louisville; Patricia Cerrito

Supply Contracts in Constrained Channels
Navid Sabbaghi, MIT; Yossi Sheffi, John Tsitsiklis

Emergency Medical Service System Design with Risk Measures
Nilay Noyan, SABANCI University

New Approaches to Nonlinear Network Design Problems in Supply Chain Optimization
Thomas Sharkey, University of Florida; Edwin Romeijn

Two Stage Approach to Decision Making in Radiation Therapy
Minsun Kim, University of Washington; Mark Phillips

RimSim: A Simulation Test Bed for Emergency Planning and Response
Suzanne Weghorst, University of Washington

Incorporating Timber Quality and Carbon in Harvesting Planning Models
Rapeepan Kantavichai, University of Washington; D. Briggs

TUESDAY, NOVEMBER 6

User-Centered Road Design in the Expression Synthesis Project
Jie Liu, University of Southern California; Elaine Chew, Alexandre Francois

Risk Level in Quantity and Time Flexible Contracts
Berrak Dag, University of Limerick; Cathal Heavey, Paul Liston

Operations Research in Breast Cancer Diagnosis
Jagpreet Chhatwal, University of Wisconsin-Madison; Oguzhan Alagoz; Elizabeth Burnside

Organizing Virtually for Inter-Organizational Technology Development: A Longitudinal Analysis of the Development of a Network Standard
Sanjeev Jha, University of Illinois at Chicago; Mary Beth Watson-Manheim

Optimal Fences and Simultaneous Determination of Price and Inventory Decisions
Michael Zhang, Saint Mary's University

LUNCH AND INTERACTIVES

You can purchase a quick lunch in the Exhibit Hall and then spend time touring the Interactive Sessions. Lunch will be available for purchase every day of the conference.

Minimum Cost Testing under Precedence Constraints
Tonguc Unluyurt, Sabanci University

On the Quest of a Batch-Time-Series Forecasting Benchmark
Konstantinos Nikolopoulos, Manchester Business School; Vassilios Assimakopoulos, Nikolaos Bougioukos, Elli Pagourtzi, Fotios Petropoulos

Response Time Reduction in Make-to-Order and Assemble-to-Order Supply Chain Design
Navneet Vidyarthi, Univesity of Waterloo; Samir Elhedhli, Elizabeth Jewkes

Asymptotic Theory of Sequential Change Detection and Identification
Kazutoshi Yamazaki, Princeton University; Savas Dayanik, Warren Powell

A Theory of Activity Distribution Based on Spatial Interaction Through the Traffic Network
Takamori Ukai, Keio University

Determining Multiple Distributions of Retail Facilities with Respect to Trip Chaining Behavior
Yudai Honma, Keio University; Osamu Kurita

Optimization Efficiency Monitoring of Moving Objects in Sensor Networks
Boris Peltsverger, Georgia Southwestern State University; Svetlana Peltsverger, Jiangchuan Wang

Scheduling First-Year Seminars
Dawn Rose, Emmanuel College; Candace Selneck

Text Mining to Summarize Complicated Datasets Containing Structured, Nominal Data
Patricia Cerrito, University of Louisville; Hamed Zahedi

A Heuristic for Clark-Scarf Algorithm
Zumbul Bulut, Lehigh University; Lawrence Snyder

Recent Progress on the Probabilistic Set-Covering Problem
Anureet Saxena, Carnegie Mellon University

Data Envelopment Analysis of the Most Efficient National Healthcare Systems
Mehmet Ceyhan, Northeastern University; James Benneyan, Aysun Sunnecti

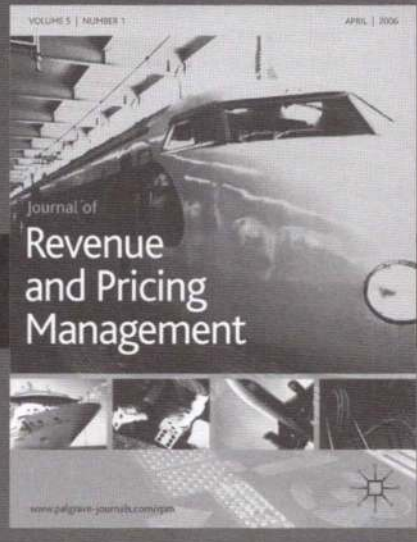
Modeling and Optimization for Organization Design
Darby Grande, Aptima; Georgiy Levchuk

Improvement, MD: A Checklist for Smart But Busy Change Leaders in Healthcare
Jose Valdez, University of Wisconsin Hospital and Clinics

An Intelligent Assembly Algorithm for Haptic Interface Applications of a Virtual Maintenance System
Jungwon Yoon, Gyeongsang National University; Christiand Yoon

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Exhibitors

Visit the Exhibit Hall to see innovative software products and the latest technical reference materials from these companies and organizations. Coffee breaks will be held in the Exhibit Hall on Monday, Tuesday and Wednesday.

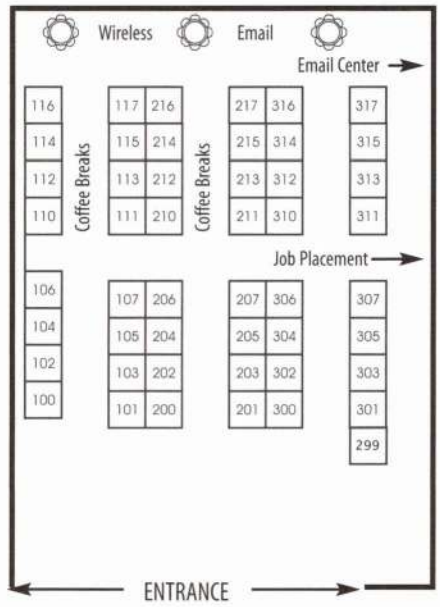
Exhibits Open

Sunday, Nov. 4	7:30pm-9:00pm Welcome Reception
Monday, Nov. 5	9:00am-5:00pm
Tuesday, Nov. 6	9:00am-5:00pm
Wednesday, Nov. 7	9:00am-3:30pm

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AMPL Optimization LLC develops and supports the AMPL modeling language, and distributes large-scale solvers and modeling tools including Ziena's KNITRO, ARKI's CONOPT, and OptiRisk's FortMP/QP/SP, SAMPL/SPInE, AMPL Studio and Windows COM objects. Over 30 other solvers work with AMPL; recent extensions support new features of KNITRO 5.0 and CPLEX 10.0.

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Visit the Computational Infrastructure for Operations Research booth to learn about free, open-source tools for O.R. professionals and students. COIN-OR is in its seventh year as a community initiative to build an open infrastructure of algorithms, models, data and other digital tools. COIN-OR is hosted online by INFORMS and is a strategic partner of the INFORMS Computing Society.

Dash Optimization **#310**
560 Sylvan Ave.
Englewood Cliffs, NJ 07632
www.dashoptimization.com
Dash Optimization develops and markets Xpress-MP, the world's leading software product for modeling and optimization. Our booth will feature live demonstrations of Dash's Xpress-MP products. Dash offers linear, mixed integer, quadratic, non-linear and stochastic programming capabilities. All of these components will be showcased using powerful development and deployment tools such as Xpress-Mosel, Xpress-IVE and Xpress Application Developer (XAD).

DecisionWare Ltda. **#312**
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Bogotá, Colombia
www.decisionware-ltd.com
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Frontline Systems, Inc. **#299**
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GAMS Development Corp. **#111**
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The General Algebraic Modeling System (GAMS) is a high-level modeling system for mathematical programming problems. It consists of a language compiler and a stable of integrated high-performance solvers. GAMS is tailored to create complex, large-scale modeling applications, and allows the user to build large maintainable models that can be adapted quickly to new situations.

GoldSim Technology Group **#106**
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www.goldsim.com
GoldSim is a Windows-based probabilistic, dynamic simulation tool designed for building hierarchical models of complex systems to support strategic planning and risk management in business, engineering and science. GoldSim can simultaneously simulate continuous and discrete dynamics, and has add-in modules to facilitate financial modeling and risk and reliability analysis.

ILOG, Inc. **#210/212**
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Imagine That, Inc. **#211**
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LINDO Systems, Inc. **#201**
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Chicago, IL 60622
www.lindo.com
LINDO Systems will highlight recent enhancements to our optimization modeling software including updates to the linear, integer and global solvers. We will be demonstrating LINDO API, our powerful solver engine; LINGO, our integrated modeling language and solvers; and What'sBest!, our large scale Excel solver. Stop by for a free trial CD.

Lumina Decision Systems, Inc. **#313**
26010 Highland Way
Los Gatos, CA 95033
www.lumina.com
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Maximal Software, Inc. **#213**
2111 Wilson Blvd., Ste. 700
Arlington, VA 22201
www.maximalsoftware.com
Maximal Software is the developer of MPL Modeling System, an advanced modeling language for formulating optimization models. We will demonstrate how MPL provides one of the fastest and most scalable modeling languages on the market, and how the OptiMax 2000 Component Library add-on can be used to build customized end-user applications to solve real-world optimization problems.

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National Science Foundation **#314**
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Reston, VA 20191
www.nsf.gov
NSF is an independent federal agency to promote the progress of science; advance the national health, prosperity and welfare; and to secure national defense. NSF is the major source of federal backing in many fields such as mathematics and computer science. NSF fulfills its mission by issuing limited-term grants--about 10,000 new awards per year--to fund specific research proposals that have been judged the most promising by a rigorous and objective merit-review system. Most of these awards go to individuals or small groups of investigators. NSF's goal is to support the people, ideas and tools that together make discovery possible.

Exhibitors

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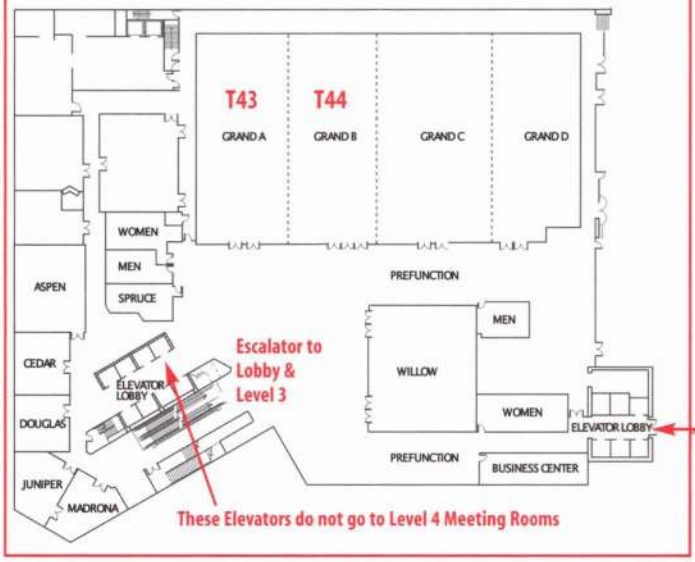
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Maps & Floor Plans

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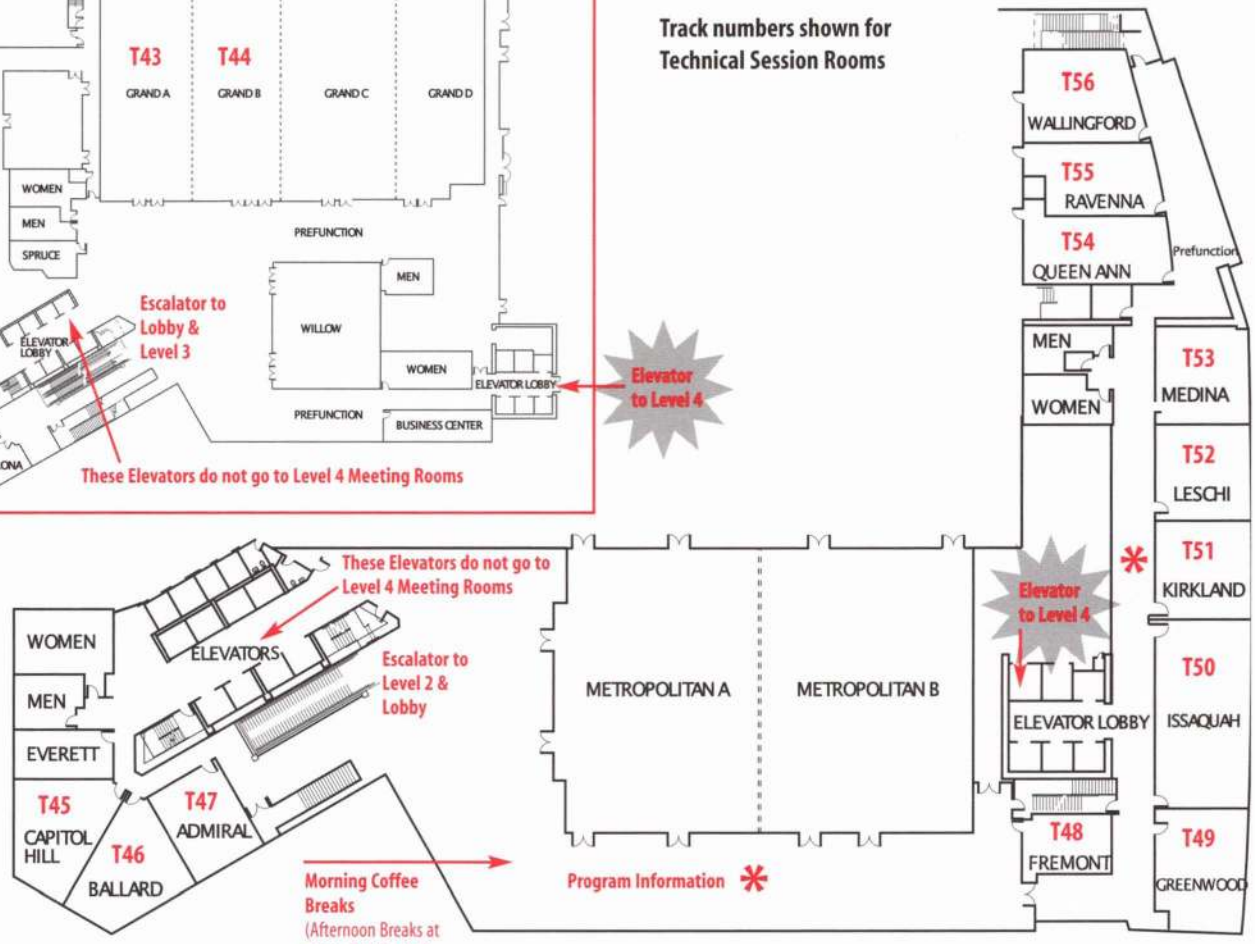
✻ Session Monitor Desk

LEVEL 2

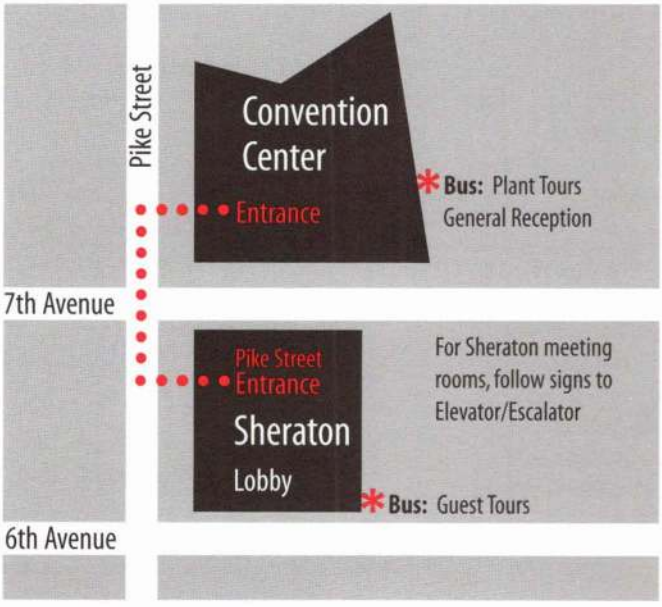


LEVEL 3

Track numbers shown for Technical Session Rooms

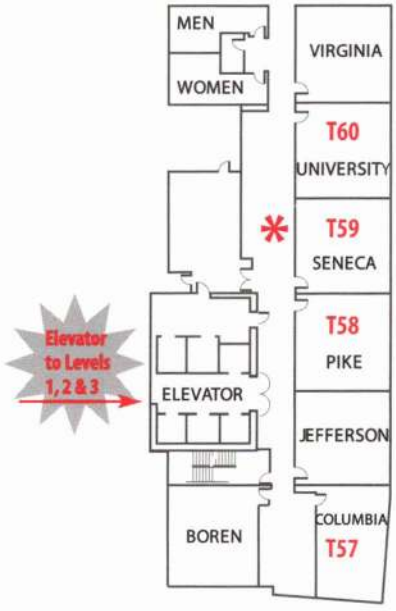


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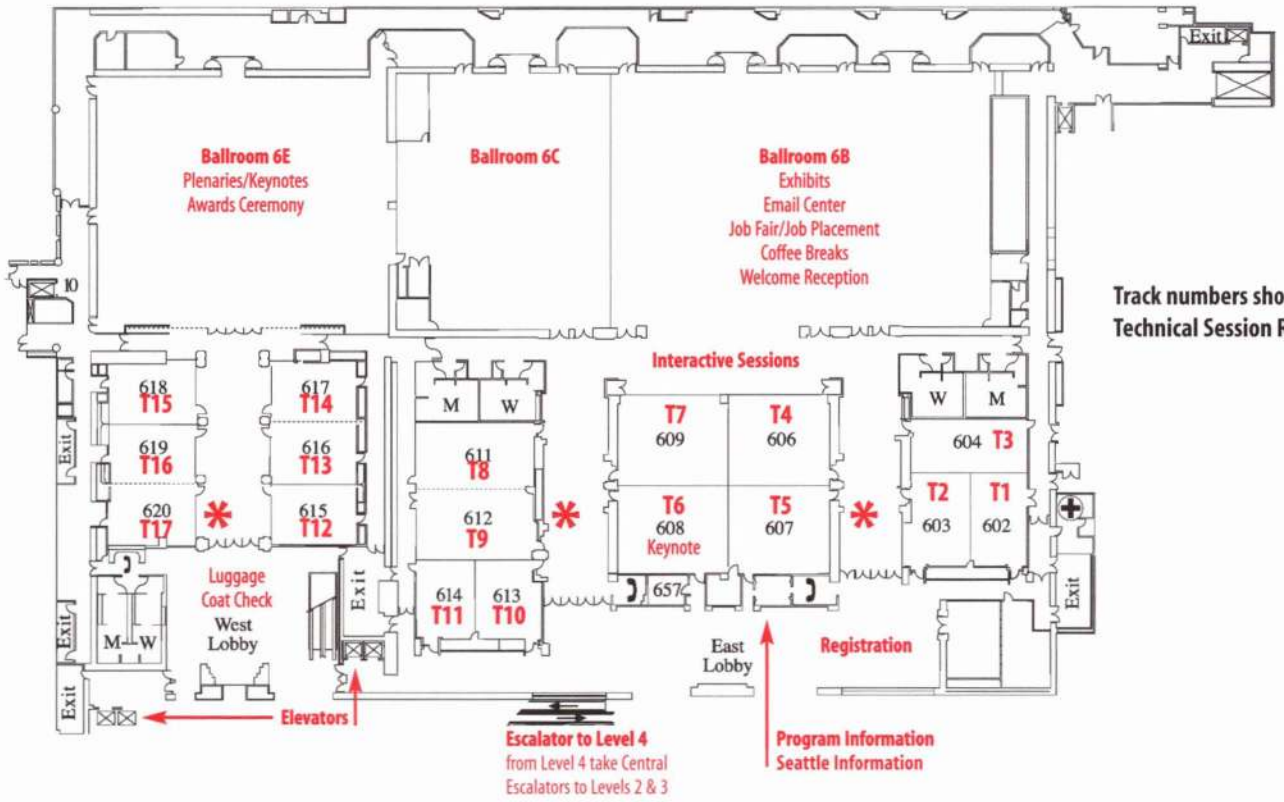
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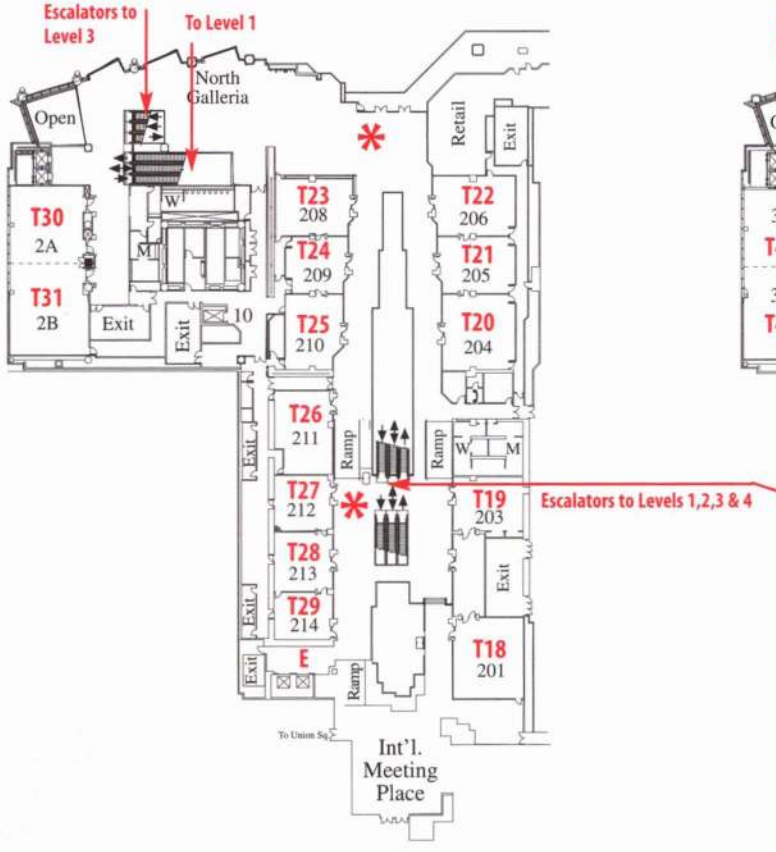
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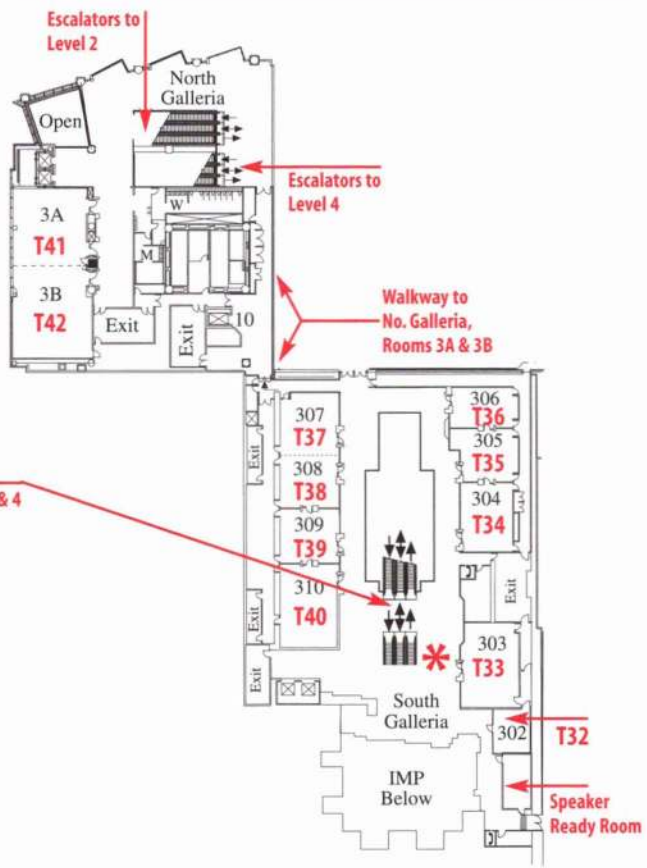
LEVEL 6



LEVEL 2



LEVEL 3



MASTER TRACK SCHEDULE–Sunday

C - Convention Center S - Sheraton

Track	Room	SA 8:00-9:30	SB 10:00-11:30	Plenary 11:40–12:30	SC 1:30-3:00	Keynotes 3:10-4:00	SD 4:30-6:00
1	C-Room 602	Supply Chain Management	Supply Chain Management		Supply Chain Management		Supply Chain Management
2	C-Room 603	Supply Chain	Supply Chain		Supply Chain		Supply Chain
3	C-Room 604	Supply Chain	Supply Chain		Supply Chain		Supply Chain
4	C-Room 606	Tutorials	Tutorials		Tutorials		Tutorials
5	C-Room 607	Dantzig Dissertation Prize	Dantzig Dissertation Prize	**Seth Bonder Some Thoughts on Our Profession: So what is it you do?"** C-Ballroom 6E	Nicholson Student Paper Prize	**Ervin Kapos Homeland Security Science and Technology: Missions, Structures and the Role of Analysis** C-Ballroom 6E	Nicholson Student Paper Prize
6	C-Room 608	MSOM	MSOM		MSOM		MSOM
7	C-Room 609	MSOM	MSOM		MSOM		MSOM
8	C-Room 611	Disruptions in Supply Chain	Disruptions in Supply Chain		Disruptions in Supply Chain		Disruptions in Supply Chains
9	C-Room 612	Multicriteria Decision Making	Multicriteria Decision Making		Homeland Security		Homeland Security
10	C-Room 613	Inventory	Inventory		Inventory		Inventory
11	C-Room 614	Manufacturing	Manufacturing		Manufacturing		Manufacturing
12	C-Room 615	Scheduling	Scheduling		Scheduling		Scheduling
13	C-Room 616	Optimization/Integer Prog.	Optimization/Integer Prog.		Optimization/Integer Prog.		Optimization/Integer Prog.
14	C-Room 617	No Session	Optimization/Nonlinear Prog.		Optimization/Nonlinear Prog.		Optimization/Nonlinear Prog.
15	C-Room 618	Opt./Linear & Complementarity	Opt./Linear & Complementarity		Opt./Linear & Complementarity		Opt./Linear & Complementarity
16	C-Room 619	Combinationatorial Optimization	Combinationatorial Optimization		Discrete Optimization		Optimization
17	C-Room 620	Information Systems Society	Information Systems Society		Information Systems Society	**Eva Lee Marcdo Zaider Edelman Reprise: Operations Research Advances Cancer Therapeutics** C-Room 608	Information Systems Society
18	C-Room 201	INFORMS Computing Society	INFORMS Computing Society		INFORMS Computing Society		INFORMS Computing Society
19	C-Room 203	INFORMS Computing Society	INFORMS Computing Society		INFORMS Computing Society		INFORMS Computing Society
20	C-Room 204	Decision Analysis	Decision Analysis		Decision Analysis		Decision Analysis
21	C-Room 205	Decision Analysis	Decision Analysis		Decision Analysis		Decision Analysis
22	C-Room 206	Decision Analysis	Data Envelopment Analysis		JFIG		JFIG
23	C-Room 208	Behavioral Process Mgt.	Behavioral Process Mgt.		Behavioral Process Mgt.		Behavioral Process Mgt.
24	C-Room 209	Software Demonstration	Software Demonstration		Software Demonstration		Software Demonstration
25	C-Room 210	Service Science	Service Science		Service Science		Service Science
26	C-Room 211	Data Mining	Data Mining		Data Mining		Data Mining
27	C-Room 212	Data Mining	Data Mining		Data Mining		Data Mining
28	C-Room 213	ICS/Metaheuristics	ICS/Metaheuristics		ICS/Metaheuristics		ICS/Metaheuristics
29	C-Room 214	ICS/COIN-OR	ICS/COIN-OR		ICS/COIN-OR		ICS/COIN-OR
30	C-Room 2A	Quality, Statistics & Reliability	QSR		QSR		QSR
31	C-Room 2B	Quality, Statistics & Reliability	QSR		QSR		QSR
32	C-Room 302	Shipping Maritime & Logistics	Shipping Maritime & Logistics		Panel: Seth Bonders		Shipping Maritime & Logistics
33	C-Room 303	Transportation Science & Logistics	TSL		TSL		TSL
34	C-Room 304	Transportation Science & Logistics	TSL		TSL		TSL
35	C-Room 305	Transportation Science & Logistics	TSL		TSL		TSL
36	C-Room 306	Transportation	Transportation		TSL		TSL
37	C-Room 307	Military Applications	Military Applications		Military Applications		Military Applications
38	C-Room 308	Marketing Science	Marketing Science		Marketing Science		To the Memory of Frank Bass
39	C-Room 309	Health Applications Section	Health Applications Section		Health Applications Section		Health Applications Section
40	C-Room 310	Health Applications Section	Health Applications Section		Health Applications Section		Health Applications Section
41	C-Room 3A	Opt./Computing in Life Sciences			INFORMS Computing		Medical Life Science
42	C-Room 3B	OR/Medicine & Health Care	OR/Medicine & Health Care		OR in Medicine & Heallthcare		OR in Medicine & Heallthcare
43	S-Grand Ball. A, Lev. 2	OR Practice	OR Practice		OR Practice		OR Practice
44	S-Grand Ball. B, Lev. 2	INFORM-ED	INFORM-ED		INFORM-ED		INFORM-ED
45	S-Capitol Hill, Lev. 3	Financial Services	Financial Services		Financial Services		Financial Services
46	S-Ballard, Lev. 3	ENRE/Energy	ENRE/Energy		ENRE/Energy		ENRE/Energy
47	S-Admiral, Lev. 3	ENRE/Forestry	ENRE/Forestry		ENRE/Forestry		ENRE/Forestry
48	S-Fremont, Lev. 3	Simulation Society	Simulation Society		Simulation Society		Simulation Society
49	S-Greenwood, Lev. 3	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
50	S-Issaquah, Lev. 3	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
51	S-Kirkland, Lev. 3	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
52	S-Leshci, Lev. 3	Railway Applications	Railway Applications		Railway Applications		Railway Applications
53	S-Medina, Lev. 3	Location Analysis	Location Analysis		Location Analysis		Location Analysis
54	S-Queen Anne, Lev.3	Applied Probability	Applied Probability		Applied Probability		Applied Probability
55	S-Ravenna, Lev. 3	Aviation Applications	Aviation Applications		Aviation Applications		Aviation Applications
56	S-Wallingford, Lev.3	Economics	Auctions		Auctions		Auctions
57	S-Columbia, Lev. 4	INFORMS Telecommunications	INFORMS Telecommunications		INFORMS Telecommunications		INFORMS Telecommunications
58	S-Pike, Lev. 4	Organization Science	Organization Science		Organization Science		Organization Science
59	S-Seneca, Lev. 4	Technology Management	Technology Management		Technology Management		Technology Management
60	S-University, Lev. 4	Technology Management	Technology Management		Technology Management		Technology Management

MASTER TRACK SCHEDULE–Monday

C - Convention Center S - Sheraton

Track	Room	MA 8:00-9:30	MB 10:00-11:30	Plenary Interactive Session	MC 1:30-3:00	Keynotes 3:10-4:00	MD 4:30-6:00
1	C-Room 602	Supply Chain Management	Supply Chain Management		Supply Chain Management		Supply Chain Optimization
2	C-Room 603	Supply Chain	Supply Chain		Supply Chain		Supply Chain
3	C-Room 604	Supply Chain	Supply Chain		Supply Chain		Supply Chain
4	C-Room 606	Tutorials	Tutorials	11:40am-12:30pm	Tutorials	**Gang Yu**	Tutorials
5	C-Room 607	INFORMS Korea Chapter	Job Placement	**Ralph L. Keeney**	History of ORMS	**Gaining Competitive**	History of ORMS
6	C-Room 608	MSOM	MSOM	**Using OR to**	MSOM	**Advantage through**	MSOM
7	C-Room 609	MSOM	MSOM	**Improve the Quality**	MSOM	**the Deployment of**	MSOM
8	C-Room 611	Disruptions in Supply Chain	Disruptions in Supply Chain	**of Your Life**	Disruptions in Supply Chain	**Advanced Decision**	Disruptions. in Supply Chain
9	C-Room 612	Homeland Security	Homeland Security	C- Ballroom 6E	Homeland Security	**Support Systems**	Homeland Security
10	C-Room 613	Inventory	Inventory		Inventory	C- Ballroom 6E	Inventory
11	C-Room 614	Manufacturing	Manufacturing		Manufacturing		Manufacturing
12	C-Room 615	Scheduling	Scheduling		Scheduling		Scheduling
13	C-Room 616	Optimization/Integer Prog.	Optimization/Integer Prog.		Optimization/Integer Prog.		Optimization/Integer Prog.
14	C-Room 617	Optimization/Nonlinear Prog.	Optimization/Nonlinear Prog.		Optimization/Nonlinear Prog.		Optimization/Nonlinear Prog.
15	C-Room 618	Linear Programming	Optimization/Stochastic Prog.		Optimization/Stochastic Prog.		Optimization/Stochastic Prog.
16	C-Room 619	Optimization	Optimization		Optimization		Optimization
17	C-Room 620	Information Systems Society	Information Systems Society	12:30pm-1:30pm	Information Systems Society	**Reuven Y. Rubinstein**	Information Systems Society
18	C-Room 201	INFORMS Computing Society	INFORMS Computing Society	**Interactive Session**	INFORMS Computing Society	**Fast Cross-Entropy**	INFORMS Computing Society
19	C-Room 203	INFORMS Computing Society	INFORMS Computing Society	Exhibit Hall	INFORMS Computing Society	**Methods for**	INFORMS Computing Society
20	C-Room 204	Decision Analysis	Decision Analysis	Entrance	Decision Analysis	**Solving NP-Hard**	Decision Analysis
21	C-Room 205	Decision Analysis	Decision Analysis		Decision Analysis	**Combinatorial**	Decision Analysis
22	C-Room 206	JFIG	JFIG		JFIG	**Optimization**	Data Envelopment Analysis
23	C-Room 208	Behavioral Processs Mgt.	Behavioral Processs Mgt.		Behavioral Processs Mgt.	**and Counting**	Behavioral Processs Mgt.
24	C-Room 209	Software Demonstration	Software Demonstration		Software Demonstration	**Problems**	Software Demonstration
25	C-Room 210	Service Science	Service Science		Service Science	C- Room 608	QSR
26	C-Room 211	Data Mining	Data Mining		Data Mining		Data Mining
27	C-Room 212	Data Mining	Data Mining		Data Mining		Data Mining
28	C-Room 213	ICS/ Metaheuristics	Metaheuristics		INFORMS Computing Society		INFORMS Computing Society
29	C-Room 214	ICS/COIN-OR	ICS/COIN-OR		Computational Opt. & Software		Computational Opt. & Software
30	C-Room 2A	Quality, Statistics & Reliability	QSR		QSR		QSR
31	C-Room 2B	Quality, Statistics & Reliability	QSR		QSR		QSR
32	C-Room 302	No Session	Shipping, Maritime, Logistics		Shipping, Maritime, & Supply Chain		Logistics
33	C-Room 303	Transportation Science & Logistics	TSL		TSL		TSL
34	C-Room 304	Transportation Science & Logistics	TSL		TSL		TSL
35	C-Room 305	Transportation Science & Logistics	TSL		TSL		TSL
36	C-Room 306	Transportation Science & Logistics	TSL		TSL		TSL
37	C-Room 307	Military Applications	Military Applications		Military Applications		Military Applications
38	C-Room 308	INFORMS Communities/Subdivisions	Game Theory		Game Theory		Game Theory
39	C-Room 309	Health Applications Section	Health Applications Section		Health Applications Section		Health Applications Section
40	C-Room 310	Health Applications Section	No Session		Health Applications Section		Health Applications Section
41	C-Room 3A	Health Applications Section	Health Applications Section		Health Applications Section		Health Applications Section
42	C-Room 3B	OR/Medicine & Health Care	OR/Medicine & Health Care		OR/Medicine & Health Care		OR in Medicine & Health Care
43	S-Grand Ball. A, Lev. 2	CPMS	CPMS		CPMS		CPMS
44	S-Grand Ball. B, Lev. 2	Education	INFORM-ED		INFORM-ED		INFORM-ED
45	S-Capitol Hill, Lev. 3	Financial Services	Financial Services		Financial Services		Financial Services
46	S-Ballard, Lev. 3	ENRE/Energy	ENRE/Energy		ENRE/Energy		ENRE/Energy
47	S-Admiral, Lev. 3	ENRE/Forestry	ENRE/Forestry		ENRE/Forestry		ENRE/Forestry
48	S-Fremont, Lev. 3	Simulation Society	Simulation Society		Simulation		Simulation
49	S-Greenwood, Lev. 3	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
50	S-Issaquah, Lev. 3	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
51	S-Kirkland, Lev. 3	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Queueing Models
52	S-Leshci, Lev. 3	Railway Applications	Railway Applications		Railway Applications		Railway Applications
53	S-Medina, Lev. 3	Location Analysis	Location Analysis		Location Analysis		Location Analysis
54	S-Queen Anne, Lev.3	Applied Probability	Applied Probability		Applied Probability		Applied Probability
55	S-Ravenna, Lev. 3	Aviation Applications	Aviation Applications		Aviation Applications		Aviation Applications
56	S-Wallingford, Lev.3	Auctions	Auctions		Auctions		Auctions
57	S-Columbia, Lev. 4	INFORMS Telecommunications	INFORMS Telecommunications		INFORMS Telecommunications		INFORMS Telecommunications
58	S-Pike, Lev. 4	New Product Development	New Product Development		New Product Development		SPRIG
59	S-Seneca, Lev. 4	Capacity & Technology Mgt.	INFORMS Publications		Management of Technology		Capacity/Technology Mgt.
60	S-University, Lev. 4	Technology Management	Technology Management		Technology Management		Technology Management

MASTER TRACK SCHEDULE– Tuesday

C - Convention Center S - Sheraton

Track	Room	TA 8:00-9:30	TB 10:00-11:30	Plenary Interactive Session	TC 1:30-3:00	Keynotes 3:10-4:00	TD 4:30-6:00
1	C-Room 602	Supply Chain Optimization	Supply Chain Optimization		Supply Chain		Supply Chain
2	C-Room 603	Closed Loop SC & Sustainable Ops.	Supply Chain		Closed Loop SC & Sustainable Ops.		Closed Loop SC & Sustainable Ops.
3	C-Room 604	Supply Chain	Supply Chain		Supply Chain		Supply Chain
4	C-Room 606	Tutorials	Tutorials	11:40am-12:30pm	Tutorials	**Sridhar Tayur**	Tutorials
5	C-Room 607	Decision Analysis	Job Placement	**Robert W. Moffat, Jr.**	Optimization/Global	**Publishing in**	OR Practice
6	C-Room 608	MSOM	MSOM	**Reinventing**	MSOM	**Operations Research**	MSOM
7	C-Room 609	MSOM	Inventory	**Operations for a**	Inventory	**and Making Money**	Inventory
8	C-Room 611	Disruptions in Supply Chain	Sustainable Development	**Globally Integrated**	Humanitarian Relief Chain Mgt	C-Ballroom 6E	Inventory Management
9	C-Room 612	Homeland Security	Homeland Security	**Economy**	Homeland Security		Homeland Security
10	C-Room 613	Inventory	Inventory	C- Ballroom 6E	Inventory		Inventory
11	C-Room 614	Manufacturing	Manufacturing		Supply Chain		Manufacturing
12	C-Room 615	Scheduling	Scheduling		Scheduling		Scheduling
13	C-Room 616	Optimization/Integer Prog.	Optimization/Integer Prog.		Optimization/Integer Prog.		Optimization/Integer Prog.
14	C-Room 617	Optimization/Nonlinear Prog.	Optimization/Nonlinear Prog.		Nonlinear Programming		Nonlinear Prog.
15	C-Room 618	Optimization/Stochastic Prog.	Optimization/Stochastic Prog.		Optimization/Stochastic Prog.		Stochastic Opt./Large-Scale Opt.
16	C-Room 619	Optimization	Optimization		Optimization		Optimization
17	C-Room 620	Information Systems Society	Information Systems Society	12:30pm-1:30pm	Information Systems Society	**John J. Garstka**	Information Systems Society
18	C-Room 201	INFORMS Computing Society	INFORMS Computing Society	**Interactive Session**	INFORMS Computing Society	**Organizational**	INFORMS Computing Society
19	C-Room 203	INFORMS Computing Society	INFORMS Computing Society	Exhibit Hall	INFORMS Computing Society	**Transformation**	Workforce Engineering
20	C-Room 204	Decision Analysis	Decision Analysis	Entrance	Decision Analysis	**Insights and**	Decision Analysis
21	C-Room 205	Decision Analysis	Decision Analysis		Decision Analysis	**Challenges**	Decision Analysis
22	C-Room 206	Data Envelopment Analysis	Data Envelopment Analysis		Decision Analysis	C- Room 608	Decision Analysis
23	C-Room 208	Behavioral Processs Mgt.	Public Prog. & Processes		Risk Analysis		Risk Analysis
24	C-Room 209	Software Demonstration	Software Demonstration		Software Demonstration		Software Demonstration
25	C-Room 210	Quality, Statistics & Reliability	QSR		QSR		QSR
26	C-Room 211	Data Mining	Data Mining		Data Mining		Data Mining
27	C-Room 212	Data Mining	Data Mining		Service Industry		Service Industry
28	C-Room 213	INFORMS Computing Society	INFORMS Computing Society		INFORMS Computing Society		Operations Management
29	C-Room 214	Opt/Computational Opt. & Software	Opt/Computational Opt. & Software		Opt/Computational Opt. & Software		Opt/Computational Opt. & Software
30	C-Room 2A	Quality, Statistics & Reliability	QSR		QSR		QSR
31	C-Room 2B	Quality, Statistics & Reliability	QSR		QSR		QSR
32	C-Room 302	Vehicle Routing	Vehicle Routing		Business Applications		Business Applications
33	C-Room 303	Transportation Science & Logistics	TSL		TSL		TSL
34	C-Room 304	Transportation Science & Logistics	TSL		TSL		TSL
35	C-Room 305	Transportation Science & Logistics	TSL		TSL		TSL
36	C-Room 306	Transportation Science & Logistics	No Session		TSL		Transportation
37	C-Room 307	Military Applications	Military Applications		Military Applications		Military Applications
38	C-Room 308	Game Theory	Game Theory		Marketing		Marketing
39	C-Room 309	Health Applications Section	Health Applications Section		Health Applications Section		Health Applications Section
40	C-Room 310	Health Applications Section	Health Applications Section		Health Applications Section		Health Applications Section
41	C-Room 3A	Health Applications Section	Health Applications Section		ICS/Bioinformatics		Health Applications Section
42	C-Room 3B	OR in Medicine & Health Care	Healthcare Systems		Healthcare Systems		Healthcare Systems
43	S-Grand Ball. A, Lev. 2	CPMS	CPMS		Aviation Applications		Aviation Applications
44	S-Grand Ball. B, Lev. 2	INFORM-ED	INFORM-ED		INFORM-ED		INFORM-ED
45	S-Capitol Hill, Lev. 3	Financial Engineering	Financial Engineering		Financial Engineering		Financial Services
46	S-Ballard, Lev. 3	ENRE/Energy	ENRE/Energy		ENRE/Energy		ENRE/Energy
47	S-Admiral, Lev. 3	ENRE/Forestry	ENRE/Forestry		Ops Mgt. in Commodity Markets		Ops. Mgt in Commodity Markets
48	S-Fremont, Lev. 3	Simulation	Stochastic Processes/Opt.		Stochastic Processes/Opt.		Finance-Risk Management
49	S-Greenwood, Lev. 3	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
50	S-Issaquah, Lev. 3	Revenue Mgt. & Pricing	New Product Development		Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
51	S-Kirkland, Lev. 3	Queueing Models	Queueing Models		Queueing Models		Queueing Models
52	S-Leshci, Lev. 3	Artificial Intelligence	Artificial Intelligence		Artificial Intelligence		Artificial Intelligence
53	S-Medina, Lev. 3	Location Analysis	Location Applications		Facility Location		Facilities Planning/Design
54	S-Queen Anne, Lev.3	Applied Probability	Applied Probability		Applied Probability		Applied Probability
55	S-Ravenna, Lev. 3	Aviation Applications	Aviation Applications		Aviation Applications		Aviation Applications
56	S-Wallingford, Lev.3	Auctions	MSOM		Energy		Energy
57	S-Columbia, Lev. 4	INFORMS Telecommunications	Ethics in OR		OR In Sports		OR In Sports
58	S-Pike, Lev. 4	New Product Development	New Product Development		New Product Development		New Product Development
59	S-Seneca, Lev. 4	Capacity & Technology Mgt.	Capacity & Technology Mgt.		Capacity & Technology Mgt.		Capacity & Technology Mgt.
60	S-University, Lev. 4	Technology Management	Technology Management		Technology Management		Technology Management

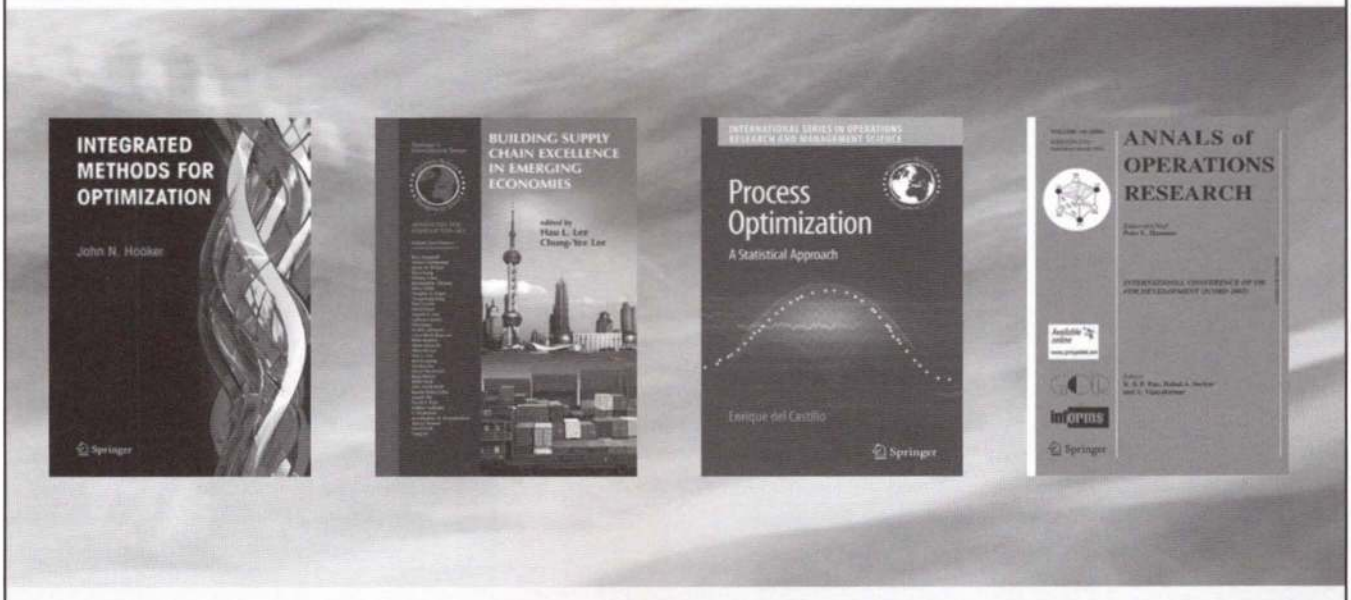
MASTER TRACK SCHEDULE–Wednesday

Plenary/Reception: Some OR HumOR and HistORY 5:10-7:00pm, C-Ballroom 6E

Track	Room	WA 8:00-9:30	WB 10:00-11:30	Plenary 11:40-12:30	WC 1:30-3:00	WD 4:30-6:00
1	C-Room 602	Supply Chain	Supply Chain Competition		Supply Chain Competition	Supply Chain Competition
2	C-Room 603	Closed Loop SC & Sustainable Ops.	Closed Loop SC & Sustainable		Closed Loop SC & Sustainable Ops.	Closed Loop SC & Sustainable Ops.
3	C-Room 604	Supply Chain	Supply Chain		Supply Chain	Supply Chain
4	C-Room 606	Tutorials	Tutorials		Tutorials	Tutorials
5	C-Room 607	Women in OR/MS	Women in OR/MS	**Robert Bixby**	Women In OR/MS	No Session
6	C-Room 608	MSOM	MSOM	**The Evolution of**	MSOM	No Session
7	C-Room 609	Inventory	Inventory	**Optimization**	Inventory	Reverse Supply Chain
8	C-Room 611	Inventory Management	Inventory Management	**in Business**	Inventory Management	Inventory Management
9	C-Room 612	Homeland Security	Mass Customization	C- Ballroom 6E	Project Management	Project Management
10	C-Room 613	Inventory	Inventory		Inventory	Inventory
11	C-Room 614	Flexible Manufacturing Sys.	Production & Scheduling		Production & Scheduling	No Session
12	C-Room 615	Scheduling	Scheduling		Scheduling	Forecasting
13	C-Room 616	Optimization/Integer Prog.	Optimization/Integer Prog.		Integer Programming	Integer Programming
14	C-Room 617	Nonlinear Programming	Networks & Graphs		Network Optimization	Network Optimization
15	C-Room 618	Stochastic Opt./Large Scale Opt.	Stochastic Opt./Large Scale Opt.		Stochastic Opt./Large Scale Opt.	Stochastic Opt./Large Scale Opt.
16	C-Room 619	Global Optimization	Global Optimization		OR Models in Healthcare	Dynamic Programming/Control
17	C-Room 620	Information Systems Society	Information Systems		Information Systems	Quality Management
18	C-Room 201	INFORMS Computing Society	INFORMS Computing Society		INFORMS Computing Society	No Session
19	C-Room 203	Workforce Engineering	Workforce Engineering		Workforce Engineering	Workforce Engineering
20	C-Room 204	Decision Analysis	Decision Analysis		Decision Analysis	Decision Analysis
21	C-Room 205	Decision Analysis	Decision Analysis		Decision Analysis	Decision Analysis
22	C-Room 206	Decision Analysis	Decision Analysis		Decision Support Systems	Decision Support Systems
23	C-Room 208	Risk Analysis	Queueing Models		Queueing Models	Queueing Models
24	C-Room 209	Software Demonstration	No Session		No Session	No Session
25	C-Room 210	Reliability	Statistics/Quality Control		Statistics/Quality Control	Statistics & Simulation
26	C-Room 211	Data Mining	Data Mining		Data Mining	Data Mining
27	C-Room 212	Service Industry	Spreadsheet Productivity		Spreadsheet Productivity	Spreadsheet Productivity
28	C-Room 213	Operations Management	Operations Management		Operations Management	Joint Cluster DM/ICS
29	C-Room 214	Computational Opt. & Software	Computational Opt. & Software		Computational Opt. & Software	Modeling Systems/Languages
30	C-Room 2A	Quality, Statistics & Reliability	QSR		QSR	QSR
31	C-Room 2B	Quality, Statistics & Reliability	Reliability		QSR	QSR
32	C-Room 302	Business Applications	Planning		Applied Probability	Applied Probability
33	C-Room 303	Transportation Science & Logistics	TSL		Transportation	Transportation
34	C-Room 304	Transportation Science & Logistics	TSL		Transportation	Transportation
35	C-Room 305	Transportation Science & Logistics	TSL		Statistics in OR	TSL
36	C-Room 306	Transportation Science & Logistics	TSL		Transportation	Transportation
37	C-Room 307	Military Applications	Military Applications		Military Applications	E-Business/Commerce
38	C-Room 308	Marketing	Marketing		Computer Science	Constraint Programming
39	C-Room 309	Health Applications Section	Optimization Tech		Robust Optimization	Stochastic Optimization
40	C-Room 310	Health Applications Section	Health Applications Section		Health Applications Section	Health Applications Section
41	C-Room 3A	ICS/Bioinformatics	ICS/Bioinformatics		ICS/Bioinformatics	Biotechnology
42	C-Room 3B	Healthcare Systems	OR in Medicine & Healthcare		OR in Medicine & Healthcare	No Session
43	S-Grand Ball. A, Lev. 2	Aviation Applications	Aviation Applications		Aviation Applications	Aviation Applications
44	S-Grand Ball. B, Lev. 2	INFORM-ED	INFORM-ED		INFORM-ED	INFORM-ED
45	S-Capitol Hill, Lev. 3	Financial Engineering	Financial Engineering		Financial Engineering	Financial Engineering
46	S-Ballard, Lev. 3	ENRE/Energy	ENRE/Energy		ENRE/Energy	ENRE/Energy
47	S-Everett, Lev. 3	Ops. Mgt. in Commodity Markets	Ops. Mgt. in Commodity Markets		No Session	Research & Development
48	S-Fremont, Lev. 3	Risk Management.	Finance Thoery		Finance Thoery	Simulation-Optimization
49	S-Greenwood, Lev. 3	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing
50	S-Issaquah, Lev. 3	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	No Session
51	S-Kirkland, Lev. 3	Queueing Models	Queueing Models		Revenue/Yield Management	Pricing & Revenue Management
52	S-Leshci, Lev. 3	Technology Management	No Session		Optimization/ Combinatorial Opt.	Intelligent Agents
53	S-Medina, Lev. 3	Facilities Material Handling	Technology Evaluation/Assessment		Technology Evaluation/Assessment	Technology Evaluation/Assessment
54	S-Queen Anne, Lev.3	Applied Probability	Applied Probability		Applied Probability	Applied Probability
55	S-Ravenna, Lev. 3	Aviation Applications	Aviation Applications		Aviation Applications	Aviation Applications
56	S-Wallingford, Lev.3	Energy	Environment Energy		Environment Energy	Auctions/Competitve Bidding
57	S-Columbia, Lev. 4	Sports & Entertainment	Innovation/Entrepreneurship		Computer-Assisted Analysis	No Session
58	S-Pike, Lev. 4	New Product Development	New Product Development		Product Development	Group Decision Making
59	S-Seneca, Lev. 4	Capacity/ Technology Mgt.	Technology Management		Technology Management	Industry Applications
60	S-University, Lev. 4	Technology Management	Technology Management		Technology Management	No Session

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Hengqing Ye
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Rebuttal Session for Presentation
Seth Bonder

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Shipping, Maritime & Supply Chain Logistics
John Liu
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Stochastic Optimization/Large Scale Optimization
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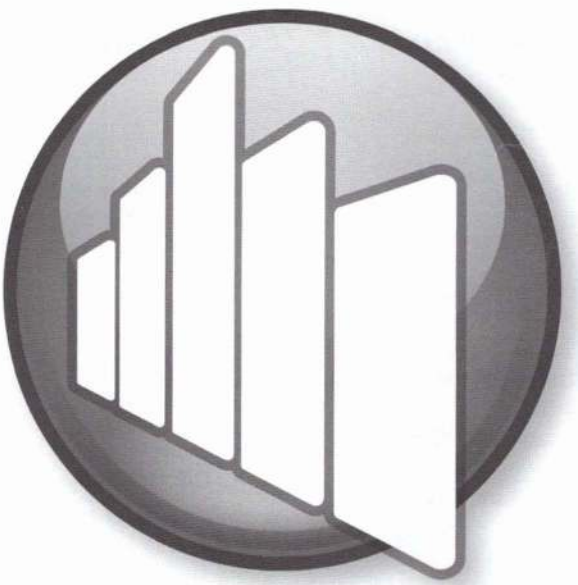
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Revenue Mgmt. & Pricing-Joint
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Nomis Solutions

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Future Meetings

INFORMS MEETINGS

2008

April 13-15
INFORMS Practice Conference: Applying Science to the Art of Business
Baltimore Marriott Waterfront
Baltimore, Maryland
Chair: Karl G. Kempf
www.informs.org/Conf/Practice08

July 14-18
IFORS 2008
Sandton Convention Centre
Sandton, South Africa
www.ifors2008.org

October 12-15
INFORMS Annual Meeting 2008 Washington
Marriott Wardman Park Hotel and
Omni Shoreham Hotel
Washington, DC
Chair: Hani S. Mahmassani
masmah@northwestern.edu

2009

April 26-28
INFORMS Practice Conference: Applying Science to the Art of Business
Sheraton Phoenix Downtown
Phoenix, Arizona

June 14-17
CORS/INFORMS International Toronto 2009
Westin Harbour Castle
Toronto, Ontario, Canada
Chair: Liping Fang
lfang@ryerson.ca

October 11-14
INFORMS Annual Meeting 2009 San Diego
San Diego Convention Center and
Hilton San Diego
San Diego, California
Chair: Soheila Jorjani
sjorjani@csusm.edu

2010

May/June 2010
ALIO-INFORMS International 2010
Buenos Aires, Argentina
Chair: Irene Loiseau
irene@dc.uba.ar

November 7-10
INFORMS Annual Meeting 2010 Austin
Austin Convention Center and Hilton Austin
Austin, Texas
Chair: Jonathan Bard
jbard@mail.utexas.edu

2011

November 13-16
INFORMS Annual Meeting 2011 Charlotte
Charlotte Convention Center
Charlotte, North Carolina
Chair: Cem Saydam
saydam@uncc.edu

INFORMS SUBDIVISION MEETINGS

2007

December 9-12
Winter Simulation Conference 2007
JW Marriott on Pennsylvania Avenue
Washington, DC
Chair: Jeffrey Tew
www.wintersim.org

2008

March 14-16
INFORMS Optimization Society
Georgia Institute of Technology
Atlanta, Georgia
Chair: Eva Lee and Sanjay Mehrotra
www2.isye.gatech.edu/opt2008/

March 27-29
INFORMS Telecommunications Conference
University of Maryland
College Park, Maryland
Chairs: S. Raghavan, Bruce Golden,
Edward Wasil
telecom.section.informs.org/conference08

April 18-19
INFORMS Southwest Regional Conference
Texas A&M University
College Station, Texas
Chair: Halit Uster
uster@tamu.edu

June 12-14
INFORMS Marketing Science Conference
Sheraton Vancouver Wall Centre
Vancouver, BC, Canada
Chair: Charles Weinberg
charles.weinberg@sauder.ubc.ca

June 18-20
Revenue Management & Pricing Section Conference
Montreal, Quebec, Canada
Chairs: Patricia Marcotte and Gille Savard
marcotte@iro.umontreal.ca

December 7-10
Winter Simulation Conference 2008
InterContinental Hotel
Miami Florida
Chair: Thomas Jefferson
www.wintersim.org

2009

January 11-13
INFORMS Computing Society Conference
Francis Marion Hotel
Charleston, South Carolina
Chair: Matt Saltzman, John Chinneck,
Bjarni Krisjansson, Chris Starr
mjs@clemson.edu

July 12-15
Applied Probability Society Conference
Cornell University
Ithaca, NY
Chairs: Shane Henderson and Mark Lewis
sgh9@cornell.edu

How to Navigate the Technical Sessions

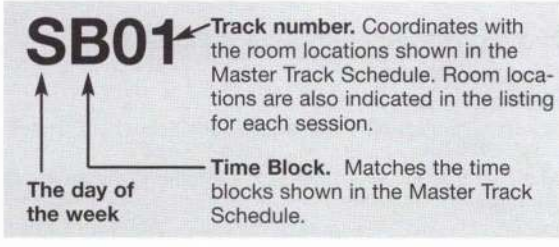
There are four primary resources to help you understand and navigate the Technical Sessions:

- This Technical Session listing, which provides the most detailed information. The listing is presented chronologically by day/time, showing each session and the papers/abstracts/authors within each session.
- The Session Chair, Author, and Session indices provide cross-reference assistance (pages 375-409).
- The map and floor plans on pages 42 and 43 show you where technical session tracks are located.
- The Master Track Schedule is on pages 44-47. 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 379-400) — 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

A — 8:00am - 9:30am
B — 10:00am - 11:30am
C — 1:30pm - 3:00pm
D — 4:30pm - 6:00pm

On Wednesday, D block is 3:30-5:00pm. Plenaries, keynotes and lunch breaks are interspersed among the technical session time blocks.

Room Locations/Tracks

All tracks and technical sessions are held in the Convention Center and Sheraton. Room numbers are shown on the Master Track Schedule and in the technical session listing.

Quick Reference

Don't miss the Quick Reference, a separate flier you received in your registration packet. It includes the Master Track Schedule and floor plans, providing a quick, portable summary of the meeting

Sunday, 8:00am - 9:30am

■ SA01

C-Room 602

Supply Chain Management I

Contributed Session

Chair: Nagihan Comez, Assistant Professor, Bilkent University, Ankara, Ankara, Turkey, nagihan@utdallas.edu

1 - Comparative Study of Consignment and Wholesale Contractual Arrangement

Dengfeng Zhang, University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52242, United States, dengfeng-zhang@uiowa.edu, Renato deMatta, Timothy Lowe

The unprecedent growth of businesses in online marketplaces brings with it new challenges to manage the supply chain. In this paper, we investigate the decisions and channel performance issues surrounding consignment contractual arrangement (CCA) and how they differ from a wholesale contractual arrangement (WCA). Also, we provide some insights on contractual preferences of managers to learn why they prefer CCA over WCA with certain sellers.

2 - Contract Design for Multiple Channels

Xiaowei Zhu, Assistant Professor, West Chester University, 312A Anderson Hall, West Chester, United States, xzhu@wcupa.edu, Samar Mukhopadhyay, Xiaohang Yue

A firm faces potential channel conflict when it opens online sale in addition to its existing retail channel. To reduce this, the firm can allow the retailer to add value to the product, the cost of which is private information, to differentiate it. We use a game theoretic approach to derive optimal contracts under full and asymmetric information.

3 - Dynamic Pricing and Ordering Decisions for Perishable Products

Chulung Lee, Professor, Korea University, Anam-dong, Seongbuk-gu, Seoul, 136-713, Korea, Republic of, leecu@korea.ac.kr, Rujing Liu, Ek Peng Chew

We study the coordination of the dynamic pricing and ordering decisions of a perishable product. We compute the optimal order quantity of new product and the optimal discounted price for older products given the remaining inventory level in order to maximize the total profit.

4 - Design of an Agent-based Supply Chain Simulation System

Liping Fang, Professor, Ryerson University, Dept. of Mechanical & Industrial Engin., 350 Victoria Street, Toronto, ON, M5B 2K3, Canada, lfang@ryerson.ca, Yucheng Wang

Design of an agent-based supply chain simulation system is presented, in which a supply chain entity is represented by an agent. The proposed system has six layers: raw material providers, component manufacturers, product assemblers, product holders, retailers, and final customers. Issues in supply chain management could be simulated and studied.

5 - Buyer-supplier Relationship Dissolution: Insights From the Ford-Firestone Breakup

Yi-Su Chen, University of Minnesota, 3-150 Carlson School of Management, 321-19th Ave S., Minneapolis, MN, 55455, United States, chen1276@umn.edu, Johnny Rungtusanatham, Kevin Dooley

Developing a strategic relationship is arduous, dissolving one is equally strenuous. The relationship between Ford and Firestone was once long-standing and valued before it was terminated. By scrutinizing their breakup, we offer insights on the key forces that increase the probability of relationship dissolution during times of crisis. Theoretical contributions and managerial implications are also discussed.

■ SA02

C-Room 603

Issues in Product Life Cycle and Durability Management

Cluster: Supply Chain

Invited Session

Chair: Steve Gilbert, Associate Professor, The University of Texas at Austin, McCombs School of Business, 1 University Station, B6500, Austin, TX, 78712, United States, Steve.Gilbert@mccombs.utexas.edu

1 - Product Design for Life Cycle Mismatch
James Bradley, Associate Professor, College of William and Mary, Mason School of Business, 118C Tyler Hall, Williamsburg, VA, 23187-8795, United States, james.bradley@mason.wm.edu, Hector Guerrero

Life-cycle mismatch occurs when component life cycles are shorter than the life cycles of products that contain them. Mitigating component obsolescence can be costly, but durable product designs can be more expensive to design and produce. Our model determines the appropriate durability for a particular product life cycle.

2 - Evaluating the Environmental Performance of Product Leasing
Mark Ferguson, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, United States, Mark.Ferguson@mgt.gatech.edu, Vishal Agrawal

We evaluate the impact of the lease versus sell decision on environmental performance measures such as the quantity of products remanufactured versus recycled or disposed. We extend the results on durable goods from the economics literature and on closed-loop supply chains in the operations literature.

3 - Replenishment Decision with Extented Warranty
Xinxin Hu, Assistant Professor, Indiana University, Kelley School of Business, Room BU570C, Bloomington, IN, 47405, United States, hux@indiana.edu, Seb Heese

This is a retailer's multiperiod replenishment problem with extended warranty. Retailer has two demands - new customers and old customers who exercise the warranty. The warranty demand has the first priority to be satisfied, and retailer must guarantee a full satisfaction. Hence, it reduces retailer's capability to meet new demand and even incurs an additional cost. We consider three uncertainties new demand, warranty exercise ratio, and fraction of customers who buy warranty.

4 - Implications of Product Lifecycle and Channel Structure Upon Optimal Investment in Durability
Sreekumar Bhaskaran, Assistant Professor, Southern Methodist University, COX Business School, 389 Crow, Dallas, TX, 75275, United States, sbhaskar@cox.smu.edu, Steve Gilbert

We investigate how the use of intermediaries in the channel of distribution affects a manufacturer's investment in the durability of a product. Depending upon the product and technology life-cycles, the nature production technology and manufacturing costs, we find that a manufacturer can have an incentive to invest more in durability when he sells through intermediaries than when he sells directly.

■ SA03

C-Room 604

Inventory in Supply Chains

Cluster: Supply Chain
Invited Session

Chair: Rodney Parker, Assistant Professor of Operations Management, Yale School of Management, 135 Prospect St, New Haven, CT, 06520-8200, United States, rodney.parker@yale.edu

1 - Duopoly Competition Between Price-setting Newsvendors
Harish Krishnan, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, Harish.Krishnan@sauder.ubc.ca, Ralph Winter

In a duopoly with demand uncertainty, consumers who experience a stock-out at one store may spill over to the competitor. Demand spillovers can turn price competition on its head, making duopoly prices higher than the monopoly price. The impact of higher prices will be offset by higher inventory levels.

2 - Setting Inventory Targets for Multiple Products with Joint Service Levels and Correlated Demands
Sridhar Tayur, SmartOps, 12 Federal Street, Suite 400, Pittsburgh, PA, 15212, United States, stayur@smartops.com, Bahar Biller

We introduce a novel comprehensive simulation-based framework for setting good inventory targets to achieve a joint service level (such as purchase order fill rate, or dollar fill rate) in a discrete time, finite horizon model where the product demands are correlated in any period, and demands of any product are correlated across time. Our solutions are close to best possible within classes of policies that APS systems can recognize.

3 - Assortment Planning with Stockout-based Substitution
Dorothee Honhon, University of Texas, Dorothee.Honhon@mccombs.utexas.edu

We consider the problem of determining the optimal assortment and inventory levels for a discrete set of products with varying prices and costs in order to maximize expected profit in a single-period setting. We use a fluid-type model to represent customer demand and obtain the optimal solution under stockout-based substitution. We then analyze the tradeoffs involved in making assortment decisions.

4 - Dynamic Inventory Games with Substitution
Rodney Parker, Assistant Professor of Operations Management, Yale School of Management, 135 Prospect St, New Haven, CT, 06520-8200, United States, rodney.parker@yale.edu, Tava Olsen

We consider multi-period stochastic games involving substitutable inventory and study when the equilibrium behavior is consistent with that observed in the equivalent static game. For inventory substitution games, we show the sustained equilibrium inventory policy is base-stock and when compared to the integrated firm, there is greater overall inventory holding but individual firms may stock less.

■ SA04

C-Room 606

Tutorial: Community-based Operations Research

Cluster: Tutorials
Invited Session

1 - Community-based Operations Research
Michael Johnson, Associate Professor, Department of Public Policy and Public Affairs, John W. McCormack Graduate School of Policy Studies, University of Massachusetts Boston, 100 Morrissey Blvd, Boston, MA, 02125-3393, United States, michael.johnson@umb.edu, Karen Smilowitz

Community-based operations research is the application of decision models to social issues of a local nature. The goal of this field is to design policies and tactics that have the potential to improve individual life outcomes and neighborhood-level outcomes by addressing welfare, equity and administrative efficiency simultaneously. Community-based OR problems tend to be messy and dependent on political and social considerations. This tutorial defines community-based OR in the context of public-sector OR/MS, highlights current research in a variety of domains and identifies a number of new research opportunities. Two case studies in food security and affordable housing emphasize the commonality of problem attributes and the diversity of modeling and solution methods.

■ SA05

C-Room 607

2007 Dantzig Dissertation Award Finalists

Cluster: Dantzig Disseratation Prize
Invited Session

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

1 - The Management of Uncertainties in Radiation Treatments of Lung Tumors
Timothy Chan, MIT, 77 Massachusetts Ave., E40-130, Cambridge MA, United States, tcychan@MIT.EDU

In the context of patient care for life-threatening illnesses, the presence of uncertainty may compromise the quality of a treatment. In this talk, we present a robust framework to optimize radiation therapy treatments (subject to realistic uncertainties) for cancer patients. We illustrate our results on a clinical case where the uncertainty is due to organ motion during treatment.

2 - Game-theoretic Approaches for Complex Systems Optimization
Shih-Fen Cheng, Singapore Management University, 80 Stamford Road, Singapore 178902, Singapore, sfcheng@smu.edu.sg

In this talk, two optimal decision-making problems in the context of automotive industry are presented. The first problem deals with the complex operational problem of shutting down a serial production line so as to achieve a desirable state. The proposed method significantly outperforms prevalent ad hoc procedures. The second problem deals with the complexity of making joint decisions within a large manufacturing corporation. A game-theoretic decomposition scheme is proposed and it's shown to have a good balance between efficiency and effectiveness.

3 - Satellite Network Design, Optimization and Management
Ioannis Gamvros, Optimization Consultant, ILOG Inc., 1195 West Fremont Ave., Sunnyvale CA 94087-3832, igamvros@ilog.com

Abstract not available at this time.

■ SA06

C-Room 608

Product Variety, Markets, and Operational Tradeoffs

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Sergio Chayet, Assistant Professor, Olin School of Business, Washington University in St Louis, St Louis, MO, 63141, United States, chayet@wustl.edu

1 - Multi Market Competition and Global Sourcing: The Role of Intellectual Property Protection

Laurens Debo, Tepper School of Business, Carnegie Mellon Universitry, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu, Jiong Sun, Sunder Kekre

We develop a model in which a US firm determines whether to sell products to the Chinese market in addition to the US market. If the firm decides to do so with a manufacturing facility in China, a local Chinese company may copy the US firm's product and compete in both Chinese and US markets. If the firm decides not to do so, the US firm incurs higher production costs for both markets. We characterize the optimal entry strategy of the US firm in these global markets.

2 - Leadtime-variety Tradeoff in Product Differentiation

Aydin Alptekinoglu, Assistant Professor, University of Florida, 358 Stuzin Hall, Gainesville, FL, 32611-7169, United States, aalp@ufl.edu, Charles Corbett

Customers generally prefer products to be delivered sooner rather than later, and they prefer products that are closer to their ideal specifications. However, firms have to make a choice between offering a more limited product line that is available immediately from stock or a broader product line that is only available to order, hence at a delay. To some degree firms can use inventory or capacity to mitigate this tradeoff, but they cannot eliminate it as Squire et al. (2006) show empirically.

3 - A Product Line Problem in a Retail Environment with Stochastic Demand

Gal Raz, Associate Professor, Darden Graduate School of Business, University of Virginia, Charlottesville, VA, 22906-6550, United States, razg@darden.virginia.edu, Oded Koenigsberg

This paper investigates a retailer's decision on the variety of products to offer while simultaneously deciding on their prices and quantities under a stochastic demand newsvendor environment that takes into account the customer heterogeneous valuation of the products in the product line. We derive the retailer's optimal strategy and examine the effect of the problem parameters on this strategy.

4 - Product Variety and Congested Production Systems: Capacity Investments and Vertical Differentiation

Sergio Chayet, Assistant Professor, Olin School of Business, Washington University in St Louis, St Louis, MO, 63141, United States, chayet@wustl.edu, Panos Kouvelis, Dennis Yu

We investigate product line design and capacity investment decisions for vertically differentiated products on design quality levels. Customers are heterogeneous in quality valuations and arrive according to a Poisson process. We model product-focused and product-flexible production processes via queuing systems. We derive the optimal capacity, product variety, and quality levels, the resulting market coverage, segmentation, and effects on congestion levels, and provide managerial insights.

■ SA07

C-Room 609

Behavioral Operations

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Karen Donohue, Associate Professor, The Carlson School, University of Minnesota, 321 19th Ave S, Minneapolis, MN, 55455, United States, kdonohue@csom.umn.edu

1 - An Experimental Investigation of Risk-Pooling Effect

Tony Haitao Cui, Assistant Professor, University of Minnesota, 321 19th Ave South, 3-150 CSOM, Minneapolis, MN, 55455, United States, tcui@umn.edu, Teck-Hua Ho, Noah Lim

This paper experimentally investigates the effect of centralization in inventory ordering decisions. The results suggest that subjects do not risk-pool in the manner predicted by the classical inventory theory. We generalize the classical theory to capture the empirical regularities by allowing subjects to form (possibly mistaken) belief about the demand and have reference-dependent preference.

2 - The Negotiation Power of Groups

Feng Chen, USC, Bridge Hall, 400F, Los Angeles, CA, 98119, United States, fchen@marshall.usc.edu, Yehuda Bassok

Negotiation power of individual is defined in several ways. It is quite common that individual players form groups and negotiate as teams. But it is not clear what the negotiation power of a team is. Typically 3 types of assumptions are made: The negotiation power of a team is equal to the average, maximum or minimum power of its members. In this study we report the result of laboratory experiment to determine the negotiation power of teams.

3 - Supplier Competition When Service Matters

Karen Donohue, Associate Professor, The Carlson School, University of Minnesota, 321 19th Ave S, Minneapolis, MN, 55455, United States, kdonohue@csom.umn.edu, Elena Katok, Saif Benjaafar

How should a buyer outsource demand across competing suppliers to optimize the level of service he receives? We analyze this problem from an analytical perspective and then test the resulting theory using a series of laboratory experiments. We find that human subjects are more aggressive in their service investments, and more sensitive to the type of competition offered, than theory would suggest.

■ SA08

C-Room 611

Managing Supply Chain Risks

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Yusen Xia, Assistant Professor, Georgia State University, Robinson College of Business, Atlanta, GA, 30303, United States, mgtyxx@langate.gsu.edu

1 - Inventory Model with Setup Cost Under Uncertain Demand and Supply

Yusen Xia, Assistant Professor, Georgia State University, Robinson College of Business, Atlanta, GA, 30303, United States, mgtyxx@langate.gsu.edu, Annabelle Feng

Although there is an extensive literature on inventory systems with random yields in various contexts, little is known about the ordering strategy with setup costs under demand and yield uncertainties. We formulate a periodic review inventory model and characterize the optimal policy in three segments of the on-hand inventory. Given the complexity of the optimal policy, we propose a simple piecewise linear policy which demonstrates good cost performance in our computational study.

2 - Conceptual Model of Performance for Contract Manufacturers

Craig Hill, Assistant Professor, Georgia State University, P.O. Box 4014, Atlanta, GA, 30302-4014, United States, chill4@gsu.edu, Robert Burgess

This research presents a model for performance from a contract manufacturers' point of view. Included in this research are descriptions of types of contract manufacturer's relationships within the supply chain and insights into possible managerial opportunities for performance enhancement.

3 - Impact of Store Brand Introduction on Product Line Selection

Liwen Chen, PhD Candidate, University of Texas at Austin, Department of IROM, McCombs School of Business, Austin, TX, 78712, United States, liwen.chen@mail.utexas.edu, Steve Gilbert, Yusen Xia

Store brands become important parts of retail stores. National brands suppliers may act strategically to the competition threat through offering horizontally differentiated product lines. We study the impact of the introduction of a store brand by a retailer on the optimal product line selection of the national brand supplier using a vertical differentiation model. We also study the effect on the supply chain profit and consumer surplus.

4 - Demand Uncertainty and Optimal Decision Making for the Newsvendor Problem

Peter Kischka, Professor, University Jena, Carl Zeiss Ztrasse 3, Jena, 07743, Germany, p.kischka@wiwi.uni-jena.de, Werner Jammernegg

We consider a set of possible demand distributions and a prior distribution for this set. Based on the predictive distribution of demand induced by the prior we introduce a mean deviation rule to incorporate the degree of uncertainty implied by an order quantity. We analyze the dependence of the optimal order quantity on the prior distribution as well as on the price and cost variables of the newsvendor model.

■ SA09

C-Room 612

Multicriteria Decision Making I

Contributed Session

Chair: Margaret M. Wiecek, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634, United States, wmalgor@clemson.edu

1 - Multi-criteria Decision Case for Traffic Improvement Project Selection

Peter Kelle, Professor, Louisiana State University, ISDS CEBA, Baton Rouge, LA, 70803, United States, qmkell@lsu.edu, Helmut Schneider

Our decision support system has been prepared for a highway improvement case based on 4 years of accident data for over 65 thousand accidents per year at more than 23 thousand locations. The Multi-Criteria Decision Making is based on Data Envelopment Analysis and it is compared with other MCDM methods.

2 - Exact Multi-attribute Group Balancing: Why Does it Work?

Anton Ovchinnikov, Darden School of Business, University of Virginia, 100 Darden Blvd, Charlottesville, VA, 22903, United States, aovchinnikov@darden.virginia.edu, Dmitry Krass

Consider a set of objects (e.g., students) possessing several properties that must be partitioned into a certain number of groups. The objective is to ensure that all groups are as balanced (equal) as possible with respect to the number of objects possessing each property. A direct approach, enforcing balance through hard constraints, may lead to infeasibility, but works well in practice. We present worst-case and average-case analysis of this phenomenon.

3 - Polynomially Solvable Multiobjective Traveling Salesperson Problems

Ozgur Ozpeynirci, Tubitak, Ataturk Bulvari No 221 Kavaklidere, Ankara, Turkey, ozgur.ozpeynirci@tubitak.gov.tr, Murat Koksalan

TSP is NP-hard in general graphs. However, some special cases are solvable in polynomial time. We work on cases where the matrix structure guarantees that tours having special properties (pyramidal tours) yield optimal solutions. We study the multi-objective extensions of this problem. We investigate the properties of the efficient solutions and develop an exact algorithm to find efficient solutions. We develop a procedure to find all efficient solutions for the special case of bi-objective TSP.

4 - Clustering Multi-objective Land Use Optimization Results

Christina Moulton, MASc Student, Systems Design Engineering, University of Waterloo, 200 University Ave W, Waterloo, ON, N2L 3G1, Canada, cmmacnei@engmail.uwaterloo.ca, Steven Roberts, Paul Calamai

Real world applications often have many competing objectives. The potentially many Pareto optimal solutions can make it be difficult for a decision maker to choose a final solution. We apply cluster analysis to organize the candidate solutions into a more tractable representation. This approach is applied to a land use change problem in an urban fringe area in Ontario, Canada. NSGA-II is used with eight landscape ecology metrics to generate non-dominated solutions as cluster analysis input.

5 - A Priori Inclusion of Preferences in Multiobjective Programming

Margaret M. Wiecek, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634, United States, wmalgor@clemson.edu

MCDM has been relying on the concept of Pareto optimality and the resulting set as the set of candidates for a final preferred decision. We propose to elicit preferences from decision makers to modify the Pareto optimality, reduce the Pareto set, and support decision making. Using convex or nonconvex, polyhedral or nonpolyhedral cones, we model preferences such as relative importance of criteria, equitability of outcomes, approximate nondominance of outcomes, and motivate their use in MCDM.

■ SA10

C-Room 613

Cooperation in Inventory Management I

Cluster: Inventory

Invited Session

Chair: Jiawei Zhang, Assistant Professor, New York University, 44 West 4 St., Suite 8-66, New York, NY, 10012, United States, jzhang@stern.nyu.edu

1 - A Decentralized Distribution System with the Manufacturer's Buyback and Resale

Greys Sosic, Marshall School of Business, University of Southern California, Los Angeles, CA, United States, sosic@marshall.usc.edu, Ulas Ozen

We analyze a distribution system in which n retailers facing uncertain demand order inventory from a manufacturer. Orders arrive to the warehouse after a lead time, during which the retailers update demand forecasts. The manufacturer can buy back items from the retailers facing low demand and sell them to those facing high demand. We study the impact of this resale opportunity and compare our results with other cases (no resale of returned items, retailers redistributing inventory on their own).

2 - Dynamic Realization Games in Newsvendor Inventory Centralization

Moshe Dror, Professor, University of Arizona, MIS, Eller College of Management, Tucson, AZ 85721, Tucson, AZ, 85721, United States, mdror@eller.arizona.edu, Ana Meca, Luis Guardiola, Justo Puerto

Consider a newsvendor centralization game. When holding and penalty costs are identical for all subsets, the game has a non empty core. We examine a related game based on demand realizations. Based on Lehrer (2002) we propose a repeated cost allocation scheme. We prove that the cost allocation processes converge a.s. to either a least square value or the core of the expected game. We also extend the results to a more general class of dynamic cost games.

3 - Partner Selection in Inventory Pooling

Eda Kemahlioglu-Ziya, UNC- Chapel Hill, CB# 3490, Chapel Hill, NC, 27514, United States, Eda_KemahliogluZiya@unc.edu

We analyze a supply chain with a single supplier and two retailers. The retailers do not carry inventory, but enforce minimum-inventory-level constraints on the supplier and share a percentage of her inventory carrying cost. Our main research question is: With what type (high/low demand and/or bargaining power) of player does each player prefer to cooperate on inventory pooling if the objective is to maximize expected profit?

4 - Cooperation in Service Systems

Shoshana Anily, Professor, Tel Aviv University, Faculty of Management, Tel Aviv, 69978, Israel, anily@post.tau.ac.il, Moshe Haviv

Consider M/M/1 service systems which can cooperate to generate a single pooled server. The cost of any coalition of servers is the mean number of customers in steady-state in that system. As the total cost is minimized by the grand coalition, we ask how to allocate it among the servers. We define a transferable utility cooperative game whose players are the servers, and show that its core is infinitely large; all of this albeit the fact that it is neither a monotone nor a concave game.

■ SA11

C-Room 614

Multi-echelon/Multi-product Inventory Optimization

Cluster: Manufacturing

Invited Session

Chair: Jiang Zhang, Assistant Professor, Adelphi University, School of Business, Garden City, NY, 11530, United States, zhang@adelphi.edu

1 - Flexible Backup Supply and The Management of Leadtime Uncertainty

Jian Li, Northeastern Illinois University, 5500 N. St. Louis Ave, Chicago, IL, 60625, United States, jli@neiu.edu, Panos Kouvelis

Facing leadtime uncertainty, the retailer conventionally places an order at a chosen time ahead to meet future demand. In this paper we study the potential use of a flexible backup supplier in a sole role, as an emergency resource in response to the leadtime information, or in a dual role, as a regular supplier that is assigned to meet part of the original demand interval and as an emergency response to leadtime information.

2 - Inventory Control When the Lead-time Changes

Sven Axsater, Lund University, P. O. Box 118, SE-22100 LUND,Sweden, Lund, Sweden, sven.axsater@iml.lth.se

A single-echelon inventory system with continuous review and Poisson demand is considered. There are linear holding and backorder costs. We study a change in the lead-time, which is typical in connection with a Just-In-Time philosophy. Our main focus is a lead-time decrease. Due to the lead-time change, the optimal steady state solution will, in general, change. We consider the transient problem of bringing the system from its original steady state to the new steady state in an optimal way.

3 - Base-stock Control of Two-stage Inventory Systems with Periodic Batching Under Fill-rate Constraint

Jun Zhang, Assistant Professor, University of Texas at Dallas, School of Management, Richardson, TX, United States, jun.zhang@utdallas.edu, Jiang Zhang, Yuanjie He

We consider a two-stage inventory system with linear inventory holding cost and a fill-rate constraint. The inventory replenishment at both stages follows an echelon base-stock policy with periodic batching. We develop an exact expression for the system's fill rate. When demand is mixed Erlang, our exact expression only involves the PDF and CDF of the Erlang distribution. Under a

general assumption, we show that the inventory optimization problem is a convex programming problem.

4 - Optimal Replenishment Policies for Multi-product Stochastic Inventory Systems

Vinayak Desphande, Purdue University, vinayak@exchange.purdue.edu, Kumar Muthuraman, Haolin Feng

We analyze optimal replenishment policies for multi-product inventory systems with joint-replenishment costs and correlated demand. Our focus is on computing and finding the structure of the optimal policies. An efficient method to compute the optimal policy that uses a moving boundary based policy improvement scheme is analyzed. A new heuristic, called an (s, c, d, S) policy is proposed, and is shown to significantly outperform the simple (s,c,S) policy analyzed in prior literature.

■ SA12

C-Room 615

Integration and Approximation Issues

Cluster: Scheduling
Invited Session

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

1 - Allocation of Jobs and Resources to Pooling Centers

Hui-Chih Hung, Assistant Professor, National University of Singapore, Industrial & Systems Engineering, Singapore, 117576, Singapore, hhc43212@gmail.com, Marc Posner

We simultaneously partition servers and job types into parallel pooling centers. Each job type has a distinct Poisson arrival rate and WIP weight. The goal is to minimize the total WIP cost. For non-identical servers, important monotonic properties are established. Improved heuristics are evaluated both theoretically and experimentally.

2 - Algorithms for Parallel Machine Problems with Capacity Restrictions

Hans Kellerer, Professor, Karl-Franzens-Universitaet, Institut fur Statistik und O.R., Universitaetsstrasse 15, Graz, A-8010, Austria, hans.kellerer@kfunigraz.ac.at

We present approximation algorithms for two variants of the classical multiprocessor scheduling with the objective of minimizing the makespan. In the first problem considered jobs have a restricted set of machines to which they may be assigned. In the second problem class considered a limit is imposed on the number of jobs which can be processed on each machine.

3 - Noncooperative Scheduling Games with Auctions

Zhixin Liu, Assistant Professor, University of Michigan-Dearborn, United States, liu.573@osu.edu, Nicholas G. Hall

We consider models where a group of agents, each with a set of jobs, schedule their jobs on a common processing facility. Each agent wants to minimize an objective function which depends on her own jobs' completion times. Sequencing positions or time slots are allocated to alternative jobs based on the bids of participating agents. We investigate the efficiency and effectiveness of auction mechanisms, and the optimization, closure, effectiveness and equilibrium of agents' bidding policies.

4 - Cell Formation with Machine Duplication and Cell Setup Costs

Wenhui Zhao, Dr., The Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States, zhao.108@osu.edu, Marc Posner

The process of cell formation assigns machines to cells. The objective is to minimize the inter-cell job flow. Two important factors that influence cell formation are machine duplication and cell setup cost. We develop and analyze a mathematical programming method to incorporate the effects of these two factors.

■ SA13

C-Room 616

Theory and Applications of Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Jean-Philippe Richard, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, jprichar@ecn.purdue.edu

1 - Mapping Onto a Flexible Low-power Electronic Fabric Architecture

Mustafa Baz, University of Pittsburgh, Pittsburgh, PA, mub3@pitt.edu, Brady Hunsaker, Gayatri Mehta, Justin Stander, Alex K. Jones

We consider a mixed-integer linear program for solving a combinatorial problem that arises from a novel electronic fabric architecture. The problem entails the mapping of a data flow graph represented as an acyclic directed graph onto a particular implementation of the architecture. For this problem, finding feasible solutions is a challenge. We present modeling and algorithmic enhancements that were necessary to make the problem tractable.

2 - Computing Maximal Sets of Mixed Integer Programs

Bo Zeng, Purdue University, Industrial Engineering, West Lafayette, IN, 47906, United States, bzeng@purdue.edu, Jean-Philippe Richard

In this talk, we introduce a systematic method to derive strong bounds on sequential lifting coefficients. We also propose a scheme to derive the maximal set of an inequality, which is defined as the set of variable coefficients whose lifting coefficients are not influenced by the lifting sequence. We then apply this tool to derive the maximal sets of various inequalities for 0-1 MIPs. In particular, we show that our result strengthens known bounds for GUB knapsack polytopes.

3 - The Value Function of a Mixed-integer Linear Program (MILP) with a Single Constraint

Menal Guzelsoy, Lehigh University, 200 West Packer Ave, Room 362, Bethlehem, PA, 18015, United States, megb@lehigh.edu, Ted Ralphs

The value function of a MILP is a function that returns the optimal solution value as a function of the right-hand-side. In this work, we analyze the structure of the value function of a MILP with a single constraint. Using subadditive duality, we show that all the information necessary to construct the value function can be obtained by examining the structure in a neighborhood of the origin. We propose a new method for extending the function from such a neighborhood to the entire real line.

4 - An Efficient Optimization Algorithm for the Capacitated Plant Location Problem(CPLP)

Choonho Ryu, Professor, Hongik University Dept.of Business Administration, 72-1 Sangsoo-dong Mapo-gu, Seoul, 121-791, Korea, Republic of, ryuch@wow.hongik.ac.kr, Monique Guignard

This paper discusses an efficient optimization algorithm for the capacitated plant location problem(CPLP), which is based on the branch-and-bound scheme. It uses Lagrangean bounds rather than LP bounds and trys to fix as many integer variables as possible at the top node, by using the information of its feasible solution which comes from the Lagrangean heuristic. Computational results are reported in terms of bound gap percentage and CPU time.

■ SA15

C-Room 618

Conic Optimization and Complementarity Problems

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Paul Tseng, Professor, University of Washington, Department of Mathematics, Box 354350, Seattle, WA, 98195-4350, United States, tseng@math.washington.edu

1 - A Homogeneous Algorithm for Monotone Complementarity Problems Over Symmetric Cones

Akiko Yoshise, Associate Professor, Univ. Tsukuba, Graduate School of Systems & Information, Univ. Tsukuba, Tsukuba, 305, Japan, yoshise@sk.tsukuba.ac.jp

For monotone conic CPs, a homogeneous model has been proposed where a bounded path having a trivial starting point exists, any accumulation point of the path is a solution of the model, if the problem is solvable then it gives us a solution, if the o problem is strongly infeasible, then it gives us a certificate proving infeasibility. We propose a class of algorithms for tracing the path above. For linear problems, polynomial iteration complexity bounds of the algorithms are derived.

2 - Convex Optimization Methods for Dimension Reduction and Coefficient Estimation

Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca, Ming Yuan, Renato Monteiro

The penalized least squares estimate model (PLSEM) recently proposed by Yuan et al. conducts parameter estimation and factor selection simultaneously and has been shown to enjoy nice properties in both large and finite samples. We explore Nesterov's first-order methods and interior point methods (IPM) for computing the PLSEM. The performance of these methods is then compared. We show that the best of Nesterov's first-order methods substantially outperforms the IPM implemented in SDPT3.

3 - A Second-order Cone Cutting Surface Method: Complexity and Application
Mohammad Oskoorouchi, Assistant Professor, California State University San Marcos, College of Business Administration, San Marcos, CA, 92096, United States, moskooro@csusm.edu, John E. Mitchell

An analytic center cutting surface algorithm that uses multiple second-order cone cuts is presented. We discuss the complexity results and show that the overall algorithm is fully polynomial. Computational experiences with random problems of moderate to large size are presented. We compare the results with that of SDPT3, SDPLR and SeDuMi and show that our algorithm outperforms the above software packages on fully dense problems.

4 - Monotonicity of Lowner Operators and its Applications to Symmetric Cone Complementarity Problems
Lingchen Kong, University of Waterloo, Department of Combinatorics and Optimiza, Waterloo, Canada, konglchen@126.com, Levent Tuncel

We present necessary and sufficient conditions for locally Lipschitz Lowner operators to be monotone, strictly monotone and strongly monotone. As a by-product of our results, we extend the Mangasarian family of NCP functions to Symmetric Cone Complementarity Problems. This corollary also solves an open problem of Tseng from 1998.

■ SA16

C-Room 619

Combinatorial Optimization I

Contributed Session

Chair: Vineet Goyal, Graduate Student, Tepper School of Business, A19C, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, vgoyal@andrew.cmu.edu

1 - Distributed Best First Search Strategy: An Illustrative Example with the 1|r|U Scheduling Problem
Edward Sewell, Professor, Southern Illinois University Edwardsville, SIUE, Edwardsville, IL, 62026, United States, esewell@siue.edu, Shane Hall, Sheldon H. Jacobson, Gio Kao

We introduce the Distributed Best First Search (DBFS) strategy for Branch and Bound algorithms. Its effectiveness is illustrated on the 1|r|U single machine scheduling problem (minimize the number of late jobs). A Branch, Bound, and Remember (BBR) algorithm is also presented that incorporates new memory-based dominance properties. The BBR algorithm with DBFS was able to solve all problems instances with up to 300 jobs, while previous algorithms encountered difficulties on problems with 120 jobs.

2 - Linear Programming Formulation of the Set Partitioning Problem
Moustapha Diaby, Associate Professor, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States, moustapha.diaby@business.uconn.edu

In this talk, we will present a polynomial-sized linear program formulation of the Set Partitioning Problem. The formulation will be illustrated with a numerical example. Computational testing and results will be discussed.

3 - An Application of Ant Colony Optimization to Job Shop Scheduling
Minseok Seo, The Pennsylvania State University, 232 Leonhard Blvd, University Park, PA, 16802, United States, mxs713@psu.edu, Jose Ventura

An algorithm based on ant colony optimization is proposed for the job shop scheduling problem with the objective of minimizing the makespan. The algorithm iteratively executes two interconnected phases. In phase I, job processing times are updated with pheromone values and a heuristic procedure, which attempts to reduce job waiting times and machine idleness, is executed to construct a new schedule. Then, in phase II, this schedule is improved through a block local search procedure.

4 - A Note on Approximation of 1-Regular 2-Color Paintshop Problem
Yuichi Asahiro, Kyushu Sangyo Univ., 2-3-1 Matsukadai, Higashi-ku, Fukuoka, 813-8503, Japan, asahiro@is.kyusan-u.ac.jp, Taku Nakamura, Eiji Miyano

Consider the following problem: The input is a word with every letter occurring exactly twice. The output is a coloring of the letter, say, red or blue under the condition that the two occurrences of the letter must be colored with different colors. Our goal is to minimize the number of color changes between adjacent letters. It is known that this problem is APX-hard. The aim of this presentation is to propose an approximation algorithm and to show several tractable special cases.

5 - Approximation Algorithms for Robust and Stochastic k-Median Problems
Vineet Goyal, Graduate Student, Tepper School of Business, A19C, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, vgoyal@andrew.cmu.edu, Anupam Gupta, Viswanath Nagarajan, Barbara Anthony

We consider a variant of the k-median problem in which the demand is uncertain and is modeled by a list of scenarios. Each scenario is a set of demand points. We need to locate k facilities such that the maximum (expected) median cost over all scenarios is minimized for the robust (stochastic) version. We give an O(log n + log m) approximation using a reverse greedy type algorithm. The algorithm is general and gives similar approximations for other robust/stochastic location problems as well.

■ SA17

C-Room 620

Joint Session ISS/ICS: Systems Evaluation

Sponsor: Information Systems Society, INFORMS Computing Society
Sponsored Session

Chair: Subodha Kumar, Assistant Professor, University of Washington, Business School, Seattle, WA, United States, subodha@u.washington.edu

1 - A Model to Analyze the Impact of P2P Networks on the Market for Content Provision and Distribution
Monica Johar, msjohar@email.uncc.edu, Nanda Kumar, Vijay Mookerjee

We develop an economic model to investigate the recent thinking that the development of P2P networks will pose a serious threat to firms in the business of providing content distribution services (e.g., Akamai). Our model considers the incentives of the producer (the content provider, e.g., CNN) together with the incentives of the consumer (who derives a positive utility from consuming the content) to derive the optimal extent of content distribution, with and without the existence of a P2P.

2 - A Model for Integrated Decision in Information Security Investment
Tridib Bandyopadhyay, Assistant Professor, Kennesaw State University, 1000 Chastain Road, Kennesaw, GA, 30144, United States, tbandyop@kennesaw.edu, Dengpan Liu

Firms invest in perimeter hardening as well as intrusion detection systems, but often under stand-alone decision frameworks. This could mean suboptimal investments in general. In this paper we develop a model that helps answer 1) How to optimally split available IT security budget among prevention and detection regimes? and 2) When an IDS is in place, how to choose the operating point in the detection regime, and investment in the prevention regime to lower the overall system cost?

3 - Our of Fear or Desire: Why Do Employees Follow Information Systems Security Policies?
Jai-Yeol Son, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, Jai-Yeol.Son@sauder.ubc.ca, Hyeun-Suk Rhee

Two well-grounded motivational models, command-and-control and self-regulation, which are viewed as competing explanations of why individuals follow rules, are used to explain employees' adherence to information systems security policy (ISSP). We aim to identify specific factors drawn from each of the two competing approaches that determine the level of employees' adherence to ISSP, and to develop and empirically test a conceptual model based on the two groups of determinants to be identified.

4 - Impact of Introducing a Direct Channel on Supply Chain Performance
Xuemei Su, College of Business Administration, California State University, Long Beach, Long Beach, CA, 90840, United States, xuemeisu@uwm.edu, Lifang Wu, Xiaohang Yue

We study the incentives for a manufacturer to introduce a direct channel in a stochastic demand environment. We find that the customer acceptance of direct channel, cross channel price sensitivity and the difference in distribution costs of the two channels play important roles in determining the existence of dual channel in equilibrium.

■ SA18

C-Room 201

Integrated Methods

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu

1 - The Accuracy of Search Heuristics: An Empirical Study on Knapsack Problems
Meinolf Sellmann, Assistant Professor, Brown University, sello@cs.brown.edu, Daniel Leventhal

Theoretical models for the evaluation of search strategies are based on assumptions regarding the probability that a value selection heuristic makes a correct prediction. We provide an empirical evaluation of value selection heuristics for knapsack problems. We investigate how their accuracy varies as a function of depth in the search-tree, and how they are affected by the relative strength of inference methods like pruning and constraint propagation.

2 - Open Constraints in a Closed World
Willem-Jan van Hoeve, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, United States, vanhoeve@andrew.cmu.edu, Jean-Charles Régin

Open constraints are defined on a flexible set of variables and appear, e.g., in the context of task scheduling on alternative resources. We present efficient domain filtering algorithms for the open global cardinality constraint, and for conjunctions of them, by integrating network flow techniques. The algorithms filter the scope of the open constraint, as well as the domains of the variables on which it is eventually defined.

3 - A Multi-point Constructive Search / Metaheuristic Hybrid for Job Shop Scheduling
Chris Beck, University of Toronto, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, jcb@mie.utoronto.ca, Jean-Paul Watson

Sophisticated multi-point metaheuristics represent the state-of-the-art in job shop scheduling. The multi-point approach has recently been incorporated in a constructive search algorithm, yielding near state-of-the-art performance. We examine a hybridization of these two approaches. Our hybrid algorithm enables fine control of the relative effort expended in intensification and diversification phases, allowing us to quantify their relative contribution to aggregate algorithm performance.

■ SA19

C-Room 203

Computational Advances in Approximate Dynamic Programming

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Warren Powell, Professor, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, powell@princeton.edu

1 - Approximate Dynamic Programming for Serial Multi-echelon Systems with Economies of Scale
Diego Klabjan, University of Illinois at Urbana-Champaign, 205 North Mathews Avenue, Urbana, IL, 61801, United States, klabjan@uiuc.edu

The value function of a serial systems with economies of scale is very complex and the underlying policies are not structured. We present a computational study based on algorithms that combine Monte-Carlo sampling and optimization. Various approximations to the value function are discussed.

2 - A Novel Method for Solving Continuous-state POMDPs
Enlu Zhou, Electrical & Computer Engineering Department, University of Maryland, College Park, MD, 20742, United States, enluzhou@umd.edu, Steven Marcus, Michael Fu

Most research on Partially Observable Markov Decision Processes (POMDPs) has been focused on finite-state space problems, where the belief space is a finite-dimensional simplex. However, many practical problems have continuous state spaces, and hence the belief space is infinite dimensional. To address this difficulty, we integrate modified projection particle filtering into MDP solving techniques to greatly reduce the dimension of the belief space and make continuous-state POMDPs tractable.

3 - Value Function Approximations for Multistage Linear Programs
Warren Powell, Professor, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, powell@princeton.edu

We describe how high-quality, practical solutions can be obtained for multistage stochastic linear programs using approximate dynamic programming. The first step involves setting up Bellman's equation using the post-decision state variable. The next step involves finding value function approximations that can be used within an LP solver. We present a series of approximation strategies, and describe where they have proven successful, as well as possible limitations.

4 - An Optimal Dynamic Hedging Strategy for Jet Fuel Costs
Juliana Nascimento, Princeton University, EQuad, ORFE Department, Princeton University, Princeton, NJ, 08544, United States, jnascime@princeton.edu, Warren Powell

We propose a dynamic strategy to hedge changes in the price of aircraft fuel using future contracts on commodities that are highly correlated with fuel. We model the commodity price using an unobservable two-factor model that allows mean-reversion in short-term prices and uncertainty in the equilibrium level to which prices revert. We combine dynamic programming and Kalman filter estimation to obtain an optimal policy that minimizes the expected costs while keeping the variance at low levels.

■ SA20

C-Room 204

Joint Session DAS/MAS: Military Decision Analysis

Sponsor: Decision Analysis, Military Applications
Sponsored Session

Chair: Gregory Parnell, Professor of Systems Engineering, United States Military Academy, Mahan Hall 432, West Point, NY, 10996, United States, gregory.parnell@usma.edu

1 - Comparing Organic vs. Handoff UAV Support to the Maneuver Company
Roger Chapman Burk, Associate Professor, US Military Academy, Department of Systems Engineering, West Point, NY, 10996, United States, roger.burk@usma.edu, Robin Burk

We consider two alternatives: (1) the Organic system, which consists of two VTOL vehicles of ~50 kg each assigned to each company and flying missions when needed; and (2) the Handoff system, a 100-200 kg air vehicle in the air constantly, operated at the battalion level, but handed off as needed to control by a company. We focus on performance measures that are strongly affected by the architecture and use high-level queuing and Markov chain models to estimate performance.

2 - Personality Modeling in High Threat Analytical Simulations
Paul West, Assistant Professor, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States, Paul.West@usma.edu

Computer simulations are key tools for course-of-action and materiel development analyses. Extensive work has been conducted in behavioral science to determine what physiological and psychological factors drive human action, but this information is often overlooked in simulations. This paper describes a methodology for enhancing synthetic humans with personality-based attributes for simulations where high-risk and high-threat environments make human performance assessment difficult.

3 - Probabilistic Modeling of Insurgency
Paul Kucik, Department of Systems Engineering, United States Military Academy, Mahan Hall, West Point, NY, 10996, United States, pkucik@stanford.edu

I use the methods of probabilistic risk analysis and systems analysis to represent the dynamic interaction between an insurgent group and the government in order to propose strategies to defeat insurgency. The model focuses at the village level and includes probabilistic submodels for both the insurgent decisionmaker and the government policymaker, where the insurgent leader's decisions affect the uncertainties faced by the policymaker, and vice versa.

4 - Setting Priorities: Value-based Program Decision Making
Patrick Driscoll, Professor, U.S. Military Academy, Dept. of Systems Engineering, Mahan Hall, Bldg 752, West Point, NY, 10996, United States, Patrick.Driscoll@usma.edu

Setting resource priorities for complex programs is recognizably difficult, a challenge compounded by the range of possible futures and the uncertainty contained in current performance estimates. We introduce a value-based approach for assisting decision makers in this context that uses DOE, simulation, and efficient portfolio principles to minimize total value return variability to stakeholders while simultaneously maximizing average value return against a set of future scenarios.

■ SA21

C-Room 205

Joint Session DAS/ENRE: Expert Elicitations For Energy Technology

Sponsor: Decision Analysis, Energy, Natural Res & the Environment
Sponsored Session

Chair: Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, United States, edbaker@ecs.umass.edu

1 - Prospective Evaluation of Applied Energy R&D at the Department of Energy

James Smith, Professor, Duke University, Fuqua School of Business, Durham, NC, 27708-0120, United States, jes9@duke.edu, Karen Jenni

In 2003, Congress asked the National Research Council (NRC) to develop an approach for estimating the benefits of DOE's fossil energy and energy efficiency R&D programs. The NRC's approach is based on a decision tree framework with expert panels assessing the likelihood of success and estimating the benefits given success. In this talk, we describe the approach and discuss the results of some applications.

2 - Photovoltaic Technology Options for Addressing Climate Change: an Expert Elicitation

Aimee Curtright, Carnegie Mellon University, Engineering and Public Policy, Pittsburgh, PA, 15213, United States, aimeecurtright@yahoo.com, David Keith, Granger Morgan

Expert elicitation is used to assess the future performance of 26 current and emerging photovoltaic (PV) technologies. The likelihood of each achieving specific module price thresholds within given time frames is evaluated. For a subset of the technologies, experts provide insight into technical barriers to success, plausible ranges of efficiencies and prices in 2030, and appropriate policy levers for optimizing PV performance. Development of the survey and results will be discussed.

3 - Uncertainty, Climate Change, and Advanced Solar R&D

Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, United States, edbaker@ecs.umass.edu, Jeffrey Keisler

Both climate change and technical change are uncertain. In this paper we combine economics and decision analysis to incorporate the uncertainty of technical change into climate change policy analysis. We present the results of an expert elicitation on the prospects for technological change in advanced solar. We combine the expert elicitations on the technology with a technologically detailed Integrated Assessment Model to derive a probability distribution over future abatement cost curves.

4 - Use of Experience Curves to Estimate the Future Cost of Power Plants with CO2 Capture

Sonia Yeh, Research Scientist, University of California-Davis, Institute of Transportation Studies, Davis, CA, 95616, United States, sonia_yeh@unc.edu, Mike Berkenpas, Matt Antes, Edward Rubin

Given the growing worldwide interest, the expected future cost of power plants with CO2 capture is of significant interest. This study uses historical experience curves as the basis for estimating future cost trends for four types of electric power plants with CO2 capture systems. We estimate future cost reductions that might be achieved by power plants employing CO2 capture. Effects of uncertainties in key parameters are evaluated via sensitivity analysis.

■ SA22

C-Room 206

Game Theory and Homeland Security

Sponsor: Decision Analysis
Sponsored Session

Chair: Jun Zhuang, PhD Candidate & Research Assistant, Department of Industrial and Systems Engineering, University of Wisconsin-Madison, 3155 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53705, United States, jzhuang@wisc.edu

1 - Stochastic Games for the MANPADS Problem

Erim Kardes, USC, USC, Ronal Tutor Hall, 3710 McClintock Ave., Room 314, Los Angeles, CA, 90089, United States, kardes@usc.edu, Randolph Hall

In this paper, we use two-person non-zero sum stochastic games to analyze the cost effectiveness of MANPADS (Man-Portable Air Defense Systems) countermeasures. These countermeasures are electronic devices that can be installed on commercial airplanes. We first present equilibrium results, and then perform sensitivity analyses by fixing attacker's strategies and solving the best response problem for the defender.

2 - Competitive Markov Decision Process Interdiction

Matthew Bailey, Asst. Professor, Bucknell University, Lewisburg, PA, United States, mdbailey@pitt.edu, Halil Bayrak

Consider a problem where an inspector controls a perimeter by installing static detection resources and subsequently devising a dynamic inspection policy, whereas a smuggler attempts to smuggle materials through the perimeter without being detected. We formulate this problem as the interdiction of a competitive Markov decision process and present a linear mixed integer model. In addition, we develop a heuristic algorithm to solve larger problem instances.

3 - Equilibrium Bluffs: A Model of Rational Feints

Santiago Oliveros, Assistant Professor, Haas School of Business-UC Berkeley, 545 Student Services Building #1900, Berkeley, CA, 94720-1900, United States, soliveros@haas.berkeley.edu

We study an attacker-defender game with incomplete information. The attacker can disguise her intentions and pretend to invade one location. Both players are fully rational and both play a pure strategy in equilibrium. We show that, under some conditions, there are equilibria with deception in which the attacker wastes resources to mislead the defender. We show that feints are a luxury good and that targets' natural protection and feints feasibility may be positively or negatively related.

4 - Modeling Secrecy and Deception in Homeland Security Resource Allocation

Jun Zhuang, PhD Candidate & Research Assistant, Department of Industrial and Systems Engineering, University of Wisconsin-Madison, 3155 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53705, United States, jzhuang@wisc.edu, Vicki Bier

In this work, we develop a game-theoretical model for whether and how a defender should disclose her resource allocation in the homeland-security context. Our model allows us to explore whether the defender should disclose correct information about her defensive resource allocation, incorrect information, or no information. Although we study secrecy and deception specifically in the homeland-security context, our work could provide insights in other contexts, such as business competition.

■ SA23

C-Room 208

Behavioral/Experimental Economics Research in Supply Chain Management

Sponsor: Behavioral Process Management (BPM)
Sponsored Session

Chair: Ozalp Ozer, Stanford University, Stanford, CA, 94305, United States, oozer@stanford.edu

Co-Chair: Murat Kaya, Assistant Professor, Sabanci University, Faculty of Engineering and Natural Sciences, MDBF, Tuzla Istanbul, 34956, Turkey, mkaya@sabanciuniv.edu

1 - Supplier and Retailer Behavior and the Effectiveness of Coordinating Contracts

Julie Niederhoff, Assistant Professor, Whitman School of Management, Syracuse University, 721 University Ave, Syracuse, NY, 13244, United States, jniederh@syr.edu, Panos Kouvelis

Supply chain coordinating contracts are theoretically equivalent when set by risk-neutral expected-profit-maximizing decision makers. However, individual effects of the decision maker interact with the situational effects of the contract framing to reveal differences in contract performance. We study this interaction to identify several key factors which drive the expected profit of the contract.

2 - How Social Reputation Networks Interact with Competition in Anonymous Online Trading

Gary Bolton, Professor, Penn State University, United States, gbolton@psu.edu, Claudia Loebbecke, Axel Ockenfels

Many Internet markets rely on "feedback systems", essentially social networks of reputation, to facilitate trust and trustworthiness in anonymous transactions. Market competition creates incentives that, in theory, may enhance or may curb the effectiveness of these systems. We investigate how market competition and social reputation networks interact to affect trust, trustworthiness and gains-from-trade in a series of laboratory online markets, where sellers face a moral hazard.

3 - Conducting Empirical Research in China

Aleda Roth, Professor, Clemson University, College of Business & Behavioral Science, Clemson, United States, aroth@clemson.edu

China has become a country of interest to researchers in supply chain management. This presentation addresses key cultural in conducting empirical research in China and presents guidance for the conduct of empirical research there.

4 - Dual Channel Management with Service Competition
Murat Kaya, Assistant Professor, Sabanci University, Faculty of Engineering and Natural Sciences, Sabanci Universitesi MDBF, Tuzla Istanbul, 34956, Turkey, mkaya@sabanciuniv.edu, Ozalp Ozer, Kay-Yut Chen

We address a manufacturer's problem of managing its direct online channel together with an independent retail channel. The consumers consider the delivery lead time in the direct channel and product availability in the retail channel in their channel selection. We identify optimal dual channel strategies that depend on the channel environment. We also present an experimental study that investigates whether our analytical model is consistent with human behavior.

■ SA24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - JMP Division-SAS Institute - JMP 7.0 for Interactive Data Analysis and Simulation
Curt Hinrichs, JMP Division-SAS Institute, SAS Campus Dr., Cary, NC, 27513, curt.hinrichs@jmp.com, Melodie Rush

JMP is a state-of-the-art data analysis and visualization package from SAS. Developed for those who desire to explore data easily with modern graphics, JMP offers elementary and advanced statistics, business visualization and exploratory data mining. Only JMP offers two-way integration with SAS, including SAS/OR. The demo highlights JMP's key capabilities.

2 - statistics.com - Data Mining in Excel - XLMiner
Peter Bruce, statistics.com, 612 No. Jackson St., Arlington, VA, 22201, peter.bruce@statistics.com

XLMiner (data mining add-in for Excel) offers database sampling, stratified sampling, partitioning into training, validation and test samples, missing data imputation, and database scoring. Plus classification/regression trees, logistic regression, neural networks, Bayesian classifier, k-nearest neighbors, multiple linear regression with subset selection, association rules, principal components, hierarchical and k-means clustering.

■ SA25

C-Room 210

Management of Complex Service Systems

Sponsor: Service Science
Sponsored Session

Chair: Ruoyi Zhou, Management of Very Complex Service Systems, IBM, 650 Harry Road, San Jose, CA, 95120, United States, ruoyi@us.ibm.com

1 - Semantics for Collaborating Organizations' Self-service Technologies
Michael Goul, Professor, Arizona State University, W.P. Carey School of Business, P.O. Box 874606, Tempe, AZ, 85287-4606, United States, michael.goul@asu.edu, Haluk Demirkan

We present the theoretical development and implementation of semantics for federated organizations' governance, design and delivery of complex self-service technologies. The semantics developed integrate technical, human and business value aspects focusing on service network performance and adaptation. Research issues in applying the semantics to service blueprints and aggregators are discussed.

2 - How Learning and Forgetting Affect the Optimal Work Allocation Policy
Geoff Ryder, PhD Candidate, University of California - Santa Cruz, 4190 Sophia Way, San Jose, CA, 95134, United States, gryder@gmail.com, Kevin Ross

Service systems often require agents to divide their time between different job functions, and their effective service level for each function changes with experience. We analyze optimal work allocation policies where an agent's efficiency for a job class may increase through experience (learning-by-doing), or decrease due to forgetting (rapidly changing requirements). Policies vary between service-dominated (eg. serve at maximum available rate) and delay-dominated (serve the longest queue).

3 - Service Pricing with Knowledgeable Consumers
Chris Anderson, Cornell University, School of Hotel Administration, Ithaca, NY, United States, cka9@cornell.edu, Leo MacDonald, Rohit Verma

Internet based businesses have appeared which target price sensitive customers with the provision of both price data and potential insight into future prices. We will present the complexities this data rich world has upon service based pricing, illustrating the issues in estimating demand models and discuss approaches to deal with this new found complexity.

4 - An Experiment to Increase Magazine Sales in a Supermarket
Arthur Swersey, Professor of Operations Research, Yale School of Management, 135 Prospect St, New Haven, CT, 06511, United States, arthur.swersey@yale.edu, Gordon Bell, Johannes Ledolter

Experimental design methods have been widely used in manufacturing, but applications to marketing and service operations have been much less common. We describe how we used a Plackett-Burman design to test 10 factors relating to advertising and promotion, and the location of the magazine in a store. We discuss design issues such as number of stores needed and length of the test period. We compare our Plackett-Burman design to fractional factorial alternatives, and discuss our results.

■ SA26

C-Room 211

Joint Session DM/ICS/CPMS: Real World Applications of Text Mining

Sponsor: Data Mining (Sponsored), INFORMS Computing Society, The Practice Section of INFORMS
Sponsored Session

Chair: Mary Crissey, SAS Insitute, 17030 Vista Park Dr, San Antonio, TX, 78247, United States, Mary.Crissey@sas.com

1 - Audio Analysis in Action
Mary Crissey, SAS Insitute, 17030 Vista Park Dr, San Antonio, TX, 78247, United States, Mary.Crissey@sas.com, Manya Mayes

With Voice capture technologies it is now possible to text mine conversations and data captured from your call centers. This talk will show how important issues were identified after data was processed through the NICE systems and SAS software. See how to classify/predict customer behavior with predictive advanced analytics. Start and stop lists, concept link diagrams and lessons learned will be cited.

2 - Applying Text Mining to Find Optimal Treatment Pathways
Patricia Cerrito, Professor of Mathematics, Univ. of Louisville, Department of Mathematics, Louisville, KY, 40292, United States, pcerrito@louisville.edu

Patients with diabetes require physicians to make a sequence of decisions to treat diabetic foot ulcers and bone infections. Physicians can choose between combinations of antibiotics, amputations, and standard wound care. Text mining is used to compress categories of patient diagnoses and treatment combinations. Survival data mining algorithms are applied to examine multiple patient events. Results indicate that the primary treatment is amputation and that antibiotics are under-utilized.

3 - The Impact of Overfitting and Overgeneralization on the Classification Accuracy in Data Mining
Huy Pham, Louisiana State University, Department of Computer Science, 298 Coates Hall, LSU, Baton Rouge, LA, 70803, United States, hpham15@lsu.edu, Evangelos Triantaphyllou

Many classification studies have been developed in the two last decades. No single method outperforms all methods all the time. The performance of a classification method in terms of its false-positive and false-negative rates may be unpredictable. The root to the problem is the overfitting and overgeneralization behaviors. However, it has not been studied from a comprehensive view. This study proposes the Homogeneity-Based Algorithm for optimally controlling the rates with the promising results.

4 - Ranking National Football League Teams Using Google's PageRank
Anjela Govan, North Carolina State University, 27695-8205, United States, aygovan@math.ncsu.edu, Russell Albright, Carl Meyer

The search engine Google uses the PageRanks of web pages to determine the order (rank) in which they are displayed to the user. In this work we expand Google's idea of web page ranking to ranking National Football League teams. The objective is to be able to rank NFL teams by their relative strengths using a new algorithm and to compare the results to existing ranking algorithms. The algorithms are implemented and tested using SAS/IML.

5 - Scio Systems Applies Advanced Text Technologies to Real Estate
Alex Lupu, Co-founder, Scio Systems, 2881 Idlewood Ln, Highland Park, IL, 60035, United States, alupu@sciosystems.com

During this talk I will share the unique niche identified for software that automatically reads and comprehends the meaning of English text as written in legal contracts. Initially, my software application focuses on lease management for commercial property management organizations. This technology touts fast turn around times as it automatically abstracts, analyzes, and monitors contract terms in the dynamic rapidly changing real estate market.

■ SA27

C-Room 212

Data Mining and Analysis

Cluster: Data Mining (Invited)
Invited Session

Chair: Sumit Sarkar, Ashbel Smith Professor of Information Systems, University of Texas at Dallas, 2601 N. Floyd Rd., SM 33, Richardson, TX, 75080, United States, sumit@utdallas.edu

1 - Developing a Measure of Risk Adjusted Revenue (RAR) for Credit Cards
B.P.S. Murthi, Associate Professor, The University of Texas at Dallas, 3.808 SOM, Richardson, TX, 75083-0688, United States, murthi@utdallas.edu, Shweta Singh, Erin Steffes

In customer relationship management, current research focuses on customer lifetime value with a view to optimizing the allocation of acquisition and retention efforts. However, in the credit card market, it is widely known that profitable customers are also more risky. Using credit card data, we develop a measure of risk adjusted revenue using data envelopment analysis. We also assess the role of modes of acquisition and of affinity cards and rewards cards.

2 - Mining Blog Data for Box Office Prediction
Eric Zheng, Assistant Professor, UT Dallas, 3.203 SOM, University of Texas at Dallas, Richardson, TX, 75083, United States, ericz@utdallas.edu, Wei Yue

Sales of products such as movies are often influenced by customers' word of mouth (WOM). Blogs present a new venue to study this WOM effect because they represent consumers' opinions over time across the population. We mine this blog data to predict the box office of movies. A text mining method is proposed to capture online opinions including volume, valence, sentiment and disposition of a blog on a movie. Initial econometric analyses show that blog has a significant effect on box office.

3 - Hide Sensitive Association Rules and Maximizing Accuracy
Syam Menon, Associate Professor of Information Systems, University of Texas at Dallas, 2601 N. Floyd Rd., SM 33, Richardson, TX, 75080, United States, syam@utdallas.edu, Sumit Sarkar

We focus on the problem of hiding sensitive association rules in shared databases. Hiding is usually achieved by altering selected transactions in such a way that they no longer support the sensitive association rules. The database should be altered as little as possible in order to maximize the benefits of sharing. We use accuracy as the measure of the quality of the altered database, and present optimal approaches to maximize the accuracy of the shared database.

4 - Learning Profiles From User Interactions
Pelin Atahan, University of Texas at Dallas, 2601 N. Floyd Rd., SM 33, Richardson, TX, 75080, United States, pxa041000@utdallas.edu, Sumit Sarkar

Personalization and recommendation systems play an important role in online business settings. An important determinant of the performance of these systems is the user profile available to the system. We study how user profiles can be implicitly learnt based on a user's traversal of a web site.

■ SA28

C-Room 213

Metaheuristics in Logistics and Transportation

Sponsor: INFORMS Computing Society/ Metaheuristics
Sponsored Session

Chair: Claudio Cunha, Associate Professor, University of Sao Paulo, Cidade Universitaria ASO, Sao Paulo, SP, Brazil, cbcunha@usp.br

1 - Metaheuristics for the Stochastic Inventory Routing Problem
Arne Lokketangen, Arne.Lokketangen@hiMolde.no, Lars Hvattum, Gilbert Laporte

We address the Stochastic Inventory Routing Problem, where the stochasticity is in demands of the customers. Heuristic solution methods are proposed, based on using infinite scenario trees to approximate the underlying Markov Decision Process. The scenario tree based methods are more general than previously proposed solution methods, and the computational results are promising.

2 - Restricted Dynamic Programming Based Neighborhoods for the Hop Constrained Spanning Tree Problem
Luis Gouveia, CIO and DEIO-FCUL, Edificio C6, Campo Grande, Lisbon, Lx, Portugal, legouveia@fc.ul.pt, Dushyant Sharma, Ana Paias

In the talk we will present a new dynamic program for the hop constrained minimum spanning tree problem. This problem arises in telecommunication network design and package routing in logistics. We will show that searching over node-level based exchanges such as shifts and swaps discussed in the literature is equivalent to search over a restricted dynamic program for the HMSTP. This study suggests new (or variations on the) neighborhood structures for the problem.

3 - A Simple and Efficient Multi-start Tabu Search Heuristic for the Uncapacitated Hub Location Problem
Claudio Cunha, Associate Professor, University of Sao Paulo, Cidade Universitaria ASO, Sao Paulo, SP, Brazil, cbcunha@usp.br, Marcos Silva

In this talk we describe a a simple and efficient multi-start tabu search heuristic to solve the uncapacitated single allocation hub location problem, a problem that arises in several contexts, including passenger airlines, postal and parcel delivery, and computer and telecommunication networks. Computational experiments using typical benchmark problems show that our approach consistently returns the best results in very short CPU times.

■ SA29

C-Room 214

Free Open-source Software for Operations Research: An Introduction to COIN-OR

Sponsor: INFORMS Computing Society/COIN-OR
Sponsored Session

Chair: Robin Lougee-Heimer, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

1 - Open Source and Software Publication
Matthew Saltzman, Clemson University, Department of Mathematical Sciences, Clemson, SC, United States, mjs@clemson.edu

Open source software (OSS) is arguably the most efficient technology transfer mechanism available today. We explain what OSS is and what its benefits are to the OR community. We describe various flavors of OSS licenses, and we discuss various issues related to publishing and using OSS. We also describe several examples of OSS resources available in the OR field.

2 - Introduction to COIN-OR: Open-source for the OR Community
Robin Lougee-Heimer, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, robinlh@us.ibm.com

Need a free solver? Modeling system? Interface? Or other computational-OR resource for your teaching, research, or application work? Over two dozen resources are available on-demand, free-of-charge at www.coin-org. Why reinvent when you can re-use? COIN-OR promotes open-source software for OR. We introduce the why, what, and how of COIN-OR.

3 - How to Publish Your Software on COIN-OR
Robert Fourer, Professor, Northwestern University, Dept. of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu

COIN-OR offers an environment tailor-made for disseminating and maintaining OR software. If you have created a software package or library that you are willing and able to open up for use by the OR community, you may want to consider adding it to the over two dozen projects currently supported at COIN-OR. This presentation will detail the steps involved.

■ SA30

C-Room 2A

Prognostics and Maintenance Management

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Nagi Gabraeel, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, nagil@isye.gatech.edu

1 - Maintenance Diagnostics, Prognostics and Health Management in Manufacturing

Stephan Biller, Group Manager, General Motors R&D, 30500 Mound Road, MC 480-106-359, Warren, MI, 48090, United States, stephan.biller@gm.com, Leandro Barajas

Maintenance generates one of the highest structural costs in automotive manufacturing. Reducing such costs can achieve results beyond those possible by implementing efficiency improvement programs alone. By integrating diagnostics and prognostics into our maintenance business processes, we have reduced spacio-temporal uncertainties associated with future states and performance of manufacturing systems and therefore enabling us to take informed and effective decisions on maintenance activities.

2 - An Optimal Stopping Rule for Sensor-driven Replacement and Spare Parts Inventory Decision Models

Alaa Elwany, PhD Candidate, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, aelwany@engineering.uiowa.edu, Nagi Gabraeel

A sensor-driven decision model is proposed to determine and dynamically revise optimal replacement and inventory policies for partially degraded components given real-time sensory information. An optimal stopping rule is then developed to decide when to stop updating and implement the most recently updated decision policy. The presented real-world case study demonstrates that this results in better decisions and reduced costs due to the improved prediction accuracy of components' lifetimes.

3 - Adaptive Spare Part Replenishment Driven by Condition Monitoring Technique

Haitao Liao, Assistant Professor, Wichita State University, 1845 Fairmount St., Industrial & Manufacturing Eng Dept., Wichita, KS, 67260-0035, United States, haitao.liao@wichita.edu

Just-in-time spare part management reduces the total downtime of a machine by carrying minimal spare part inventory and replenishing it only when and as needed. This paper presents a sensor-driven adaptive spare part replenishment strategy for several machines of the same type. A joint estimation approach is utilized to quantify the health status of each machine for updating the system-level replenishment strategy. An example of a bench top CNC milling machine is provided for demonstration.

4 - Structured Maintenance Policies for a Non-stationary, Partially Observable Markov Decision Process

Ludmila Zheltova, Case Western Reserve University, 11119 Bellflower Road, Peter B. Lewis Building, Cleveland, OH, 44106, United States, ludmila.zheltova@case.edu, Lisa Maillart

We analyze a partially observable Markov decision process (POMDP) maintenance model and determine conditions under which the optimal inspection/replacement policy exhibits appealing structure. These results generalize existing work by considering the important case in which the system deteriorates according to a known, time-dependent transition probability matrix.

■ SA31

C-Room 2B

Bayesian Reliability Modeling

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Refik Soyer, George Washington University, Decision Sciences Dept. Funger Hall 415, School of Business, Washington, DC, 20052, United States, soyer@gwu.edu

1 - Dynamic Bayesian Information Measures for Duration Analysis

Ehsan Soofi, Lubar School of Bus., P.O. Box 742, University of Wisconsin-Milwaukee, Milwaukee, WI, 53201, United States, esoofi@uwm.edu, Nader Ebrahimi, S.N.U.A. Kirmani

We present measures of information about the parameters provided by observation from the residual life distribution where the support is truncated at the current age. The current age induces a dynamic into the information measures. Dynamic versions of well-known measures of information provided by the data about parameters are studied. These measures are applied to dynamic updating of information about parameters and predictive distributions for some well-known lifetime models.

2 - Bayesian Imperfect Debugging Modeling

Tevfik Aktekin, The Geeorge Washington University, 2201 G Street, NW, Suite 415, Washington, DC, 20052, United States, taktekin@gwu.edu, Toros Caglar

The scope of our research is to develop a bayesian imperfect debugging model in software reliability using MCMC methods. The proposed model will help us to study the behavior of the fault detection rate per fault, number of faults left on the software code over time and the reliability of the software up to a particular time via statistical inference.

3 - A General Bayesian Inference Procedure for Accelerated Tests

Thomas Mazzuchi, George Washington University, 1776 G Street NW, EMSE Suite 101, Washington, DC, 20052, United States, mazzu@gwu.edu

This talk presents development of a general model for accelerated life testing using the Bayesian paradigm. Both design and inference implications will be discussed. The inference procedure uses the well-known Markov Chain Monte Carlo (MCMC) methods to derive posterior approximations. The approach is illustrated with an example.

4 - Semiparametric Bayesian Decision Models

Refik Soyer, George Washington University, Decision Sciences Dept. Funger Hall 415, School of Business, Washington, DC, 20052, United States, soyer@gwu.edu, Jason Merrick

We consider a semi-parametric model to describe failure characteristics of a system. Using a gamma process prior for the cumulative intensity function complicates the Bayesian analysis when the updating is based on failure count data. We develop a Bayesian analysis using MCMC methods and determine replacement strategies. Adoption of MCMC methods involves a data augmentation algorithm. We show the use of our approach with actual data.

■ SA32

C-Room 302

Logistics Insurance and Risk Management

Cluster: Shipping, Maritime, and Supply Chain Logistics
Invited Session

Chair: Xianghua Gan, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, China, lgtxgan@polyu.edu.hk

1 - Premium-call Policies for Mutual Insurance

Xianghua Gan, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, China, lgtxgan@polyu.edu.hk

Mutual insurance (MI) is a type of insurance where those protected by the insurance (policyholders) also have certain "ownership rights in the organization. MI has been the dominant insurance vehicle in marine insurance market for over 150 years. Assuming periodic premium collection, we find the optimal premium-call policy for the mutual insurance organization.

2 - Incentives of Contingent Options in Mutual Insurance

John Liu, Lgtjliu@polyu.edu.hk, Jiguang Yuan

A key drawback of mutual insurance is its indistinguishable principal-agent structure. As a result, typical revelation mechanisms (e.g., non-linear deduction-based premium, etc.) can hardly be implemented in mutual insurance. Intrigued by the fact that P&I Club, a marine mutual insurance with linear premium (i.e., tonnage-based premium rate), has over 150 strong years of history, we in this paper intend to examine alternative revelation scheme in mutual insurance.

3 - Exchange of Demand Information Across Retailers in a Supply Chain

Jianghua Wu, Assistant Professor, Renmin University of China, School of Business, 59 Zhongguancun St., Beijing, 100872, China, jwu@ruc.edu.cn

We study the impact of information sharing across decentralized retailers in a supply chain. The manufacturer supplies similar products to multiple retailers and each retailer serves its independent end market. We show that, under constant market conditions, the number of retailers may affect their incentives to share information.

■ SA33

C-Room 303

Urban Transportation Planning Models I: Models and Methods for Transportation Network Design

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Xuegan (Jeff) Ban, Assistant Research Engineer, CCIT, University of California, Berkeley, 2105 Bancroft Way, Berkeley, CA, United States, xban@berkeley.edu

1 - Sample Average Approximation and Decomposition Techniques for Stochastic Network Design Problems

Gopal Patil, PhD Candidate, Rensselaer Polytechnic Institute, JEC-4002, Dept. of Civil Engineering, Troy, NY, 12180, United States, patilg@rpi.edu, Satish Ukkusuri

Stochastic Network Design Problems incorporates stochasticity in network parameters such as demand, capacity and travel time. Introducing stochasticity increases the complexity of already complex network design problems. Our experiences with KNITRO, FILTERóthe solvers to deal with non-convex problemsó show that these tools are not capable of handling larger problems. In this study we reduce the complexity of problem using sample average approximation (SAA) and decomposition approaches.

2 - Estimating Investment Requirement for Maintaining and Improving Highway Systems
Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States, yafeng@ce.ufl.edu, Siriphong Lawphongpanich, Yingyan Lou

This paper presents an integrated and robust approach for estimating the investment necessary to maintain and/or improve the future levels of service and pavement conditions of facilities in a highway network. The approach assumes that future travel demands and facility conditions are confined to an ellipsoidal uncertainty region. The problem is formulated as a mathematical program with equilibrium constraints and solved via a cutting plane algorithm on the Sioux Falls network.

3 - Carrier-carrier Collaborative Networks: A Network Design Formulation
Salvador Hernández, Research Assistant, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States, shhernan@purdue.edu, Srinivas Peeta

A Less-than-truckload (LTL) carrier has demand it cannot fully serve for multiple origins and destinations. It seeks to collaborate with other carriers who may share all, part, or none of its network. The goal of the LTL carrier is to identify the routes that minimize the sum of the collaborative path costs. A mixed integer formulation is presented which precludes load splitting between arcs. Issues are identified, and solutions are presented and discussed on varying network sizes.

4 - A Decomposition Scheme for Bi-level Dynamic Network Design Problem
Dung-Ying Lin, Graduate Research Assistant, The University of Texas at Austin, 1 University Station C1761, ECJ Hall Suite 6.208, Austin, TX, 78712, United States, dylin@mail.utexas.edu, Ampol Karoonsoontawong, S. Travis Waller

The bi-level dynamic network design problem is strongly NP-hard. Solving this problem efficiently is critical in the development of the capacity expansion policies on networks. A Dantzig-Wolfe decomposition based heuristic scheme is proposed to address this issue. Numerical experiments are performed, new solution methodologies are discussed, and insights are presented.

■ SA34

C-Room 304

Freight Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: April Kuo, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, United States, aprilkuo@umd.edu

1 - A Nationwide High-speed Rail System for Freight
Russell Meller, Hefley Professor of Logistics, University of Arkansas, Center for Engr Logistics and Distrb., 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, rmeller@uark.edu, Jen Pazour, Kevin Gue

High-speed rail is often touted as a way to reduce congestion on the nation's highways by removing passenger car traffic. But reducing the amount of freight traffic would also reduce highway congestion. So, given the advances in high-speed rail, the potential exists for developing a nationwide system for freight. We present a network design model that considers transit times and highway traffic and an application of it with data from a major truckload carrier as a potential case study.

2 - Integration of Facility Location and Layout of Intermodal Transportation System with Scheduling
Guven Kaya, Koc University, Department of Industrial Engineering, Sariyer, Istanbul, 34450, Turkey, gukaya@ku.edu.tr, Ceyda Oguz, Metin Turkay

We developed an integrated model for facility layout and scheduling problems arising in intermodal freight logistics for the municipality of Istanbul. After formulating it as an MIP model, we proposed both exact and heuristic algorithms to solve it. This will be applied to the system Istanbul municipality has and the results will be discussed.

3 - Combinatorial Auction for Multi-carrier Freight Transport
April Kuo, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, United States, aprilkuo@umd.edu, Elise Miller-Hooks

We propose a combinatorial auction of rail track capacity among multiple carriers in a spot market. The auction process is analyzed in a simulation platform, where a carrier's bidding behavior is considered. A computationally efficient, approximate method for bid construction (i.e. for solution of the winner determination problem) is developed.

4 - Scheduled Service Network Design for Rail Carriers
Endong Zhu, CIRRELT, University of Montreal, C.P. 6128, succursale Centre-ville, Montreal, QC, H3C 3J7, Canada, endong@crt.umontreal.ca, Michel Gendreau, Teodor Gabriel Crainic

We are addressing the service network design problem in freight rail transportation. The problem simultaneously considers the service selection and scheduling, traffic distribution, blocking policy, and train make-up policy. To explicitly describe the flows of services, blocks, and cars/commodities, a cyclic time-space network structure with three layers is constructed. Based on the network structure, we present a linear mixed-integer formulation. Solution method ideas are also discussed.

■ SA35

C-Room 305

Stochastic Multi-Stage Resource Allocation Model with Reservation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Lijian Chen, Assistant Professor, University of Louisville, Department of Industrial Engineering, Speed School of Engineering, RM312, Louisville, KY, 40292, United States, lijian.chen@louisville.edu

1 - Performance of Zero-Memory Policies in a Single Product Inventory System with Inaccurate Counts
Olga L. Ortiz, Georgia Institute of Technology, School of Industrial and Systems Engineering, oortiz@isye.gatech.edu, Chelsea C. White III, Alan Erera

We model an inventory system with inaccurate counts as a partially observed Markov decision process and show that under certain conditions, a zero-memory policy that is equivalent to an optimal policy for its completely observed counterpart is adaptive. A simulation study is used to assess the value of improved inventory accuracy.

2 - Parallel Machine Scheduling to Minimize Weighted Completion Time Variance
Yang Sun, Assistant Professor, California State University, Sacramento, College of Business Administration, 6000 J Street, Sacramento, CA, 95819, United States, yang.sun@asu.edu, John Fowler, Xueping Li

The parallel machine scheduling problem with the objective of minimizing completion time variance has many structural optimality properties. However, these properties do not hold for cases in which the objective is to minimize weighted CTV. Hence, it is difficult to develop constructive heuristics for the weighted version of the problem. In this research, we use a genetic algorithm and a set of greedy heuristics to search for better solutions. Computational results are also provided.

3 - Inventory Based Allocation Policies for Flexible Servers in Serial Systems
Maria Mayorga, Assistant Professor, Clemson University, Freeman Hall Box 34020, Clemson, SC, United States, mayorga@CLEMSON.EDU, Kevin Taaffe, Ramesh Arumugam

Motivated by industrial applications, we study the allocation of a flexible server in a serial process. Rather than using standard server vacation rules, we consider polling policies that are characterized by endogenous parameters, such as inventory levels, with the goal of maximizing throughput. We analyze this problem using queuing theory and simulation when needed.

4 - Stochastic Multi-stage Resource Allocation Model with Reservation
Lijian Chen, Assistant Professor, University of Louisville, Department of Industrial Engineering, Speed School of Engineering, RM312, Louisville, KY, 40292, United States, lijian.chen@louisville.edu

We propose a resource reservation approach for the stochastic multi-stage resource allocation problem within a fixed time horizon. By reserving and releasing resources by stages, the scenario tree is significantly reduced and the non-convexity is eliminated. As a result, solving the multi-stage stochastic program becomes implementable for business scale problems. In the remaining part of the paper, we present the optimal condition and results.

■ SA36

C-Room 306

Transportation I

Contributed Session

Chair: Ramesh Bollapragada, Associate Professor, College of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, rameshb@sfsu.edu

1 - Unspecified-Time Airline Tickets

Guoren Zhang, PhD Candidate, Richard Ivey School of Business The University of Western Ontario, gzhang@ivey.uwo.ca, Peter C. Bell

A new phenomenon in airline industry is that airlines sell Unspecified-Time Airline Tickets (UTAT). UTAT represents a seat purchased by a consumer for travel during some time window on a flight decided by airline the. Low price UTAT can attract leisure travelers who are not time sensitive. In this paper, we study the new pricing problems of UTAT for airline companies. We explore necessary conditions for airline carriers to introduce UTAT under different assumptions.

2 - Model and Algorithm for the Courier Delivery Problem with Uncertainty

Ilgaz Sungur, USC, 3715 McClintock Avenue, GER240, LA, CA, 90089, United States, sungur@usc.edu, Maged Dessouky, Fernando Ordonez

We propose a model for VRPTW with uncertainty combining scenario-based stochastic optimization for probabilistic customers and robust optimization for uncertain service times. Our model maximizes customers serviced and similarity of routes in each scenario while minimizing total cost and lateness penalty. We develop a two-phase insertion-based heuristic balancing these objectives. Our experiments study sensitivity of the heuristic and show improvements over a real-life large scale problem.

3 - Ride Service Outsourcing for Profit Maximization

Bruce Wang, Researcher, University of Wisconsin, 1415 Engineering Dr. Room 2205, Madison, United States, wangx@engr.wisc.edu, Yihua Wang, Teresa Adams

Frequently service requests exceed the carrier's available capacity. Advance outsourcing therefore remains an important component of transportation service providers' business. In this paper, we develop a model for ride service outsourcing. Test with sedan ride services data indicates that the optimization techniques dramatically improves the carrier's outsourcing decision and profitability.

4 - Column Generation for Ship Scheduling Problems with Flexible Cargo Sizes

Bjorn Nygreen, Professor, NTNU, Norwegian University of Science and Tech, Trondheim, N- 7491, Norway, bjorn.nygreen@iot.ntnu.no, Jens Lysgaard, Geir Brönmo

We show that introduction of flexible cargo sizes in a column generation framework is not straightforward. We handle the flexible cargo sizes heuristically when solving the subproblems. We have compared our method with an a priori column generation approach, and our computational experiments on real world cases show that our Dantzig-Wolfe approach is faster than the a priori generation of columns, and we are able to deal with larger or more loosely constrained instances.

5 - Slow Progress of FasTrak: Usage Analysis of an Electronic Toll Collection System

Ramesh Bollapragada, Associate Professor, College of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States, rameshb@sfsu.edu, Sanjit Sengupta, Hector Bedolla

Through quantitative and empirical models, we provide several recommendations that help reduce the traffic congestion problems at all Bay area bridges, through increased usage of FasTrak devices for electronic toll collection(from the current level of 40% to a future level of 70%). Our paper is influencing the government and policy makers such as MTC and BTA in the Bay area, and the work here has appeared in several local television and radio channels, as well as in over a dozen newspapers.

■ SA37

C-Room 307

Munition Applications

Sponsor: Military Applications
Sponsored Session

Chair: James Moore, The Air Force Institute of Technology, AFIT/ENS Bldg 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433-7765, United States, james.moore@afit.edu

1 - Communication Models for a Cooperative Networks of Autonomous Agents

Clayton Commander, Air Force Research Laboratory, 101 W. Eglin Blvd, Ste. 144, Eglin AFB, FL, 32542, United States, commandc@eglin.af.mil, Ashwin Arulselvan, Panos Pardalos, Mauricio G. C. Resende, Michael Hirsch

The cooperative communication problem on mobile ad-hoc networks (CCPM) deals with maximizing the connectivity for a set of wireless agents as they traverse a graph from a set of source nodes to a set of destination nodes. Here we introduce continuous formulations and compare the results of several case studies. This provides a more realistic model of the problem as supported by the numerical evidence.

2 - Information Sharing and Cooperation in Multi-Agent Systems

David Jeffcoat, Egline AFB, jeffcoatd@eglin.af.mil

This research is concerned with the modeling and analysis of cooperation within a heterogeneous, multi-agent team. Our focus is on a special form of cooperation, namely information sharing. The objective is to develop mathematical models for cooperation via information sharing in complex large-scale systems. The approach is based on the techniques of discrete-state, continuous-time Markov chain models. The primary application context is the search for targets in a combat scenario.

3 - Weapon Target Assignment Problems: An In-depth Survey

Theresa Wilson, AFRL/MNGN, 101 W. Eglin Blvd Suite 341, Eglin AFB, Fl, United States, wilsonta@eglin.af.mil, Panos Pardalos, Michael Hirsch

In its most general form, the Weapon Target Assignment problem and the more general resource allocation problem are known to be NP-complete. Numerous formulations exist and many heuristics have been implemented to solve this problem. In this paper, we present a comprehensive survey of the different formulations and heuristics for the Target-Based Weapon Target Assignment Problem.

4 - Scheduling a Single Sensor in a Time-variant Environment

Mesut Yavuz, Shenandoah University, 1460 University Drive, Winchester, VA, 22601, United States, myavuz@su.edu, David Jeffcoat

The allocation and scheduling of sensors is a significant problem in military operations research. Recent work in the area focuses on a class of sensors able to observe multiple sites of interest, one at a time. In this research, we consider multiple sites each with time-variant activity rates. We establish computational complexity of the problem and propose both deterministic and stochastic methods for its solution. We also compare the solution methods via a computational study.

■ SA38

C-Room 308

Marketing I

Sponsor: Marketing Science
Sponsored Session

Chair: Gary Erickson, Professor, University of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, erick@u.washington.edu

1 - Incorporating Uncertainties into Product Development and Engineering Design

R. Jean Ruth, General Motors Research & Development, MC 480-106-256 R&D VDR, 30500 Mound Rd., Warren, MI, 48090-9055, United States, rjean.ruth@gm.com, Artemis Kloess, Sharon Zielinski

For product applications that require balancing competing attributes and features, methods for incorporating uncertainties about consumer market research information and technology capabilities in the future, eliciting expert judgments, and combining sources of information are key. We use vehicle examples to discuss sources of uncertainty and how uncertainties evolve, consider methods for handling key uncertainties, and suggest areas for further research and development of applied methods.

2 - Forecasting New Product Demand Using a Generalized Heterogeneous Model

Michael J. Scott, Associate Professor, University of Illinois at Chicago, MIE (MC 251), 842 W. Taylor St., Chicago, IL, 60607, United States, mjscott@uic.edu, Joseph A. Donndelinger, Jeffery A. Robinson, Luke A. Wissman, Sina Ghotbi

Market research methods for demand forecasting range from conjoint analysis to contingent valuation methods such as the Van Westendorp Price Sensitivity Meter. Their usefulness in new product development is limited by complex relationships between market research methods and market demand models. We investigate the generalization of market demand models to use market research data from a variety of sources and facilitate interpretation by both practitioners and decision-makers.

3 - Making MaxDiff More Informative: Statistical Data Fusion by Way of Latent Variable Modeling

Lynd Bacon, SVP Analytics, Polimetrix, Inc., 285 Hamilton Ave, Suite 200, Palo Alto, CA, 94301, United States, lynd@polimetrix.com, Peter Lenk

MaxDiff Scaling (AKA Best/Worst Analysis), is a special kind of choice-based conjoint that has been steadily gaining popularity in recent years. One weakness of it is that individual differences in scale origin are lost. We describe a type of HB model that fuses MaxDiff and rating scales data so that scores relative to a sample-level common origin can be estimated. We compare specifications that are and are not consistent with Random Utility Theory, and provide example applications.

4 - Product Line Design Optimization for Heterogeneous Markets: A Decomposition-based Approach

Jeremy Michalek, Assistant Professor, Carnegie Mellon University, Scaife Hall 323, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jmichalek@cmu.edu

Optimization of product attribute levels using conjoint data is common; however, products with engineering content involve critical tradeoffs in the ability to actually achieve desired levels. We present a method for product line optimization that incorporates consumer heterogeneity and efficiently coordinates positioning and design models to achieve realizable firm-level optima, and we examine the tradeoff between part commonality and product differentiation.

■ SA39

C-Room 309

Critical Decisions in Healthcare

Sponsor: Health Applications Section
Sponsored Session

Chair: Renata Kopach-Konrad, Purdue University Industrial Engineering, 315 N. Grant St., West Lafayette, IN, 47907, United States, rkopach@purdue.edu

1 - A Simulation-based Peri-operative Decision Support System

Daphne Sniekers, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, sniekers@mie.utoronto.ca, Mike Carter

In this study, a simulation tool was created which models the flow of patients through the entire preoperative process; from decision to perform to discharge from the recovery ward. The model will allow users to test varying scenarios such as increased orthopedic block times, on the daily bed census, PACU overload, ward bed availability, and cancellation rates. The model is being piloted at two sites, and is part of a larger project of developing a general framework for a perioperative DSS.

2 - A System Dynamics Resource Allocation Model of an Emergency Department

Sonia Vanderby, PhD Candidate, University of Toronto, 438 Rickard Rd., Bowmanville, ON, Canada, sonia@mie.utoronto.ca, Mike Carter

Can SD be used to model an ED? EDs have previously been modeled via DES, with little history of the use of SD. A high-level simulation of an ED at The Ottawa Hospital was developed to test various scenarios requested by TOH. The goal of the model is to provide hospital administrators with a tool to assist them with making long-term resource allocation decisions in an effort to reduce delays in the ED. Scenario outcomes, as well as the pros and cons of SD in such a model are discussed.

3 - Stochastic Overbooking Model for Outpatient Scheduling Under General Service Time

Santanu Chakraborty, Purdue University, 166 E Stadium Avenue, West Lafayette, IN, 47906, United States, chakrabs@purdue.edu, Mark Lawley, Kumar Muthuraman

Here study a stochastic scheduling problem for outpatient clinics under general service time. Patients are characterized based on their probability of missing an appointment. To compensate this, scheduler overbooks the slots, thereby maximizing profit. Here we propose a numerical technique using a myopic policy for optimal performance. It involves computing multidimensional numerical integrations. As a special case, we propose a simplified approach when the service time distribution is gamma.

■ SA40

C-Room 310

Pierskalla Award

Sponsor: Health Applications Section
Sponsored Session

Chair: Jay Rosenberger, Assistant Professor, University of Texas-Arlington, IMSE Dept., Arlington, TX, United States, jrosenbe@uta.edu

Co-Chair: Julie Simmons Ivy, University of Michigan, jsimmons@bus.umich.edu

1 - Algorithmic Prediction of Health Care Costs and Discovery of Medical Knowledge

Margret Bjarnadottir, MIT, 77 Mass Ave., MIT E40-149, Cambridge, MA, 02139, United States, margret@mit.edu, Grant Wang, Michael Kane, J. Christian Kryder, Rudra Pandey, Santosh Vempala, Dimitris Bertsimas

Rising health care costs are one of the world's most important problems. Correspondingly, predicting such costs with accuracy is a significant first step in addressing this problem. We utilize modern data mining methods and claims data from close to 400,000 members over three years, to provide a)rigorously validated predictions of health care cost and b) an illustration through two examples, that our methods can lead to discovery of medical knowledge.

2 - An Analysis of the General Minimum Cost Vaccine Formulary Selection Problem

Sheldon H. Jacobson, University of Illinois, Siebel Center, 201 N. Goodwin Ave, Urbana, IL, 61801, United States, shj@uiuc.edu, Shane Hall, Edward Sewell

The General Minimum Cost Vaccine Formulary Selection Problem (GMCVFSP) models a general childhood immunization schedule for optimally selecting a vaccine formulary. Both exact algorithms and heuristics are presented. The results reported provide fundamental insights into the structure of GMCVFSP, as well as practical value for the public health community.

3 - Solving Beam Angle Selection and Dose Optimization Simultaneously via High-Throughput Computing

Hao Zhang, University of Wisconsin-Madison, Industrial and Systems Engineering Dept., 1513 University Avenue, Madison, WI, 53706, United States, haoz@cae.wisc.edu, Robert Meyer, Leyuan Shi, Warren D'Souza

In this research we provide a framework for integrating two stages of Radiation Treatment Planning (RTP): Beam Angle Selection (BAS) and Dose Optimization (DO). A metaheuristic approach, Nested Partitions (NP), is applied. Computational efficiency is achieved by utilizing High-Throughput Computing (HTC) via the Condor system. Computational results show that our framework has led to a significant improvement in terms of solution quality and delivery time comparing with current clinic practices.

4 - Maximum Matchings on Graphs for Allocating Kidney Paired Donation

Sommer E. Gentry, Assistant Professor, United States Naval Academy, 572-C Holloway Road, Mailstop 9E, Mathematics Department, Annapolis, MD, 21402, United States, gentry@usna.edu, Dorry L. Segev, T. S. Michael

Kidney paired donation matches a patient and incompatible donor with another patient and donor for an organ exchange. The best donations are a weighted graph matching. A preemptive multiobjective matching problem is: first maximize transplants for a favored group, second maximize transplants for all, and lastly maximize geographic proximity of the donations. Two results about the size of weighted matchings allow solution of the multiobjective problem using standard weighted matching techniques.

■ SA41

C-Room 3A

Medical Diagnosis and Disease Prediction

Sponsor: Optimization/ Optimization and Computing in Medicine and Life Sciences
Sponsored Session

Chair: Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Chromosomal Mapping Identifies Patterns for Progression of Breast Cancer Molecular Subtypes

Gabriela Alexe, Computational Biologist, PhD, The Broad Institute of MIT and Harvard, 7 Cambridge Center, Cambridge, MA, 02142, United States, galexe@broad.mit.edu, Shridar Ganesan, Daniel Scanfeld, Charles DeLisi, Gul S. Dalgin, Gyan Bhanot, Pablo Tamayo, Jill P. Mesirov, Arnold Levine

In this study we re-analyze gene expression data of matched pairs of ductal carcinoma in situ and invasive ductal carcinoma to discover specific patterns of progression for breast cancer molecular subtypes.

2 - Novel Optimization Models for Classification of Brain's Physiological States

W. Art Chaovalitwongse, Assistant Professor, Rutgers University, 96 Frelinghuysen Rd, Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu, Ya-Ju Fan, Rajesh Sachdeo

We present new optimization models used in epilepsy treatment to classify different physiological states of the brain from electroencephalograms (EEGs). The proposed technique is used to select the brain areas that best classify seizure susceptibility (pre-seizure) and normal periods. The empirical results show that the proposed technique achieves an average sensitivity and an average specificity over 80% in 10 patients.

3 - Predictive Models for Cardiovascular Disease

Tsung-Lin Wu, Georgia Institute of Technology, Industrial & Ssytems Engineering, Center for OR in Medicine & HealthCare, Atlanta, GA, 30332-0205, United States, tlwu@isye.gatech.edu, Eva K. Lee

In this talk, we describe an optimization-based predictive model that allows multi-group classification while constraining the inter-group misclassification rate. A feature selection heuristics will be outlined. Applications to cardiovascular disease data and other real-world dataset are provided to illustrate the power of our model.

■ SA42

C-Room 3B

Combinatorial Optimization in Medicine and Bioinformatics

Cluster: Operations Research in Medicine and Health Care
Invited Session

Chair: Jim MacGregor-Smith, Professor, Dept. of Mechanical and Industrial Eng, Elab Building, Univ of Massachusetts, 160 Govenor's Drive, Amherst, MA, 01003, United States, jmsmith@ecs.umass.edu

1 - Scheduling the Adjuvant Endocrine Therapy for Early Stage Breast Cancer

Sergiy Butenko, Industrial and Systems Engineering, Texas A&M University, College Station, TX, butenko@tamu.edu, Sera Kahruman, Illya Hicks, Kathleen Diehl, Elif Kolotoglu

Based on the data available through published trial results, we build a mixed integer nonlinear programming model in order to find an optimal treatment plan for a given Hr+ early stage breast cancer patient who is postmenopausal. The results of numerical experiments suggest the effectiveness of some of the schedules currently used in practice, as well as indicate some effective alternative treatment plans.

2 - Modeling the IMRT Beam Selection Problem as a Facility Location Problem

Gino Lim, University of Houston, 4800 Calhoun Rd, E211 Engr. Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu, Josh Reese

The beam selection problem in radiotherapy is to select the best n gantry angles which treat the tumor while minimizing damage to healthy tissues. We propose a new approach that begins with an optimal k-beam plan, then use the p-median problem to prune this plan down to an n-angle plan ($n < k$) so that the distortion is minimized between the original plan and the final plan. We show that partial least squares approach coupled with p-median model is able to obtain good treatment plans.

3 - Secondary Structure Prediction in Proteins with a New Dihedral Angle Measure

Jim MacGregor-Smith, Professor, Dept. of Mechanical and Industrial Eng., Elab Building, Univ of Massachusetts, 160 Govenor's Drive, Amherst, MA, 01003, United States, jmsmith@ecs.umass.edu, Moon Kim, Yunho Jang

Secondary structure prediction in proteins is a necessary prerequisite for tertiary prediction in the protein folding process. Based upon the combinatorial optimization properties of Steiner trees, a new dihedral angle measure is derived to aid in this process. Numerous experimental results with this new angle measure and its probability distribution are presented in order to characterize the alpha-helix and beta-sheet structures of proteins.

■ SA43

S-Grand Ball. A (Lev. 2)

Probability Management

Cluster: O.R. Practice
Invited Session

Chair: Sam Savage, Consulting Prof., Stanford University, Dept.. of MS&E, 326 Terman, Stanford, CA, 94305, United States, savage@stanford.edu

1 - Quantity and Time Flexible Contracts Under Uncertain Price and Demand

Mohamed Wahab Mohamed Ismail, Assistant Professor, Mechanical and Industrial Engineering, Ryerson University, Toronto, ON, M5B 2K3, Canada, wahab@ryerson.ca, Rongbing Huang

We study two types of supply contracts under uncertain price and demand. Both contracts allow the firm to purchase at discrete intervals over a given period of time. A time-flexible contract requires the firm to specify how many units it will purchase at each time, while the firm does not have commitment to purchase the specified quantity at each time. Quantity flexible contract allows the firm to purchase any discrete quantity within specified quantity window.

■ SA44

S-Grand Ball. B (Lev. 2)

Teaching Case Competition 1

Sponsor: INFORM-ED
Sponsored Session

Chair: Chris Zappe, Interim Dean, Bucknell University, 701 Moore Avenue, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

1 - Presentations of Finalists #1 and #2 for the Eighth Annual INFORMS Case Competition

Chris Zappe, Interim Dean, Bucknell University, 701 Moore Avenue, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

The four finalists for the 2007 INFORMS Case Competition will deliver final presentations of their cases to a panel of judges and the audience. All are welcome to attend and observe these presentations as well as ask questions of the finalists. The winner of the competition will be selected by the judges at the end of the four presentations. The winner and the runners-up will be announced at the INFORM-ED Annual Business Meeting.

■ SA45

S-Capitol Hill (Lev. 3)

Financial Services Section Student Paper Competition

Sponsor: Financial Services
Sponsored Session

Chair: Emmanuel Hatzakis, Vice President, Global Equities, Merrill Lynch & Co., 4 World Financial Center, 5th Floor, New York, NY, 10080, United States, manos_hatzakis@ml.com

1 - The GDEA Model of Fundamental Analysis Under Expert Information and Its Application to U.S. Markets

Xin Zhang, PhD Candidate, University of Tennessee, College of Business Administration, Management Science, Knoxville, TN, 37996, United States, xzhang3@utk.edu, Chanaka Edirisinghe

Stock selection based on fundamental analysis of public firms is addressed. A generalized DEA model is developed to analyze firms' financial statements over time to determine a relative financial strength indicator that is highly correlated with stock returns. The model uses expert information in input/output selection. The correlation maximization binary model is solved via a two-step heuristic algorithm. Computational evidence is presented with over 800 public firms from 9 US sectors.

2 - Price Evolution of Real Assets with Optimal Strategies

Mehmet Saglam, Analyst, First Manhattan Consulting Group, 90 Park Avenue, New York, NY, 10016, United States, ms444@cornell.edu, Yildiray Yildirim, Hazer Inaltekin

We propose a new model for the evolution of real estate prices with changes in the market structure over time. Our model considers a wide range of inputs, including stochastic interest rates, demand for the asset, and random shocks to observe the sale process at the micro level. The holder of the asset makes optimal decisions in the face of changing market conditions by considering the level of interest rates, demand and keeping the asset in the sale market for optimal amount of time.

3 - A New Modeling Approach to Price Employee Stock Options
Premal Shah, MIT, E40 - 115, 77 Massachussetts Avenue, Cambridge, MA, 02139, United States, premal@mit.edu, Dimitris Bertsimas

We propose a new risk management based framework to model an exercise strategy for Employee Stock Options. The framework leads to an intuitive barrier based exercise policy under which the cost of issuing an Employee Stock Option can be bracketed by narrowly separated bounds. Moreover, the approach can also be applied to price a portfolio of options.

4 - Optimizing Dynamic Portfolio Selection by Reinforcement Learning
Haleh Valian, PhD Candidate, Rutgers University, Department of Industrial and Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States, valian@rci.rutgers.edu, Mohsen Jafari, Davood Golmohammadi

In this research a decision making model proposed for dynamic portfolio management. An agent who has some initial wealth invests in a market. Two types of asset are considered, riskless asset (bank account or bond), and risky asset (stock). The agent should choose an action to change the portfolio based on the environment. An action may have a fixed space or unfixed space. If the agent does not take any action, events (observable and unobservable) will change the market and value of portfolio. The general problem is how to enable an agent to maximize an external reward signal by taking an action in an environment. Here, dynamic portfolio management is studied as mathematically modeled by a Semi-Markov Decision Processes (SMDP). To optimize this model, Q-learning as reinforcement learning technique has been applied.

5 - Option Pricing Under a Hyper-exponential Jump-diffusion Model
Ning Cai, Columbia University, 313A Mudd, Dept.. of IEOR, Columbia University, New York, NY, 10027, United States, nc2118@columbia.edu, Steven Kou

We propose a jump diffusion model with jump sizes having a hyper-exponential distribution. This model provides a link between asset pricing models with exponential tails and power tails, and leads to analytical solutions for lookback, barrier and perpetual American options. This is made possible by using martingale methods to study some multi-dimensional integro-differential equations, and by solving related first passage time problems and optimal stopping problems.

■ SA46

S-Ballard (Lev. 3)

Agent Based Modeling

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Daniel J. Veit, Professor, University of Mannheim, Schloss, Mannheim, BW, 68131, Germany, veit@uni-mannheim.de

1 - Agent-based Modeling and SImulation for Logistics Markets and Co2 Reduction
Han La Poutre, Professor, CWI, Kruislaan 413, 1098 SJ, P.O. Box 94079, Amsterdam, 1090 GB, Netherlands, Han.La.Poutre@cwi.nl, Valentin Robu, Pieter Jan 't Hoen, Han Noot

We present research results on the reduction of CO2 emission by intelligent truck usage, as part of the Dutch research program Energy, Ecology, and Technology. We describe market-based, automated techniques for cargo allocation to trucks and transportation companies. We present agent-based models and interactive simulation systems. We model the players by agents and design bidding strategies. We also describe how to get robustness in the results of adaptive simulation systems.

2 - A Reinforcement Learning Approach to Finding Nash Equilibrium of Multi-player Matrix Games
Tapas K. Das, Professor, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, das@eng.usf.edu, Vishnu Nanduri

With the advent of e-commerce, the contemporary marketplace has evolved significantly toward competition-based trading of goods and services. Many such market scenarios can be modeled as matrix games. This paper presents a computational algorithm to obtain Nash equilibria of n-player matrix games. The RL algorithm is tested on a set of sixteen matrix games with up to four players and sixty four action choices.

3 - Electricity Generation Portfolios and Market Prices
Augusto Ruperez Micola, Research Fellow, IMD - Institute for Management Development, Chemin de Bellerive, 23, Lausanne, 1007, Switzerland, Augusto.RuperezMicola@imd.ch, Albert Banal-Estanol

We use an agent-based simulation to study how the diversification of electricity generation portfolios influences wholesale prices. The results suggest that: diversification leads to lower market prices; the influence of diversification is mediated by the supply to demand ratio; in each demand case there is a threshold where pivotal dynamics change; pivotal dynamics pre- and post-threshold are the cause of non-linearities in the influence of diversification on market prices.

4 - Energy Systems Modeling Using Complex Adaptive Systems Techniques
Michael North, Argonne National Laboratory, Decision and Information Sciences Divisi, 9700 S. Cass Avenue, Argonne, IL, 60439, United States, north@anl.gov, Charles Macal

This presentation will discuss the application of complex adaptive systems representation techniques, such as agent-based simulation, to energy systems modeling.

■ SA47

S-Admiral (Lev. 3)

Forestry I: Harvest Scheduling with Spatial Constraints

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Sam Pittman, Operations Research Analyst, Weyerhaeuser Timber Company, WTC 1B20 P.O. Box 9777, Federal Way, WA, 98063, United States, sam.pittman@weyerhaeuser.com

1 - Does the Size of the ARM Matter?
Marc McDill, Associate Professor, Pennsylvania State University, School of Forest Resources, University Park, PA, 16802, United States, mem14@psu.edu, Sandor Toth, Sandor Toth

We explore the question of how factors like problem size, formulation type, characteristics of the forest, and side constraints affect solution times for spatially explicit area-restricted (ARM) forest planning problems. Conclusions are based on a synthesis of the literature and an experiment using both hypothetical and real forest planning problems.

2 - Economic and Fragmentation Effects of Multiple Adjacencies in the Area Restriction Model
Juan Pablo Vielma, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, jvielma@isye.gatech.edu, Marcos Goycoolea

In this work we consider the Area Restriction Modeland study the effects of using different adjacency definitions on the optimal objective value and the fragmentation of the optimal solution. We consider several definitions of adjacency based on distance and length of the intersection between forest stands and we also study the effect of simultaneously using more than one adjacency definition. Results presented are based on several real forest data sets available in the FMOS repository.

3 - Computational Comparison of Stand-centered versus Cover-constraint Formulations
Joseph Wilck, PhD Candidate, Pennsylvania State University, Leonhard Building, Department of Industrial Engineering, University Park, PA, 16802, United States, jhw157@psu.edu, Marc McDill, Steven Mills, Sandor Toth

The computational performance of applying the stand-centered versus the cover-constraint formulations for the area restriction model is examined on seven forests, each with two maximum harvest opening sizes. The stand-centered formulation applied as both constraints and cutting planes is examined. The cover constraints as cutting planes for the stand-centered formulation is also investigated. Formulation and solution times are reported, along with spatial feasibility of those solutions.

4 - Integer Models for Tactical Planning in Forestry
Evelyn Richards, Associate Professor, Faculty of Forestry and Environmental Management, University of New Brunswick, Fredericton, NB, E3B6C2, Canada, ewr@unb.ca, Eldon Gunn

We present a system of integer programming models supplemented with local heuristics to solve tactical planning problems in a hierarchical forest management system. The models provide decision support to managers for assessment of spatial tradeoffs.

5 - Applying Price Directed Decomposition to Hierarchical Forest Planning Models
Sam Pittman, Operations Research Analyst, Weyerhaeuser Timber Company, WTC 1B20 PO Box 9777, Federal Way, WA, 98063, United States, sam.pittman@weyerhaeuser.com, Bruce Bare, D. Briggs

Hierarchical production models offer a means of better managing large and complex forest planning models dealing with forest-wide and landscape level detail. In this talk, Lagrangian relaxation is used to formulate a hierarchical model that maximizes the net present value of harvest incomes while recognizing specific geographical units that are subject to harvest flow and green-up constraints. The model is solved using a modified Dantzig-Wolfe decomposition/column generation routine.

■ SA48

S-Fremont (Lev. 3)

Optimization via Simulation I

Sponsor: Simulation
Sponsored Session

Sigrun Andradottir, Professor, Georgia Tech, Stewart School of ISYE, Atlanta GA 30332, United States, sa@isye.gatech.edu

1 - Optimization via Simulation with Industrial Strength COMPASS
Barry L Nelson, Professor, Northwestern University, Department of Ind. Eng. & Mgmt. Sci., 2145 Sheridan Road, Evanston, IL, 60208, United States, nelsonb@northwestern.edu, Jeff Hong, Jie Xu

Industrial Strength COMPASS (ISC) is a particular implementation of a general framework for optimizing the expected value of a performance measure of a stochastic simulation with respect to integer-ordered decision variables. ISC provides convergence guarantees and statistical inference when it terminates while addressing problems of practical size and complexity. We describe the framework behind ISC and compare it to a popular commercial solver.

2 - Evolutionary Optimization with Controlled Random Search
Jiaqiao Hu, State University of New York at Stony Brook, Dept.. of Applied Math and Stat., Stony Brook, NY, 11794, United States, jqhu@ams.sunysb.edu, Steven Marcus, Michael Fu

We consider an optimization technique, where a population of probabilistic models are maintained at each iteration. The key question in the proposed approach is how to distribute a given sampling budget among different models. We formulate this problem as an MDP model and derive an optimal sampling scheme. The sampling scheme is then further used to update the current population to produce improving models. Numerical studies are carried out to illustrate the method.

3 - Ranking and Selection Techniques with Overlapping Variance Estimators
Christopher Healey, Doctoral Student, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, chealey@isye.gatech.edu, David Goldsman, Seong-Hee Kim

Some ranking and selection (R&S) procedures for steady-state simulation require an estimate of the asymptotic variance parameter of each system. We show that the performance of such procedures depends highly on the quality of the variance estimates that are used. We study the performance of R&S procedures with two new variance estimators - overlapping area and overlapping Cramér-von Mises - which show better long-run performance than other estimators previously studied in R&S problems.

4 - Averaging Frameworks for Discrete Simulation Optimization
Andrei Prudius, PhD Student, Georgia Tech., Stewart School of ISyE, Atlanta, GA, 30332, United States, aprudius@isye.gatech.edu, Sigrun Andradottir

We present two frameworks for designing random search methods for discrete simulation optimization that allow the estimated performance of each system to be the average of all observations collected at that system. The methods within our frameworks may use all available information to decide adaptively on how to expend simulation effort and are almost surely convergent. We also demonstrate the empirical effectiveness of averaging and adaptivity in context of the simulated annealing.

■ SA49

S-Greenwood (Lev. 3)

Topics in Price Optimization and Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Robert Phillips, Nomis Solutions, robert.phillips@nomissolutions.com

1 - Optimal Repricing of Financial Services
Robert Phillips, Nomis Solutions, robert.phillips@nomissolutions.com, Dan Huang

We investigate optimal repricing policies for financial services such as loans when repricing is allowed. The goal of repricing can be to increase profitability or deter competition. Optimal policies are derived under different customer behavior models.

2 - Revenue Management in the Airline Industry: An Empirical Study
Yong-Pin Zhou, University of Washington Business School, Seattle, WA, 98195-3200, United States, yongpin@u.washington.edu, Ming Fan, Minho Cho

In this paper, we use the data from Bureau of Transportation Statistics to empirically examine the revenue management practice in the airline industry. Specifically, we study how the operational policies affect pricing, operational performance and revenue. Our results show that operational policies such as capacity and code-sharing have significant impacts on price dispersion, load-factor, and revenue. We also find that route level revenue increases in price dispersion.

3 - A Two-competitor Game with Customers Buying the Lowest Available Fare in the Market
Darius Walczak, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, dwalczak@prospricing.com

Two airlines in the following competitive setting. Each airline tries to maximize expected revenue from an initial, finite inventory of seats over a finite time horizon. The price point structure is the same for both. Customers seek the lowest price in the market; when the prices match they make a random choice. We allow a nonzero probability that a customer does not buy. All necessary probabilities are known to each airline and the price points can change at each customer request.

■ SA50

S-Issaquah A & B (Lev. 3)

Competition and Strategic Behavior in Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Guillaume Roels, Assistant Professor, UCLA, 110 Westwood Plaza, B511, Los Angeles, CA, 90066, United States, groels@anderson.ucla.edu

1 - Dynamic Pricing Under Customer Reluctance Behavior
Victor Araman, Assistant Professor, Stern School of Business, NYU, 44 West Fourth Street, New York, NY, 10012, United States, varaman@stern.nyu.edu, Vladimir Krasik

This work aims at studying a simple revenue management problem when the seller tracks reluctant customers. In a continuous time setting where arrivals of customers follow a Poisson process, the seller adjusts prices based on remaining inventory but also on number of customers that are considering buying the item. This work is driven by the advanced capabilities of online retailers to trace their potential buyers and suggest ways to incorporate this information in the pricing decisions.

2 - Newsvendor Model Under Unknown Dependency Between Inventory Decision and Demand
Soonhui Lee, PhD Student, Northwestern University, 2145 Sheridan Rd C151, Evanston, IL, 60208, United States, s-lee4@northwestern.edu, Tito Homem-de-Mello, Anton J. Kleywegt

We study inventory problems where a decision maker determines the order quantities based on the newsvendor model under the situation of unknown dependency between decision and demand. Because the dependency is unknown to the decision maker, he believes the newsvendor model produces optimal decisions. We study how the order quantities deviate from the true optimal order quantities with repeated application of the model and show situations under which the resulting revenue can be arbitrarily bad.

3 - Multi-channel Competition with Opaque Products
Senthil Veeraraghavan, Asst Professor, Wharton School, Philadelphia, PA, United States, senthilv@wharton.upenn.edu, Kinshuk Jerath, Serguei Netessine

Priceline, Hotwire and several other companies popularized selling of opaque travel products whose exact specification is masked from the consumer until the sale is complete. We show that opaque products are effective in dealing with strategic consumers who face a trade-off of buying a transparent product at a higher price now with the chance of getting opaque product at a lower price later.

4 - Competing for Shelf Space
Guillaume Roels, Assistant Professor, UCLA, 110 Westwood Plaza, B511, Los Angeles, CA, 90066, United States, groels@anderson.ucla.edu, Victor Martinez de Albeniz

We model the competition for shelf space in a multi-supplier retail point. We consider a retailer that seeks to allocate its shelf space capacity to maximize its profit. Given that products associated with larger profit margin are granted more shelf space, suppliers can offer the retailer financial incentives to obtain larger space allocations. We analyze the competitive dynamics arising from the scarcity of space and investigate the performance of various contracting mechanisms.

■ SA51

S-Kirkland (Lev. 3)

Revenue Management Applications in the Hospitality Industry

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Utku Yildirim, Walt Disney World Co., 1375 E Buena Vista Dr., Lake Buena Vista, FL, 32830, United States, Utku.Yildirim@disney.com

1 - Revenue Management with Stochastic Programming
Julia L. Higle, The Ohio State University, Industrial and Systems Engineering, Columbus, OH, United States, higle.1@osu.edu

We present revenue management models based on stochastic programming constructs. Our model is one that combines capacity-based calculations to obtain price-based policies, while explicitly recognizing the stochastic nature of customer demand in the various market segments. Data requirements and computational implications will be discussed.

2 - Practical Challenges in Optimizing Room Rates for Hotels and Gaming Resorts
H. Ahmet Kuyumcu, President, Prorize, LLC, 12138 Madison Drive, Atlanta, GA, 30346, United States, akuyumcu@prorize.com, Amar R. Duggasani

There are many practical challenges in optimizing room rates for hotels and gaming resorts. These include, but not limited to, incorporation of demand uncertainty, rate uncertainty, customer value, price sensitivity, overbooking, groups, promotions, room upgrades, room cross-sells, competitive rates, and market level information. This presentation expplores some of these challenges in more detail.

3 - Maximum Utility Model with Reservation Prices
Romy Shioda, Assistant Professor, University of Waterloo, 200 University Ave West, Waterloo, ON, Canada, rshioda@math.uwaterloo.ca, Levent Tuncel

We consider the revenue management problem of pricing a product line with several customer segments, working under the assumption that every customer's product choice is determined entirely by their reservation price. We formulate the problem as a mixed-integer programming problem and develop several heuristics. We test the practical efficacy of our method, in terms of both computation time and impact on revenue, on customer purchase order data from a tourism company.

4 - Restaurant Revenue Management
Utku Yildirim, Walt Disney World Co., 1375 E Buena Vista Dr., Lake Buena Vista, FL, 32830, United States, Utku.Yildirim@disney.com

In this presentation, we investigate the revenue management problem of a restaurant which accepts advanced bookings and walk-ins. We utilize mathematical programming methods to identify the optimal availability for different discount categories and table mix for the restaurant. We conclude with possible extensions of the model.

■ SA52

S-Leschi (Lev. 3)

RASIG Student Paper Session

Sponsor: Railrway Applications
Sponsored Session

Chair: Pooja Dewan, General Director Decision Systems, BNSF Railway, Service Design and Performance, 2400 Western Center Boulevard, Fort Worth, TX, 76131, United States, Pooja.dewan@bnsf.com

1- RASIG Student Paper Competition
Pooja Dewan, General Director Decision Systems, BNSF Railway, Service Design and Performance, 2400 Western Center Boulevard, Fort Worth, TX, 76131, Pooja.dewan@bnsf.com

RASIG (Rail Applications Special Interest Group), a subdivision of INFORMS (Institute for Operations Research and ManagementScience) sponsored a student research paper contest on Management Science in Railroad Applications. Authors of First Place, Second Place, and Honorable Mention papers will be asked to present the papers at this session.

■ SA53

S-Medina (Lev. 3)

Location Analysis

Sponsor: Location Analysis
Sponsored Session

Chair: Oded Berman, Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5S3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - The Probabilistic p-Minimax Problem on a Network with Random Demand Weights
Jiamin Wang, Assistant Professor, Long Island University, Roth Hall 202, 720 Northern Blvd, Brookville, NY, 11548, United States, jiamin.wang@liu.edu, Oded Berman

We study the problem of locating p facilities to serve clients residing at the nodes of a network with probabilistic demand weights. The objective is to minimize the probability that the maximum weighted distance from a client to the closest facility exceeds a given threshold value. We analyze the problem and develop exact solution procedures and heuristics to solve it.

2 - Profit-maximizing Service System Design with Elastic Demand and Congestion
Robert Aboolian, Professor, California State University San Marcos,)College of Business Administration, San Marcos, Ca, 92096, United States, raboolia@csusm.edu, Dmitry Krass, Oded Berman

The problem seeks to locate a set of immobile service facilities, allocate service capacity so as to maximize overall profits. Demand is stochastic and elastic. Customer mean demand rate is a function of travel time, and waiting time at the facilities. Problem is formulated and approximate and exact approaches are developed.

3 - Impact of Time Sensitive Demand on Facilitiy Location
Mozart Menezes, Assistant Professor, HEC - School of Management, Paris, 1 Rue de la Liberation, Jouy-en-Josas, 78351, France, menezes@hec.fr, Oded Berman, Dmitry Krass

In this paper we consider the problem when customers patronize the business whenever items ordered can be delivered within certain amount of time. Such problems are often faced by internet-based retailers, such as Amazon.com. We investigate the trade-off between proximity to customers and demand fragmentation. Thus, inventory and location decisions are made, taking into account fixed location, inventory-related and opportunity costs. We present theoretical results and heuristic results.

4 - The Lorenz Curve in Location Analysis
Tammy Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States, tdrezner@fullerton.edu, Zvi Drezner, Jeffery Guyse

We investigate the location of facilities with equity considerations, i.e., minimizing the Gini coefficient of the Lorenz curve. The model is formulated, analyzed and an algorithm that finds the optimal location of one facility in a bounded area in the plane is constructed. Problems involving continuous demand on a segment, square, disk, are investigated. Randomly generated problems with up to 10,000 demand points are successfully solved in a reasonable computer time.

■ SA54

S-Queen Anne (Lev. 3)

Control of Queueing Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Serhan Ziya, Assistant Professor, Department of Statistics and Operations Research University of North Carolina, Chapel Hill, NC, ziya@email.unc.edu

1 - A Call Center Model with Upgrades: An Update
Mark E. Lewis, Associate Professor, Cornell University, 226 Rhodes Hall, School of Oper. Res. and Inform. Engin., Ithaca, NY, 14853, United States, mel47@cornell.edu, Douglas Down

We consider a two station call center. Station 1 is staffed by a finite set of workers that are cross-trained in the sense that they can work at either station. Station 2 is staffed by a finite set of dedicated workers. At random times, customers from Station 1 are upgraded to Station 2. Optimal allocation policies and stability are considered.

2 - Optimal Policies and Bounds for Parallel Server Systems
Michael Veatch, Gordon College, 255 Grapevine Rd, Wenham, MA, 01984, United States, mike.veatch@gordon.edu

Performance of parallel servers under optimal sequencing control is analyzed using dynamic programming and approximate linear programming. The impact of flexibility is assessed under optimal and longest queue policies. Optimal policy characteristics are found and compared with previous resource pooling conditions.

3 - On the Accuracy of Announcing the Delay of Last to Enter Service in Large Call Centers

Achal Bassamboo, Northwestern University, a-bassamboo@northwestern.edu, Mor Armony

In recent times, many call-centers announce some estimate of the wait to callers when they are not served immediately. In response to the delay announcement callers may balk or be willing to wait for their service. In this talk we consider a simple delay announcement to a new caller: The delay of the last customer to enter service (DLS). We show that these announcements are quite accurate when the system size is large.

4 - An Analysis of a Multi-server Ticket Queue with Abandonment

Kaan Kuzu, PhD Student, The Pennsylvania State University, Smeal College of Business, 471B Business Building, University Park, PA, 16802, United States, kzk107@psu.edu, Susan Xu

A Ticket Queue is a new technology that manages customer flows in a service system using numbered tickets. We propose an analytical model for a multi-server ticket queue with balking and reneging customers. We develop the solution procedure, heuristics, and bounds for key system performance measures, and benchmark the ticket and physical queues.

■ SA55

S-Ravenna (Lev. 3)

Allocation and Exchange of Airport Slots

Sponsor: Aviation Applications
Sponsored Session

Chair: Michael Ball, Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States, mball@rhsmith.umd.edu

1 - Demand Management: Options for Ensuring the Efficient Use of Scarce Airport Capacity

David Gillen, Professor, University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, david.gillen@sauder.ubc.ca

I provide an assessment of alternative strategies for allocating scarce airport capacity. I include quantitative and qualitative measures. An important difference between the two approaches is prices allocate capacity on the basis of willingness to pay while slot restrictions require a method of allocation. I identify key efficiency and equity issues focusing mostly on market based mechanisms and provide summary tables of the impacts of different approaches as well as their benefits and costs.

2 - Practical Rolling Horizon Airport Slot Auction with Dynamic Quantities

Andrew Churchill, Graduate Research Assistant, University of Maryland, 3117 AV Williams, College Park, MD, 20742, United States, churchil@umd.edu, David Lovell, Michael Ball

We propose an innovative auction mechanism to distribute airport slots. An annual auction is held to distribute a pool of slots. The novelty lies in the application of an integer programming model to determine if slots should be added or removed from the pool each year. These adjustments are undertaken to achieve model targets on the expected delays and cancellation rates. Other features include an initial price-stabilization period and considerations for airport-specific requirements.

3 - The Number of Slots to Submit to Market Mechanisms

David Lovell, Associate Professor, University of Maryland, 1173 Martin Hall, College Park, MD, 20742, United States, lovell@eng.umd.edu, Andrew Churchill, Michael Ball, Avijit Mukherjee

We propose a sequence of three integer programming models to determine the appropriate number of arrival slots to allocate per time period at a slot-controlled airport whose slots are exchanged in a competitive market, e.g. an auction. The models differ in their economic assumptions, calibration requirements, and computational complexity. We offer some recommendations for calibration and show sensitivity analysis for important parameters.

4 - Optimization Models for the Equitable Assignment of Slot Lifetime

Moein Ganji, University of Maryland, 3429 Tulane Dr., Apt 24, Hyattsville, MD, 20783, United States, moein_g@yahoo.com, Michael Ball

The FAA is investigating new airport slot management policies that involve the use of Operating Authorizations with finite lifetimes. Since expiration dates must be staggered, the initial lifetimes assigned will vary between one and ten years. We develop integer programming and heuristic methods for the equitable assignment of lifetimes. Equity is measured relative to the historic slot ownership/use.

■ SA56

S-Wallingford (Lev. 3)

Economics

Contributed Session

Chair: John Mamer, UCLA Anderson Grad. School of Mgmt., 110 Westwood Plaza, D518, Los Angeles, CA, 90095, United States, jmamer@anderson.ucla.edu

1 - Can Realistic Wealth Distributions be Quantitatively Described by Kinetic Models?

Nelson L. Lammoglia, Doctoral Student, Universidad de los Andes, Dep. of Industrial Engineering, Bogotá, Colombia, n-lammog@uniandes.edu.co, Víctor Muñoz, José Rogan, Benjamìn Toledo, Roberto Zarama, Juan Alejandro Valdivia

Data on wealth distributions in trading markets show a power law behavior at the high end, where in general $\sum$; is greater than 1 (Pareto's law). However, current trading models based on kinetic theory, where a saving propensity is assigned to each agent, are claimed to model only a power law tail with an exponent which is always close to 1. In this work we reach the opposite conclusion. We show that a kinetic model for a trading market is able to predict any power law tail behavior, in particular Pareto's law. We use our approach to reproduce (a) the world billionaires wealth distribution, based on Forbes 2006 data, that displays $\sum$=1, 4; 1.4; and (b) the World Distribution of Household Wealth, recently published by The World Institute for Development Economics Research (UNU-WIDER), where $\sum$=1.5

2 - A Peer-to-peer System as an Exchange Economy

Christina Aperjis, Stanford University, Terman Engineering Center, Room 391, Stanford, CA, United States, caperjis@stanford.edu, Ramesh Johari

We formulate a peer-to-peer system for filesharing as an exchange economy: a price is associated with each file, and users exchange files only when they can afford it. This formulation solves the freeriding problem, since uploading files is a necessary condition for being able to download. However, we do not explicitly introduce a currency; users must upload files in order to earn a budget for downloading.

3 - Outsourcing Patient Care: A Transaction Cost Analysis

Nahush Chandaver, Student, University of South Florida, 3421, Park Square, W-2, TAMPA, FL, 33613, United States, nchandav@mail.usf.edu, Kingsley Reeves

The aim is to provide a model to predict the most cost efficient organizational form for disease management (DM) programs in health plans by using transaction cost theory and switching regression techniques. Regression models will be constructed using survey data and used to determine whether outsourcing or integrating a DM program is more cost efficient for different types of diseases. The results will also provide empirical evidence regarding which transaction cost factors most affect these programs.

4 - Economic Interpretation of Implied Constraints in the Presence of Indivisible Goods in Resource Allocation

Talat Genc, University of Guelph, Dept.. of Economics, Guelph, ON, N1G2W1, Canada, tgenc@uoguelph.ca, Suvrajeet Sen

For a special case of 0-1 MILP problems, we show the existence of unique shadow prices and recover the total cost of inputs, even when the underlying model includes indivisibilities that are modeled using integer variables. We also provide an interpretation of valid inequalities (i.e., certain disjunctive cuts) in the form of productivity requirements that must be satisfied for integer programming problems.

5 - Exploding Offers and Search

John Mamer, UCLA Anderson Grad. School of Mgmt., 110 Westwood Plaza, D518, Los Angeles, CA, 90095, United States, jmamer@anderson.ucla.edu, Steven Lippman

We consider the situation of a buyer who makes an offer to purchase a single object from a seller who follows a standard continuous time finite horizon search model. The buyer has two options for framing his offer. Make a permanent offer, good from the time it is made until the object is sold, or make an exploding offer, good only at the instant it is made. Which choice maximizes the buyer's chance of purchasing the object at his offer price with an exploding offer?

■ SA57

S-Columbia (Lev. 4)

Joint Session TELECOM /ICS: Optimization in Wireless Networks

Sponsor: INFORMS Telecommunications Section, INFORMS Computing Society
Sponsored Session

Chair: Kerem Bulbul, Assistant Prof., Sabanci University, Manufacturing Systems & Industrial Eng., Orhanli, Tuzla, Istanbul, 34956, Turkey, bulbul@sabanciuniv.edu

1 - Access Point Diversity for Efficient Packet Forwarding in Wireless LANs

Ozgur Ercetin, Assistant Prof., Sabanci University, Electronics Engineering, Orhanli, Tuzla, Istanbul, 34956, Turkey, oercetin@sabanciuniv.edu

In 802.11 wireless networks, a user usually has the option of connecting to one of several available access points (APs). We argue that the user can obtain better quality of service by diversifying its traffic among APs. In this work, we consider the optimal packet splitting algorithms that would maximize the user throughput based on the channel loss characteristics, transmission rates and required resiliency to packet loss.

2 - Flow and Cut Models for the Minimum Energy Broadcasting Problem in Ad Hoc Wireless Networks

Dag Haugland, Associate Professor, University of Bergen, Department of Informatics, PB. 7803, Bergen, N, 5020, Norway, nmidd@uib.no, Joanna Bauer, Di Yuan

We develop flow and cut-based integer programming models for the problem of minimizing the total energy of a broadcast session in wireless ad hoc networks. The strength of the models is analyzed theoretically, and we prove that the strongest flow-based model and its cut-based counterpart are equally strong. By expanding the network, we also show how the problem can be transformed to the minimum Steiner tree problem in digraphs. Reports on numerical experiments comparing the models are provided.

3 - Solving the Minimum Energy Broadcasting Problem in Ad Hoc Wireless Networks by Integer Programming

Keumseok Kang, Krannert School of Management, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, kangk@purdue.edu, Kemal Altinkemer, Sibel Salman

We study the minimum energy broadcasting problem in ad hoc wireless networks. For this NP-hard problem, we propose a new integer programming formulation based on a set covering model and a Lagrangian relaxation procedure to solve the problem. We provide extensive computational tests.

4 - Delay Constrained Minimum Power Broadcasting in Wireless Networks

Kerem Bulbul, Assistant Prof., Sabanci University, Manufacturing Systems & Industrial Eng., Orhanli, Tuzla, Istanbul, 34956, Turkey, bulbul@sabanciuniv.edu, Ozgur Ercetin, Tonguc Unluyurt

We consider the minimum power broadcasting problem in an ad hoc wireless network operating under a hard constraint on the end-to-end delay between the source and each node in the network. We first characterize the optimal solution to a closely related problem in dense networks using a dynamic programming (DP) formulation. The insights provided by the structure of the optimal DP solution lead to effective algorithms for the original problem, and we demonstrate their performance computationally.

■ SA58

S-Pike (Lev. 4)

Innovative Approaches to Technology Entrepreneurship

Sponsor: Organization Science
Sponsored Session

Chair: Ted Baker, Assistant Professor, North Carolina State University, Nelson Hall, Box 7229, NCSU Campus, Raleigh, NC, 27695, United States, ted_baker@ncsu.edu

1 - Crying the News of Technology Opportunity: Influence Processes of Boundary Spanners

Lynda Aiman-Smith, North Carolina State University, lynda_aiman-smith@ncsu.edu, Susan Katz

Little is reported in the innovation literature about how science, innovations and technologies originating externally in university-sponsored research centers are disseminated into organizations. In this paper we focus on the role of boundary spanners and the influence processes they use convincing others in their home organizations that they have spotted an opportunity potential they have seen in a university setting, and that the potential opportunity should be pursued by the home organization. We specifically examine boundary spanners who are working with academics involved in research on nanotechnology. Our exploratory work is based on semi-structured interviews with over 30 boundary spanners from a variety of organizations in a number of industries who have regular interactions with academics in National Nanoscience Centers.

2 - Building Legitimacy for Novel Technologies: The Case of WARF and Human Embryonic Stem Cells

Sanjay Jain, University of Wisconsin-Madison, sjain@bus.wisc.edu

Building legitimacy for novel technologies within a highly institutionalized environment often involves resolving a fundamental paradox: how do actors conform to an institutional regime while simultaneously taking steps to change it? I carry out an in-depth study of the role played by various actors at a prominent mid-West university – most notably WARF, its patenting and licensing office – in supporting the emergence of human embryonic stem cell technology. Through my narrative account, I identify two processes – which I term protecting and influencing respectively – that play a key role in building legitimacy for novel technologies. The implications of these findings for theories of institutional entrepreneurship, technological change and technology transfer are discussed.

3 - Resource Mobilizing in Constrained Environments: A Study of Technology Social Ventures

Geoffrey Desa, University of Washington-Seattle, gdesa@u.washington.edu, Suresh Kotha

Non-profit and for-profit technology social ventures mobilize resources and create scalable social innovations despite a scarcity of funding and institutional support. We draw upon bricolage, an emerging perspective in entrepreneurship, which suggests that firms can intentionally make do with existing resources at hand. These resources include junk materials (e.g. technology, machinery, hardware and software), labor (e.g. volunteers, friends and family), and skills (e.g. volunteer knowledge of efficient processes or alternative technologies), and are often available for free or cheaply. Building upon a comparative case study and the resource mobilization literature, we develop propositions to explain how institutional factors and collective agency affect resource-mobilization, and in turn attract beneficiaries and customers to the venture. We test these propositions on a sample of 200 technology social ventures.

4 - In Response to Surprise in New Firms: Interactions of Improvisation and Organizational Memory

Yan Gong, University of California-Irvine, gongy@merage.uci.edu, Ted Baker, Anne S. Miner, Dale Eesley

This paper proposes that two key factors related to organizational knowledge use will shape the outcome of responding to a surprise. First, the organization's memory enhances the chances that its surprise response will have a valued outcome. Second, both lower and higher levels of improvisation will have a relatively more positive impact on organizational outcomes than intermediate level of improvisation. We test these ideas using a sample of 141 surprise events.

■ SA59

S-Seneca (Lev. 4)

Issues in Project Management

Sponsor: Technology Management
Sponsored Session

Chair: Ted Klastorin, Professor, University of Washington, Dept. of ISOM, Box 353200, Seattle, WA, 98195-3200, United States, tedk@u.washington.edu

1 - Project Scheduling When Success is Uncertain

Gregory Dobson, Associate Professor, University of Rochester, Simon School, Rochester, NY, United States, greg.dobson@simon.rochester.edu, Joseph Szmerekovsky, Vera Tilson

We examine project scheduling when activity success is uncertain and can lead to project cancellation. We look at IP formulations for a variety of special cases and develop lower bounds and heuristics. We report on the performance of heuristics wrt lower bounds. We investigate robustness of solutions when probabilities are difficult to estimate.

2 - Incentive Contracts Under Asymmetric Information: Extension to General Project Networks

Murat Bayiz, University of Southern California, murat.bayiz@marshall.usc.edu, Charles Corbett

We consider a set-up where a project manager interacts with multiple subcontractors who work on different tasks of a project. The project manager sets incentives to motivate subcontractors to work harder on their tasks. We study such incentives contracts and compare them with fixed price contracts under general project networks. We also investigate effects of information asymmetry and project network structure on contracting decisions.

3 - The Incorporation of Activity Failures in Project Planning: A Formalization and Some Preliminary Results
Roel Leus, Katholieke Universiteit Leuven, FETEW, KBI, Naamsestraat 69, Leuven, 3000, Belgium, roel.leus@econ.kuleuven.be, Bert De Reyck, Yael Grushka-Cockayne

The goal of this article is to survey the relevant literature on project scheduling with possible activity failures from a number of different disciplines, and to distill from these sources the formulation of a general optimization problem, the further study of which we would like to foster among the scheduling community. The model has been formulated with R&D projects in mind, but its study may be useful also for developing planning methods in other contexts. We discuss a number of different aspects of this task selection and scheduling model with task failures by means of a number of illustrative examples.

4 - The Role of Time in Improving Project Performance
Dwight Smith-Daniels, Arizona State University, dwight.smith-daniels@asu.edu, Vicki Smith-Daniels

Past empirical research on projects reveals that the project initiation phase is particularly challenging and important to project success. This environment is simulated in this research using a multi-period project simulation that involves the planning and execution of a project by a newly formed project team of experienced project professionals. In this controlled experiment, we examine the effects of planning time duration on project performance results.

5 - Development of a New Product with Base and Complementary Components in a Duopoly Market
Ted Klastorin, Professor, University of Washington, Dept. of ISOM, Box 353200, Seattle, WA, 98195-3200, United States, tedk@u.washington.edu, Young Jin Lee

We study a firm that is planning to introduce a new product consisting of both a durable good base product and a complementary consumable component (e.g., printer and ink-cartridges). Consumers initially purchase the initial product with both components but later purchase multiple copies of the complementary component. The innovator firm's products consist of both components while an imitator firm produces only the complementary product. We analyze optimal strategies for both firms.

■ SA60

S-University (Lev. 4)

Innovation and Entrepreneurship

Sponsor: Technology Management
Sponsored Session

Chair: Nile Hatch, Marriott School - BYU, Provo, UT, 84602, United States, nile@byu.edu

1 - When Networks Matter: An Examination of Network Content and Firms' Innovation Performance
Irem Demirkan, Northeastern University, 313 Hayden Hall, College of Business Administration, Boston, MA, 02115, United States, irem@utdallas.edu, David Deeds

In this study we look into the issue of network content - the characteristics of the actors and/or the qualitative nature of the relationships- and its change over time. We explore how the content of relationships within a firm's ego-network affects the focal firm's innovative performance in biotechnology. Data from the biotechnology industry over a span of seventeen years largely support our hypotheses.

2 - TMS Dissertation Award Winner: Decoupling Market Incumbency from Organizational Experience: The Case of Anti-Cancer Drugs
Lourdes Sosa, London Business School, Regents Park, London, United Kingdom, lsosa@london.edu

Focusing on the analysis of differences in R&D performance through a technological change, I discuss two findings based primarily on my dissertation research. First, I discuss the empirical consequences of failing to decouple market incumbency from organizational experience. In particular among those empirical consequences, I explain the resulting distortion on the assessment of competitive advantage in research productivity and in risk-taking behavior. As second finding, I discuss the advantages of separating R&D competences that are application-specific from those that represent technological platforms, since their differential distribution across firm categories significantly explains heterogeneity in R&D performance during a discontinuity.

3 - Learning Services for Innovation and Competitive Advantage
Tom Hill, Director of Learning and Knowledge Management, Genentech, 1 DNA Way, South San Francisco, CA, 94080, United States, hill.thomas@gene.com

Evolving conditions of the biotech industry require regular innovation, transformation, and productivity improvement in product development, patient services, reimbursement, regulatory compliance, and competition. Learning and knowledge management services enable managers to create solutions for our patients and a sustainable competitive advantage for Genentech.

4 - Mapping the Growth Path Through Controlled Burn
Nile Hatch, Marriott School - BYU, Provo, UT, 84602, United States, nile@byu.edu

Balancing growth against profitability is one of the (many) fundamental challenges of entrepreneurial activity. When innovation confers competitive advantage, growth still requires investment that must be funded through margins or investors. With a game theoretic model of rivalry, I analyze the tradeoff between margins and growth and illustrate optimal growth paths for various competitive advantages.

Sunday, 10:00am - 11:30am

■ SB01

C-Room 602

Supply Chain Management II

Contributed Session

Chair: Xuying Zhao, Assistant Professor, University of Notre Dame, Notre Dame, South Bend, IN, United States, xuying.zhao@utdallas.edu

1 - Replenishment Coordination in Distribution Systems with Multiple Items and Retailers
Mustafa Cagri Gurbuz, Professor, MIT-Zaragoza International Logistics Program, Avda. Gomez Laguna, 25, 1a Planta, Zaragoza, 50009, Spain, mgurbuz@zlc.edu.es, Kamran Moinzadeh, Yong-Pin Zhou

We discuss a distribution system with M items, N identical retailers, and a warehouse under random demand. Different inbound/outbound (to/from the warehouse) shipment consolidation policies to reduce logistics related costs are proposed. We analyze the economic impact of shipping several items to a retailer in the same outbound truck in addition to replenishing all the retailers simultaneously via several coordinated replenishment policies.

2 - Managing Suppliers' Delivery Performance with Service Level Agreements
Liping Liang, PhD Student, University of British Columbia, Sauder School of Business,2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, liping.liang@sauder.ubc.ca, Derek Atkins

Service-level agreements (SLA) are often observed in practice to manage suppliers' delivery performance. Under a SLA, a supplier agrees to meet a pre-specified service level (e.g., ready rate) over a review period. We investigate the optimal SLA between a supplier and a buyer when the supplier can invest both in inventory and in leadtime reduction to meet the service level target. We compare the performance of a ready-rate contract and a ready-rate-with-window contract.

3 - A Game Theoretic Approach for the Evaluation of Delayed Incentives in Supply Chains
Jing (Jenny) Zhou, Assistant Professor, University of North Carolina at Charlotte, Department of Business Information Systems & Operations Management, Charlotte, NC, 28223, jzhou7@uncc.edu, Moutaz Khouja

We study consumer rebates offered by a manufacturer in a two-stage supply chain. Consumers make purchase and redemption decisions in two scenarios: 1) the manufacturer keeps the wholesale price unchanged when introducing a rebate; 2) both the wholesale price and the rebate are endogenous. We find that the retailer and manufacturer are better off with the rebate, but consumers are worse off. We examine certain incentive schemes to improve the system performance.

4 - Production and Admission Control in Assemble-to-Order Manufacturing Systems
Oben Ceryan, University of Michigan, 2350 Hayward, Ann Arbor, MI, 48109, United States, oceryan@umich.edu, Izak Duenyas, Yoram Koren

We consider the production and admission control of a two-stage assemble-to-order system. Components are produced to stock, and a selection of these components is assembled to order in a shared assembly line. We derive structural results regarding a firm's decision on when to accept an order for a certain product and how many components of each type to produce. These results enable us to develop an effective heuristic solution which is robust with respect to the number of products offered.

5 - Dynamic Rolling Knapsacks: Capacity Management in Multi-period Make-to-order Businesses

Hiroshi Ochiumi, Visiting Assistant Professor, University of Washington, Bothell, Box 358533, 18115 Campus Way NE, Bothell, WA, 98011, United States, ochiumi@marshall.usc.edu, Sriram Dasu

A make-to-order firm receives two types of orders - normal and urgent. Urgent orders fetch a premium, and must be fulfilled using the current capacity. The firm can use either the current or future capacity to produce normal orders. The company is interested in policies for withholding capacity for urgent orders. We identify optimal capacity rationing rules by modeling the problem by a dynamic rolling knapsack problem.

■ SB02

C-Room 603

Integrated Operations-marketing Models for Supply Chains

Cluster: Supply Chain
Invited Session

Chair: Saibal Ray, Associate Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, saibal.ray@MCGILL.CA

1 - Product Design and Demand Uncertainty

Qin Geng, Assistant Professor, Robert Morris University, School of Business, 6001 University Boul, Moon Township, PA 15108, United States, qingeng@uiuc.edu, Nicholas Petruzzi

Price-setting newsvendor model provides framework for understanding how demand uncertainty affects optimal pricing. The model assumes that the product specifications are designed regardless of whether or not the seller of the product is facing uncertainty in demand. But what if the product design question is given explicit consideration? We investigate how uncertainty affects the product design decision and how this question affects our understanding of how demand uncertainty affects pricing.

2 - Optimal Timing of Orders and Pricing in a Periodic Review Model

Yuyue Song, Assistant Professor, Memorial University of Newfoundland, A1B 3X5, Canada, ysong@mun.ca, Saibal Ray, Manish Verma

In this paper we analyze a profit-maximizing firm using a periodic review model. The decision variables for the firm are: time between the orders, order size and price to charge to the end customers. We first characterize the optimal decisions for an approximate model which is popular in the literature. We then show under what conditions such approximations can result in significant profit penalty.

3 - Distributing a Product Line in a Decentralized Supply Chain

Jing Shao, University of British Columbia, Vanouver, Vancouver, BC, Canada, jing.shao@sauder.ubc.ca, Thomas Mccormick, Harish Krishnan

We study a manufacturer who distributes a horizontally differentiated product line through competing retailers. We investigate how retailers' incentives are affected by the substitution between products as well as between retailers. The incentive distortions in a decentralized supply chain are characterized, and various contracts that coordinate the channel are provided.

4 - A Sequential Location and Pricing Problem for a Duopoly

Yue Zhang, McGill University, 1001 Sherbrooke Stree West, Montreal, QC, H3A1G5, Canada, yue.zhang3@mail.mcgill.ca, Saibal Ray, Vedat Verter

We investigate a sequential location and pricing problem for two profit-maximizing firms, which compete on a unit line market. Each customer purchases one unit of the product from the store providing higher utility. We assume that the early-mover first decides its location as a monopoly, and focus on the optimal location and pricing strategy for the later entrant and the adjusted pricing strategy for the early-mover.

■ SB03

C-Room 604

Cooperation in Supply Chains and Operations

Cluster: Supply Chain
Invited Session

Chair: Saif Benjaafar, Professor & Division Director, University of Minnesota, Industrial & Systems Engineering, Department of Mechanical Engineering, Minneapolis, MN, 55455, United States, saif@umn.edu

1 - Cost Allocation of Capacity Investment Game

Xin Chen, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States, xinchen@uiuc.edu

Consider a set of manufacturers, which need to build capacities and then make productions to satisfy their demand. By taking advantage of the economies of scale of capacity investment, the manufacturers may build joint capacity and make joint productions to reduce their operating costs. Under rather general assumptions on the capacity investment cost, we show that the resulting capacity investment game has a nonempty core.

2 - On the Benefits of Assortment-based Cooperation Among Independent Producers

Baris Tan, Professor of Operations Management, Koc University, Rumeli Feneri Yolu, Sariyer, Istanbul, 34450, Turkey, btan@ku.edu.tr, Yalcin Akcay

We consider a market for a set of substitutable products and a number of firms where each firm produces a subset of these products as its assortment. Depending on the assortment and the substitution behavior of the customer, either a product is sold or the sale is lost. We analyze the cooperation of such independent producers which offer a combined set of products to their customers and determine the characteristics of firms and their products that would facilitate a beneficial cooperation.

3 - Coordinated Production Strategies for Outsourced Operations

Tolga Aydinliyim, Assistant Professor, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene OR 97403, United States of America, tolga@lcbmail.uoregon.edu, George Vairaktarakis

We consider a model where multiple manufacturers outsource to the same third-party with specialized resources. Such business transactions are increasingly handled online where third-party's available capacity is announced to the manufacturers. As opposed to the current practice of the FCFS booking of the third-party capacity, centralized control generates significant savings, but result to inferior performance individually. We present savings sharing schemes that promote centralization.

4 - A Note on Power of Two Inventory Games

Moshe Dror, Professor, University of Arizona, MIS, Eller College of Management, Tucson, AZ 85721, Tucson, AZ, 85721, United States, mdror@eller.arizona.edu, Bruce C. Hartman

Recently Anily and Haviv (2007) published a study showing that a group of products ordered in subsets using EOQ and a power-of-two rule has a cooperative game which is totally balanced and concave. We show that the game is analogous to the classical airport landing fee games. The solution can be constructed in polynomial time rather than by an integer program. The Shapley value can also be computed in polynomial time.

5 - On Service Capacity Pooling and Cost Allocation Among Independent Forms

Saif Benjaafar, Professor & Division Director, University of Minnesota, Industrial & Systems Engineering, Department of Mechanical Engineering, Minneapolis, MN, 55455, United States, saif@umn.edu, Yigal Gerchak, Yimin Yu

We analyze the benefit of capacity pooling for a set of independent firms. Firms decide jointly on capacity level for the shared facility to minimize capacity investment and delay costs subject to service level requirements. Firms also decide on how costs are allocated. We identify conditions under which firms prefer a grand coalition to any other facility sharing arrangement. We also describe settings when this is not the case.

■ SB04

C-Room 606

Tutorial: Operations Research and Homeland Security: From Models to Implemention

Cluster: Tutorials
Invited Session

1 - Operations Research and Homeland Security: From Models to Implementation

Lawrence Wein, Paul E. Holden Professor of Management Science, Stanford University, Graduate School of Business, Stanford University, Stanford, CA, 94305, United States, lwein@stanford.edu

We give an overview of our research in two areas of homeland security: catastrophic biological events (preparing and responding to a smallpox attack, an airborne anthrax attack, and a botulinum toxin attack on the food supply, and assessing infection control measures for pandemic influenza) and border control (preventing nuclear weapons from entering the country on a shipping container and from entering a city, using biometrics to prevent terrorists from entering the

country, and analyzing U.S. immigration strategy from a homeland security viewpoint). We focus on the modeling, the policy recommendations and the implementation of these recommendations.

■ SB05

C-Room 607

2007 Dantzig Dissertation Award Finalists

Cluster: Dantzig Disseratation Prize
Invited Session

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

1 - Deriving Value from Customer Networks

Shawndra Hill, Operations and Information Management Department The Wharton School of the University of Pennsylvania 3730 Walnut Street, Suite 500 Philadelphia, PA, shawndra@wharton.upenn.edu

My dissertation addresses the question: How can firms derive value from data on consumer networks? Firms may be able to capitalize on the fact that consumers interact. Firms that collect explicit data on networks of interactions may be able to mine it to increase revenue or to reduce costs. Results of my research show that information in consumer network data improves business outcomes. In this presentation, I will discuss network-based marketing, a collection of marketing techniques that take advantage of links between consumers to increase sales. Using a large telecommunications data set that represents the adoption of a new telecommunications service, I show very strong support for the hypothesis that network linkage can directly affect product/service adoption. Specifically, I show three main results: (1) "Network neighbors"-those consumers linked to a prior customer-adopt the service at a rate 3-5 times greater than baseline groups selected by the best practices of the firm's marketing team. In addition, analyzing the network allows the firm to acquire new customers who otherwise would have fallen through the cracks, because they would not have been identified based on traditional attributes. (2) Statistical models, built with a very large amount of geographic, demographic and prior purchase data, are significantly and substantially improved by including network information. (3) More detailed network information allows the ranking of the network neighbors so as to permit the selection of small sets of individuals with very high probabilities of adoption.

2 - Air Cargo Revenue and Capacity Management

Andreea Popescu, Georgia Institute of Technology, 3186 Alton Rd, Atlanta GA 30341, Andreea.Popescu@turner.com

We address two problem categories: Air Cargo Revenue Management, the airlines' problem of managing the capacity available for free sale to generate more revenue; and Air Cargo Capacity Management, the freight forwarders' problem of confirming capacity with the airlines a few days before the flight takes off such that the demand from the shippers is satisfied at minimum cost. We show in the air cargo revenue management section that a discrete estimator for the air cargo show-up rate can result in significant higher revenue than the Normal estimator currently used, and we develop bid prices taking into account the demand lumpiness existent in the air cargo industry. We model the air cargo capacity management problem as a perishable inventory management problem with positive lead times, and show that the optimal policy is stationary for lead times of one and two periods.

3 - Efficient Closed-Loop Optimal Control of Petroleum Reservoirs under Uncertainty

Pallav Sarma, Stanford University, pallav@chevron.com

Real-time model-based oil and gas reservoir management requires efficient computational techniques for optimizing reservoir performance under uncertainty. Such production optimization problems typically involve large, highly complex reservoir simulation models (numerical models of fluid flow behavior in the subsurface reservoir and surface facilities), with thousands of unknowns and many constraints. Further, our understanding of the subsurface oil and gas reservoir is always highly uncertain, and this uncertainty is reflected in the models. As a result, performance prediction and production optimization, which are the ultimate goals of the entire modeling and simulation process, are generally suboptimal. This work discusses a model-based closed-loop approach for efficient and accurate real-time production optimization that consists of three key elements - optimization, uncertainty propagation and model updating, and various algorithms such as adjoint models, kernel principal component analysis and polynomial chaos expansions are proposed/adapted to perform these tasks efficiently.

■ SB06

C-Room 608

Integrated Risk Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Lingxiu Dong, Associate Professor, Washington University in St. Louis, Olin School of Business, Saint Louis, MO, United States, dong@wustl.edu

Co-Chair: Panos Kouvelis, Professor, Washington University in St Louis, Olin School of Business, Campus Box 1133, 1 Brookings Lane, St Louis, MO, 63130, United States, kouvelis@wustl.edu

1 - The Relationship Between Capital Structure and Operational Characteristics

John Birge, University of Chicago, Chicago, IL, John.Birge@ChicagoGSB.edu

A variety of models have been proposed to explain capital structure. The tradeoff theory is generally interpreted to imply that market leverage increases with firm profitability. Empirical studies suggest that the opposite relationship is, however, true, and, therefore, tend to support other explanations including asymmetric information and agency costs. In this talk, we will discuss an alternative based on a news vendor structure and will present empirical results that support this model.

2 - The Role of Financial Services in Procurement Contracts

Xiang-Feng Chen, Fudan University, 220, Handan Rd., Shanghai, 200433, China, xchen@stern.nyu.edu, Rene Caldentey

We investigate the interplay between operations and financial decisions in the design of procurement contracts. A budget constrained retailer purchases a product from a supplier and afterwards sells it in a retail market to a random demand. We compare two forms of financing for the retailer: ëExternal Financing' in the form of a commercial loan and ëInternal Financing' in which the supplier offers financial services to the retailer in the form of a specially tailored procurement contract.

3 - Integration of Operational and Financial Hedging

Rong Li, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, 178899, Singapore, rongli@smu.edu.sg, Panos Kouvelis, Qing Ding

We study a multi-period hedging problem for a manufacturer who faces uncertain demand of commodity components. Traditional inventory management studies operational hedging only. In this research, we consider different types of financial hedging together with two operational hedging methods, which include a long-term flexible contract with a supplier and spot market participation. Optimal hedging policies are determined for a risk-averse manufacturer.

4 - Global Facility Network Design Under Price Flexibility

Lingxiu Dong, Associate Professor, Washington University in St. Louis, Olin School of Business, Saint Louis, MO, United States, dong@wustl.edu, Ping Su, Panos Kouvelis

We consider a global firm who sells as a monopolist in both the domestic and foreign markets. We characterize the optimal global network design, and investigate the impact of price flexibility and the uncertainties in exchange rate and/or demand on the firm's facility location and capacity decisions.

■ SB07

C-Room 609

Retail Operations

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Gurhan Kok, Associate Professor, Duke University, One Towerview Drive, Durham, NC, United States, gurhan.kok@duke.edu

1 - Incorporating Price and Inventory Endogeneity in Firm Level Sales Forecasting

Vishal Gaur, Cornell University, vg77@cornell.edu, Saravanan Kesavan, Ananth Raman

We construct a simultaneous equations model to interrelate sales, inventory, and gross margin for a retailer at the firm level. Using public financial data, we estimate 6 causal effects among these variables. Our model yields insights about these effects that support theoretical literature. It also provides sales forecasts, which in our numerical tests, are more accurate than forecasts from time-series models that ignore inventory and gross margin as well as those from equity analysts.

2 - Improving Consumers' Product Valuation under Retail Competition

Olga Perdikaki, The University of North Carolina at Chapel Hill, Kenan-Flagler Business School, CB# 3490, McColl Bldg., Chapel Hill, NC, 27599-349, United States, olga_perdikaki@unc.edu, Jayashankar Swaminathan

Several retail practices are aimed towards increasing consumer valuation about their product offerings. We consider a stylized model with two retailers where consumers can obtain the informational services provided by one retailer but buy the product from another retailer. We provide managerial insights on how factors such as market expansion, intensity of competition, level of investment as well as direction of consumer flow impact the outcome of competition.

3 - The Impact of Fast Response in Inventory-based Competition

Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Felipe Caro

We propose a multi-period extension of the competitive newsvendor model of Lippman and McCardle (1997), to investigate the impact of fast replenishment capabilities on competition. For this purpose, we consider two asymmetric retailers that compete in terms of inventory, i.e., excess demand overflows to the competitor. We visualize this problem as the competition between a traditional retailer that makes-to-stock before the season starts versus a retailer that has a fast response to the market.

4 - Optimal Assortment under Product Returns

Alex Grasas, University of Florida, Dept. of Industrial &Systems Engineering, Weil Hall, Gainesville, FL, 32608, United States, agrasas@ufl.edu, Elif Akcali, Aydin Alptekinoglu

Motivated with the question of whether retailers should consider product returns when merchandising (as they compose their product lines), we explore the interactions between product assortment and return policy decisions of a firm under both make-to-order (MTO) and make-to-stock (MTS) environments. We show that the structure of the optimal assortment critically depends on the refund fraction and whether the products are supplied on an MTO or MTS basis.

■ SB08

C-Room 611

Supply Disruptions and Risk

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Nesim Erkip, Bilkent University, Dept.. of IE, Ankara, TR, 06800, Turkey, nesim@bilkent.edu.tr

1 - Contracting Between Downside Risk Averse Supplier and Risk Neutral Retailer

Sudarsan Rangan, The University of Alabama, ISM Department, Alston Hall, The University of Alabama, Tuscaloosa, AL, 35487, United States, srangan@cba.ua.edu, Charles Sox

The objective of this research project is to develop a coordinating contract acceptable to all agents involved. This paper attempts to model and analyze the supplier's downside risk in some existing types of contracts and to identify conditions under which the supply chain can be coordinated in a single period setting under demand uncertainty.

2 - On the Value of Flexible Suppliers in Supply Chains with Disruption Risks

Soroush Saghafian, PhD Student, University of Michigan, Dep. of Industrial and Operations Eng., 1205 Beal Avenue, The University of Mich, Ann Arbor, 48109, United States, soroush@umich.edu, Mark Van Oyen

We analyze the value of a flexible supplier in a supply chain where suppliers have disruption risks. In a two-echelon supply chain, a manufacturer produces two types of products, each having an inflexible and a flexible supplier. We derive optimal sourcing and contracting level and investigate the value of the flexible supplier and the value of information on disruption threat levels of unreliable suppliers.

3 - Managing Supply Disruptions in an Assembly System

Gregory DeCroix, Associate Professor, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, 53706, United States, gdecroix@bus.wisc.edu

This paper studies the management of a supply chain for a product that is assembled from multiple components, some of which are subject to supply disruptions. We evaluate heuristic policies for managing inventories in this system, and explore alternate strategies for mitigating the risk of the supply disruptions.

4 - Computing Default Probabilities for a Three Level Supply Chain

Nesim Erkip, Bilkent University, Dept.. of IE, Ankara, TR, 06800, Turkey, nesim@bilkent.edu.tr, Sila Cetinkaya

Consider a buyer facing random demand, a first tier supplier(OEM manufacturer) and a second tier supplier (supplier of the OEM). We investigate the effect of buyer sharing her demand information with the supply chain under arbitrary contract structures all enforcing total satisfaction of the random demand. We are especially interested incomputing default probabilities of different parties, as well as the default probability for the supply chain.

■ SB09

C-Room 612

Multicriteria Decision Making II

Contributed Session

Chair: Chun-Ting Lin, University of Michigan, Ann Arbor, 1697 Broadway St. Apt # 401, Ann Arbor, MI, 48105, United States, jctlin@umich.edu

1 - A Study of Regret and Rejoicing in Decision-making and a New MCDM Method Based Theme

Xiaoting Wang, Louisiana State University, 3550 Nicholson Dr. Apt. 2118, Baton Rouge, LA, 70802, United States, xwang8@lsu.edu, Evangelos Triantaphyllou

First we discuss how some emotional feelings such as regret and rejoicing may greatly influence people's preferences in decision-making. Next a new MCDM method, which can incorporate the notion of anticipated regret and rejoicing systematically, is proposed. Some essential properties of the new method are also discussed.

2 - Quality Representation of the Solution Set in Biobjective Programming

Stacey L. Faulkenberg, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634, United States, sfaulke@clemson.edu, Margaret M. Wiecek

As mathematicians engaged in multiple criteria decision making, it is our task to support the decision maker by presenting her with a quality representation of the solution set from which she may choose a final preferred solution. We review quality measures for solution sets of multiobjective programs available in the literature and propose new concepts. For biobjective programs we present methods which produce representations optimizing these measures. Numerical examples are included.

3 - Multicriteria Batch Process Control by Upstream Rescheduling

Abdullah Cerekci, Teaching Assistant, Industrial and Systems Engineering Department/Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, cerekci@tamu.edu, Amarnath Banerjee

Dynamic scheduling of batch machines is a very complex problem. Policies that reduce cycle time using near future arrival time predictions exist in the literature. Our recent studies improve these approaches by incorporating the schedule of the upstream machines. In this paper, we further extend batch control problem by considering cycle time and tardiness objectives at the same time. Our upstream rescheduling based look-ahead policy gives promising results for this multicriteria problem.

4 - Multi-objective Model for Vendor Selection

Vijay Wadhwa, PSU, 310 Leonhard Building, University Park, PA, 16802, United States, vuw100@psu.edu, A.Ravi Ravindran

In any large organization, millions of dollars are spent on outsourcing. Most large organizations are outsourcing those activities that are either not cost efficient or not core to their businesses. In this work we develop vendor selection methods with Price, lead-time and rejects (quality) are explicitly considered as three conflicting criteria that have to be minimized simultaneously. We present and compare goal programming and compromise programming as multi-objective optimization methods.

5 - Decision Making Using Decision Field Theory and Linear System Model

Chun-Ting Lin, University of Michigan, Ann Arbor, 1697 Broadway St. Apt # 401, Ann Arbor, MI, 48105, United States, jctlin@umich.edu

The psychological Decision Field Theory (DFT) proves capability in illustrating dynamic decision making process. In this paper, we present a Generalized DFT system by considering closed-loop systems with multiple decision makers in decision making process. Simulation of the proposed model provides evidence that individual momentary preferences control organizational overall performance. Case study gives managerial implication in improving group decision making process.

■ SB10

C-Room 613

Cooperation in Inventory Management II

Cluster: Inventory
Invited Session

Chair: Jiawei Zhang, Assistant Professor, New York University, 44 West 4 St., Suite 8-66, New York, NY, 10012, United States, jzhang@stern.nyu.edu

1 - P-additive Games: A Class of Totally Balanced Games Arising From Inventory Situations with Temporary

Ana Meca, Professor, Universidad Miguel Harnandez, Edificio Torretamarit, Avda. Universidad s\n, Elche, 03202, Spain, ana.meca@umh.es, Luis Guardiola

We introduce a new class of totally balanced cooperative TU games, namely p-additive games. It is inspired by the class of inventory games that arises from inventory situations with temporary discounts (Toledo, 2002) and contains the class of inventory cost games (Meca et al., 2003, 2004). It is shown that p-additive games are totally balanced. The modified SOC-rule is proposed as a core-allocation for p-additive games.

2 - Large Newsvendor Games

Marco Scarsini, Professor, LUISS, Via O. Tommasini 1, Roma, RM, 00162, Italy, marco.scarsini@gmail.com, Luigi Montrucchio

We consider a game, called newsvendor game, where several retailers, who face a random demand, can pool their resources and build a centralized inventory that stocks a single item on their behalf. Profits have to be allocated in a way that is advantageous to all the retailers. A game in characteristic form is obtained by assigning to each coalition its optimal expected profit. We show that in a game with a continuum of players, under a nonatomic condition on the demand, the core is a singleton.

3 - A Collaborative Decentralized Distribution System with Demand Updates

Ulas Ozen, Researcher, Bell Labs Ireland, Blanchardstown Industrial Park, Blanchardstown, Dublin, Dublin 15, Ireland, U.Ozen@tm.tue.nl, Greys Sosic, Marco Slikker

We consider a distribution system that consists of a manufacturer, a warehouse, and n retailers, which face stochastic demand and order from the manufacturer. The retailers can update their demand forecasts, while their orders are shipped to the warehouse. We analyze cooperation between the retailers with and without information sharing, and we investigate its impact on the retailers and the manufacturer. Afterwards, we focus on coordination of the entire supply chain through buy-back contracts.

■ SB11

C-Room 614

Manufacturing System Design for Product Variety

Cluster: Manufacturing
Invited Session

Chair: Jeonghan Ko, University of Michigan, 2350 HAYWARD ST., 2250 G.G. BROWN, Mechanical Engineering, Ann Arbor, MI, United States, jeonghan@umich.edu

Co-Chair: Jack Hu, University of Michigan, Hayward St., 2250 G.G. Brown, Ann Arbor, MI, 48109, United States, jackhu@umich.edu

1 - A Quantitative Approach to Achieving Optimal Balance Between Product Variety and Manufacturability

Jeremy Michalek, Assistant Professor, Carnegie Mellon University, Scaife Hall 323, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jmichalek@cmu.edu

We incorporate econometric models of consumer demand for product variety with manufacturing investment and production allocation decisions to resolve tradeoffs among product functionality, market performance and manufacturing cost under a profit objective.

2 - Flexible vs. Dedicated Capacity in Serial Processes

Amit Eynan, Professor, University of Richmond, 1 Gateway Rd, Richmond, VA, 23173, United States, aeynan@richmond.edu, Lingxiu Dong

Flexible capacity allows firm to allocate resources following realization of products' demand. This feature, however, comes at a cost as versatile capacity is more expensive than dedicated one. This trade-off received much attention recently and has been explored while implicitly treating the process as a single stage. This study considers this trade-off within a multi-stage context and identifies which stages along the process should be flexible (or dedicated) and their optimal capacity levels.

3 - Manufacturing Line Design for Product Variety Considering Line Flexibility and Task Similarity

Jeonghan Ko, University of Michigan, 2350 Hayward St., 2250 G.G. Brown, Mechanical Engineering, Ann Arbor, MI, United States, jeonghan@umich.edu, Jack Hu

Classical approaches to manufacturing line design have usually concerned serial configurations of identical machines. We developed mixed integer programming models for maximizing (1) cost-effectiveness of line configurations for multiple product models by the appropriate combinations of dedicated and flexible machines, and (2) the similarity of manufacturing tasks assigned to a machine for different product models.

■ SB12

C-Room 615

Scheduling Applications & Algorithms

Cluster: Scheduling
Invited Session

Chair: Zhi-Long Chen, Associate Professor, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu

Co-Chair: Lei Lei, Rutgers University, Rutgers Business School, United States, llei@business.rutgers.edu

1 - Scheduling Truck Arrivals at an Air Cargo Terminal

Chung-Lun Li, Chair Professor of Logistics Management, The Hong Kong Polytechnic University, Department of Logistics, Hung Hom, Kowloon, Hong Kong, China, lgtclli@polyu.edu.hk, Jinwen Ou, Vernon Ning Hsu

We consider the scheduling of truck arrivals at an air cargo terminal. By coordinating arrivals of cargo delivery trucks with outbound flight departure schedules, some of the shipments can be transferred directly to the departing flights, while others will be stored at the terminal's storage facility and incur extra costs. The objective is to obtain a feasible schedule so as to minimize the total cost of operations.

2 - Scheduling Robotic Cells with a Stochastic Processing Time

Neil Geismar, Texas A&M University, Mays Business School, College Station, TX, United States, ngeismar@yahoo.com, Michael Pinedo

We consider the operations of a robotic cell in which one process has a stochastic processing time. We first demonstrate how proximity of the stochastic process to the bottleneck process effects throughput, which leads to formulas for the cell's expected throughput. We also find the distribution function of the robot's cycle time and verify it with simulation results. On-line scheduling schemes to improve throughput are also presented.

3 - Inbound Logistics Scheduling with Milk Runs with Limited Unloading Capacity

Xiangtong Qi, Assistant Professor, Hong Kong University of Science and Technology, Department of Industrial Engineering and, Clear Water Bay, Kowloon, Hong Kong - ROC, ieemqi@ust.hk, Jinwen Ou, Chung-Yee Lee

A 3PL company uses a milkrun system to pick up components from suppliers to an automotive maker. Suppliers are clustered into subsets where each subset is visited by one truck run. One bottleneck of the system is the unloading docks at the warehouse where trucks are waiting for unloading. We formulate the problem as a scheduling problem with unloading servers and develop algorithms to improve system efficiency. The work is partly supported by NSFC/RGC Joint Research Scheme N_HKUST612/06.

4 - Optimality Proof of the Kise-Ibaraki-mine Algorithm

Zhi-Long Chen, Associate Professor, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu, Shan-Lin Li, Guo-Chun Tang

Kise, Ibaraki and Mine [Operations Research, 26 (1978), 121-126] give an $O(n^2)$ time algorithm to find an optimal schedule for the single-machine number of late jobs problem with agreeable job release dates and due dates. We point out that their proof of optimality for their algorithm is incorrect by a counter-example, and give a correct proof of optimality.

5 - Container Vessel Scheduling: Some Solvable Cases

Lei Lei, Rutgers University, Rutgers Business School, United States, llei@business.rutgers.edu, Endre Boros, Selim Bora

Container vessel scheduling in a supply chain environment is a new but difficult optimization problem because of the additional constraints on suppliers' capability and customer-delivery requirements. We introduce some strongly polynomial time solvable cases encountered in such scheduling processes involving customer receiving time-windows, cargo release times and due dates, and capacitated heterogeneous vessels.

■ SB13

C-Room 616

Computational Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - MIP: Beyond Tradition

Zonghao Gu, Distinguished Scientist, ILOG Inc., 4050 Walnut Creek Trail, Alpharetta, 30005, United States, gu@ilog.com

Traditionally, MIP solvers use a branch-and-cut algorithm to search and return a single optimal solution. We present the progress of our recent MIP developments, including dynamic search and non-traditional parallel algorithm, with benchmarks showing the significant performance improvement, especially on hard models.

2 - Integer Programming Strategies for Large-scale, Cancer Instances

Kyungduck Cha, Georgia Institute of Tech., chacha2000@isye.gatech.edu, Eva K. Lee

In this talk, we will describe integer programming models and computational strategies for some large-scale intractable MIP instances arising from cancer treatment planning.

3 - Solution Approaches for Integer Bilevel Programs

Scott Denegre, Lehigh University, 200 W. Packer Avenue, Mohler Laboratory, Bethlehem, PA, 18015, United States, scd3@lehigh.edu, Ted Ralphs

We consider novel solution approaches for integer bilevel programs (IBPs). Extensions to polyhedral techniques developed for IPs are derived and new classes of valid inequalities are introduced, leading to a branch-and-cut algorithm. Particular emphasis is placed on integer interdiction problems, a subclass of IBPs and a natural extension of the network interdiction problem. Multiobjective programming techniques are used to analyze the tradeoff between resources and interdiction effort success.

■ SB14

C-Room 617

Derivative-free Nonlinear Programming

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Joshua Griffin, Sandia National Laboratories, 4970 Owens Drive Apt 637, Pleasanton, CA, 94588, United States, jgriffi@sandia.gov

1 - Derivative-free Software for Multiagent Hybrid, Optimization in Parallel

Joshua Griffin, Sandia National Laboratories, 4970 Owens Drive Apt 637, Pleasanton, CA, 94588, United States, jgriffi@sandia.gov, Tamara Kolda

We discuss strategies for accelerating convergence of Generating Set Search (GSS) by providing the ability to evaluate externally generated points. These modifications provide several new capabilities: 1) the user may runmultiple local searches simultaneously, 2) the user may concurrently use additional (non-GSS) optimization strategies while sharing common point evaluations, and 3) the ability to extend capabilities to global optimization.

2 - Derivative-free Optimization as a Tool for Simulator Calibration

Genetha Gray, Sandia National Laboratories, P.O. Box 969, MS 9159, Livermore, CA, 94551, United States, gagray@sandia.gov

Scientists and engineers use computational simulations in the design and study of complex systems. However, the usefulness of these simulations can hinge on the values of certain simulator parameters. Thus, calibration procedures are applied to improve the quality of the simulations and to minimize underlying model uncertainties. In this talk, we will describe how derivative-free optimization can play a key role in the calibration process and give some real world examples and results.

3 - Algorithm and Application of ORBIT, a Derivative-free, Trust-region Radial Basis Function Optimizer

Christine Shoemaker, Professor, Cornell University, School of Civil and Environmental Eng., Cornell University, Hollister Hall, Ithaca, NY, 14853, United States, cas12@cornell.edu, Stefan Wild, Rommel Regis

We present a new derivative-free algorithm, ORBIT (Optimization by Radial Basis Function Interpolation in Trust Regions), for unconstrained local optimization. ORBIT is designed for computationally expensive functions, for which a large number of function evaluations is not feasible. We present numerical results for a number of functions, including watershed calibration and optimization of a partial differential equation model for decontamination of groundwater.

■ SB15

C-Room 618

Dynamic Variational Inequalities

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Mihai Anitescu, Computational Mathematician, Argonne National Laboratory, Mathematics and Computer Science Divisio, 9700 S. Cass Avenue, Argonne, IL, 60439, United States, anitescu@mcs.anl.gov

1 - Gradient-based Algorithms for Finding Nash Equilibria in Extensive Form Games

Andrew Gilpin, Carnegie Mellon University, Computer Science Department, Pittsburgh, PA, 15213, United States, gilpin@cs.cmu.edu, Javier Pena, Samid Hoda, Tuomas Sandholm

We present a gradient-based algorithm for finding Nash equilibria of two-person, zero-sum sequential games. The algorithm is based on modern smoothing techniques for non-smooth convex optimization and requires O(1/eps) iterations to compute an eps-equilibrium. Fast iterations enable the approximation of equilibria for games with a tree representation of 100 billion nodes. We develop heuristic improvements and demonstrate their efficacy on a range of real-world games.

2 - A Descent Method for Differential VIs Arising in Non-cooperative Differential Nash Equilibrium

Changhyun Kwon, PhD Candidate, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, chkwon@psu.edu, Terry Friesz

In this paper, we consider a gap function for differential variational inequalities (DVIs) and study an equivalent optimal control problem. In particular, we employ a differential gap function — the so-called D-gap function — and its gradient to form a descent method for DVIs. An application of DVIs to differential Nash games is also investigated. In particular, we solve an abstract linear-quadratic differential Nash game and a model of oligopolistic competition.

3 - Advances in Evolutionary VI Modeling of Electric Power Supply Chains with Real-Life Applications

Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts, Finance and Operations Management, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu, Zugang Liu

In this paper, we propose a new model of dynamic electric power supply chains with explicit transmission capacities using evolutionary variational inequalities. We then demonstrate an application of the model for ISO New England and show how the model captures dynamic pricing as well as dynamic electric power transactions.

4 - A Differential Variational Inequality Formulation for Rigid Body Dynamics with Polyhedral Bodies

Gary Hart, University of Pittsburgh, 301 Thackeray Hall, Pittsburgh, PA, United States, gdhart@pitt.edu, Mihai Anitescu

We present a differential variational inequality formulation for rigid body dynamics with polyhedral bodies. The formulation is based on a novel measure for depth of penetration between polyhedral bodies that has a linear complexity. Numerical results show that a time-stepping approach based on this formulation achieves constraint stabilization for fixed time steps.

■ SB16

C-Room 619

Combinatorial Optimization II

Contributed Session

Chair: Barbara Tocchella, University of Brescia - Department of Electronics for Automation, Via Branze 38, Brescia, 25123, Italy, barbara.tocchella@ing.unibs.it

1 - Solving a General Infrastructure Investment Model Using Column Generation

Matthias Nowak, Post-Doc, NTNU, Alfred Getz veg 3, Trondheim, 7491, Norway, mefju@iot.ntnu.no, Jogeir Myklebust, Asgeir Tomasgard

The motivation for this paper is long term infrastructure development in the energy sector, including natural gas and hydrogen value chains. The model is a mixed-integer linear program that is difficult to solve by branch-and-bound

methods. The solution method is based on the column generation methodology utilizing off-the-shelf branch-and-bound optimization libraries. Numerical results will be presented.

2 - Timetabling and Grouping of Project Presentations of Student Teams

Burcin Bozkaya, Asst. Prof., Sabanci University, Faculty of Management, Orhanli, Tuzla, Istanbul, Turkey, bbozkaya@sabanciuniv.edu, Can Akkan

We present the continuation of our work on timetabling and grouping of student project presentations. The objective is to group students into teams and schedule their presentations into time slots. We use an IP-based model and solve it with a heuristic approach. Our criteria include homogeneity across time slots in terms of student background, and homogeneity within time-slots in terms of presentation material. We present our model, discuss solution methods, and present computational results.

3 - Heuristic Algorithms for Multidimensional Multiple-choice Knapsack Problem

Cheng-Huang Hung, Assistant Professor, Department of Information Management, National Taiwan University of Science and Technology, 43, Keelung Rd., Sec. 4, Taipei, Taiwan - ROC, alexhung@cs.ntust.edu.tw, Pei-Chi Chen

We introduce two heuristics (Heu-1 and Heu-2) to solve Multidimensional Multiple-Choice Knapsack Problem (MMKP). We propose a new local search direction and searching scheme. Computational results show that our local search direction is better than Moser's with 99% confidence in small instances or when the number of services is large. Computational results also show HEU-1 is better than Moser's algorithm with 95% confidence, and HEU-2 is better than Khan's algorithm with 99% confidence.

4 - The Raw Material Unloading Problem of a Steelworks: Combinatorial Nature

Yunetech Han, Student, Postech, San31, Hyoja-dong, Nam-gu, IME Chaos Lab, Pohang, 790-784, Korea, Republic of, bluerain@postech.ac.kr, Soo Y. Chang, Byung-In Kim, K yung-Kuk Lim, Wooram Kwak

Unloading raw material from ships at the seaport of a steelworks has unique characteristics. The scheduling problem is very complicated due to several factors such as the dynamic nature of berthing eligibility of each ship, the uneven capacities of unloading equipment, the requirement for keeping balance of the ship, and the complexity of belt conveyor operation. In this talk, we discuss the combinatorial nature of the scheduling problem and show that some of sub problems are NP-hard.

5 - The Traveling Purchaser Problem with Budget-constraint

Barbara Tocchella, University of Brescia - Department of Electronics for Automation, Via Branze 38, Brescia, 25123, Italy, barbara.tocchella@ing.unibs.it, Renata Mansini

We analyze a variant of the Traveling Purchaser Problem (TPP) where the purchasing costs of products can not exceed a defined budget threshold. We propose and compare two solution algorithms, a simple local search heuristic and a more elaborated Variable Neighborhood Search. The proposed algorithms have been used to solve both the capacitated and the uncapacitated version of the problem. Test problems have been obtained by adding a budget constraint to known benchmark instances for the TPP.

■ SB17

C-Room 620

Online Social Networks

Sponsor: Information Systems Society
Sponsored Session

Chair: Yong Tan, University of Washington, Business School, Box 353200, Seattle, WA, 98195-3200, United States, ytan@u.washington.edu

1 - Employee Blogs: Is Honesty the Best Policy for a Firm?

Rohit Aggarwal, Doctoral Candidate, University of Connecticut, OPIM, School of Business, University of Connecticut, Storrs, CT, 06269, United States, Rohit.Aggarwal@business.uconn.edu, Ram Gopal, Ramesh Sankaranarayanan

Blogs have recently received a lot of attention, especially in the business community, with a number of firms encouraging their employees to blog. Employee blogs can cast a firm in positive (negative) light, thereby enhancing (harming) the firm's reputation. Under certain conditions negative posts can actually help the overall reputation of the firm. The rationale is that negative posts raise the credibility of a blog and attract more readers, who then will also be exposed to the positive posts.

2 - Brand Recognition in a Networked Digital World

Jeongha Cath Oh, University of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, jhoh@u.washington.edu

Sustaining constant demand and achieving channel recognition are especially difficult for online portal sites. The popularity of individual content guarantees neither increased demand nor regular visits. In this paper, we analyze a dataset collected from YouTube.com. Setting the number of subscribers to a channel as the dependent variable, and individual network measures as independent variables, we investigate the dynamics of channel selection by users in networked digital channels.

3 - Collaorative Software Development and the Small World Phenomenon

Param Vir Singh, University of Washington, 5000 22nd Ave NE #210, Seattle, WA, 98105, United States, psidhu@u.washington.edu

Software developers have traditionally worked in local clusters isolated within firms. The new paradigm of software development, open source, represents a system that allows flow of resources across clusters. With the advent of open source the formerly isolated clusters have become more massively connected networks. In this study, I find evidence that the networks that possess small world properties, high clustering and short average path length, are conducive for software development.

■ SB18

C-Room 201

Computational Stochastic Programming

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Jeff Linderoth, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706-1572, United States, jtl3@lehigh.edu

1 - Sequential Stopping Rules for Stochastic Programming

Guzin Bayraksan, Assistant Professor, University of Arizona, P.O. Box 210020, Tucson, AZ, 85721, United States, guzinb@sie.arizona.edu

A critical component of Monte Carlo sampling-based methods is determining when to stop to ensure a desired quality of the solutions. In this talk, we present several rules to stop and increase the sample sizes. We discuss computational issues and compare the empirical performance of different stopping rules on problems from the literature. We also apply variance reduction techniques and test their effectiveness.

2 - Sampling Approaches for Optimization with Probabilistic Constraints

Jim Luedtke, Georgia Institute of Tech., jluedtke@gatech.edu, Shabbir Ahmed, George Nemhauser

We study Monte Carlo sampling approaches for obtaining approximate solutions to optimization problems with probabilistic constraints. We show how sample approximation problems can be used to obtain feasible solutions and optimality bounds, without requiring the nominal optimizatio problem to be convex. We also study the rates of convergence of the approximations.

3 - Branch-and-cut (BAC) Based Decomposition for SIP with Mixed-integer Variables in Both Stages

Yang Yuan, The Ohio State University, Industrial and Systems Engineering, Columbus, OH, United States, yuan.65@osu.edu, Suvrajeet Sen

A Branch-and-Cut approach to decomposition of SIP problems refers to a class of decomposition methods in which the cost-to-go value function is approximated through branching and cutting within the second stage IP. In this talk, we will discuss a method which allows branching based on objective functions in both stages.

■ SB19

C-Room 203

New Directions in Vehicle Routing

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Bruce Golden, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, bgolden@rhsmith.umd.edu

Co-Chair: Edward Wasil, Professor, American University, Kogod School of Business, Washington, DC, 20016, United States, ewasil@american.edu

1 - Vehicle Routing with Time Windows and Time-dependent Rewards: A Problem from the American Red Cross

Jinxin Yi, SAS Institute, Inc., Cary, NC, United States, Jinxin.Yi@sas.com, Alan Scheller-Wolf

We describe a vehicle routing problem faced by the American Red Cross (ARC). ARC must decide from which sites to retrieve blood and how their shuttles should be routed in order to provide them with a sufficient amount of platelets at minimum transportation costs. The volume of blood received at a site is time-dependent. We develop a new approach to solve this problem optimally. Application to actual ARC data indicates potential savings of 60%.

2 - A Hybrid Monte Carlo Local Branching Algorithm for the Single VRP with Stochastic Demands

Michel Gendreau, Universite de Montreal, Montreal, Canada, michelg@crt.umontreal.ca, Walter Rei, Patrick Soriano

We present a new algorithm that uses both local branching and Monte Carlo sampling in a multi-descent search strategy for solving 0-1 integer stochastic programming problems. This procedure is applied to the single vehicle routing problem with stochastic demands. Computational results show the usefulness of this new approach to solve hard instances of the problem.

3 - The Probabilistic Arc Routing Problem

Si Chen, Assistant Professor, Murray State University, CSIS, College of Business and Public Affairs, Murray, KY, 42071, United States, sichen80@gmail.com, Bruce Golden, Richard Wong, Hongsheng Zhong

We study the probabilistic arc routing problem that arises in the small package delivery industry. Each day, drivers traverse streets following a predetermined sequence. The streets that need to be visited vary daily. Our model produces a tour over all the streets, which is used to generate daily routes. We present heuristics for solving this problem.

4 - Balanced Billing Cycles and Vehicle Routing of Meter Readers

Chris Groer, University of Maryland, AMSC Program, College Park, MD, 20742, United States, cgroer@comcast.net, Bruce Golden, Edward Wasil

Utility companies send their fleets of meter readers out on each day of the billing cycle to determine each customer's usage. Over time, customers are removed and others are added to the existing routes. A utility company must, therefore, adjust its meter-reading routes. We discuss this problem in this paper.

■ SB20

C-Room 204

Directions in Machine Learning and Reasoning

Sponsor: Decision Analysis
Sponsored Session

Chair: Eric Horvitz, Principal Researcher, Microsoft Research, One Microsoft Way, Redmond, WA, United States, horvitz@microsoft.com

1 - Streaming Intelligence: Machine Learning and Reasoning in Daily Life

Eric Horvitz, Principal Researcher, Microsoft Research, One Microsoft Way, Redmond, WA, United States, horvitz@microsoft.com

I will discuss how technical developments and trends are providing a fertile climate for integrating machine learning and reasoning into applications and services. I will review several illustrative efforts and prototypes that highlight promises with the flow of machine intelligence into daily life, including efforts in traffic forecasting, mobile commerce, search, operating systems, and call routing.

2 - Models of Searching and Browsing: Studies and Applications

Douglas Downey, Doctoral Student, University of Washington, Box 352350, Seattle, WA, 98195, United States, ddowney@cs.washington.edu, Susan Dumais, Eric Horvitz

We describe the formulation, construction, and evaluation of predictive models of human information seeking from a large dataset of Web search activities. Utilizing machine learning techniques, we construct predictive models and analyze which properties of users, queries, and search sessions are the most predictive of future behavior. We also discuss applications of the predictive models, focusing on the example of performing principled prefetching of content.

3 - Towards Lifelong Machine Learning

Ashish Kapoor, Researcher, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, akapoor@microsoft.com, Eric Horvitz

We study principles of lifelong learning with following characteristics: continuous training over long periods, scarce informational resources and non-stationary environments. In such a system, the decision to extend a case library is made continuously by balancing cost of acquiring new information with benefit of increased predictive accuracy. The system adapts to underlying dynamics by caching and recalling information as context changes require.We review key concepts and real-world applications.

4 - Probabilistic Index Maps: Capturing Structure of Natural Signals by Mining Their Self-similarity

Nebojsa Jojic, Senior Researcher, Microsoft Research, One Microsoft Way, Redmond, WA, United States, jojic@microsoft.com

One of the problems in modeling natural signals is that signals with very similar structure may locally have completely different measurements, e.g., images taken under different illumination conditions, or the speech signal captured in different environments. Rather than modeling a signal as an array or a matrix of local measurements, I will argue that interesting structure in signals is better captured when the signal is defined as a matrix whose entries are discrete indices to a separate palette of possible measurements.

■ SB21

C-Room 205

Joint Session DAS/ENRE: Decision Analysis and the Environment

Sponsor: Decision Analysis, Energy, Natural Res & the Environment
Sponsored Session

Chair: Richard Anderson, Asst. Professor, Duke University, Nicholas Sch. of Environment, Box 90328, Durham, NC, 27708, United States, richard.anderson@duke.edu

1 - Using Science and Decision Analysis to Set Water Quality Standards

Melissa Kenney, Water Quality Modeling and Decision Analysis, Duke University, Box 90328, Research Dr., LSRC A229, Durham, NC, 27705, United States, m.kenney@duke.edu, Robert Clemen, Ralph Keeney, Kenneth Reckhow, Craig Stow

One question states struggle with is how to set water quality standards; this is particularly difficult for eutrophication control since different levels of nutrients cause different waterbody responses. We developed a two-step procedure to set nutrient criteria: (1) we determined the most predictive measured variables using structural equation modeling, and (2) we assessed the optimal variable level using multiattribute utility analysis. The procedure was applied to lakes in North Carolina.

2 - A Decision Analysis Framework for Water Quality Management Decision Support

Bill Labiosa, US Geological Survey, 345 Middlefield Rd, MS-531, Menlo Park, CA, 94025, United States, blabiosa@usgs.gov

I describe a decision analysis framework for evaluating water quality management strategies using: 1) causal Bayesian networks to predict outcomes; 2) penalty functions on targets; and 3) hypothesis variables to model highly uncertain aspects of the management problem. The framework allows the comparison of strategies, prioritization of studies, and the interpretation of new monitoring results in the context of hypotheses. Since the penalties are parametric, non-consensus is allowable.

3 - Reconciliation of Inconsistencies in MAUT Weights

Richard Anderson, Asst. Professor, Duke University, Nicholas Sch. of Environment, Box 90328, Durham, NC, 27708, United States, richard.anderson@duke.edu, Robert Clemen

Multiple elicitations of MAUT weights by different methods is recommended decision-analytic practice, typically followed by attempts to reconcile any differences. An important question is what happens and what should happen during weight reconciliation. We address this issue, discussing previous research as well as results of a recent pilot study in an environmental decision context.

■ SB22

C-Room 206

DEA Theory & Application I

Cluster: Data Envelopment Analysis
Invited Session

Chair: Joe Zhu, Worcester Polytechnic Institute, Dept.. of Management, Worcester, MA, 01609, United States, jzhu@wpi.edu

Co-Chair: John Ruggiero, University of Dayton, 517 Miriam Hall, Dayton, OH, United States, John.Ruggiero@notes.udayton.edu

1 - Measuring Energy Efficiency in the Context of an Emerging Economy: The Case of Indian Manufacturing
Kankana Mukherjee, Department of Management, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA, 01609, kmukher@wpi.edu

In recent years the Indian economy has been striving to achieve a rapid growth rate. However, one of the challenges facing the economy is the high levels of energy supply that would be needed to sustain this growth path. Hence attaining energy efficiency is crucial for the economy. This paper examines the Indian manufacturing sector and utilizes Data Envelopment Analysis to obtain comprehensive measures of performance given the joint goals of achieving GDP growth as well as energy conservation.

2 - Prevalence of Anchor Points in DEA
Jose Dulá, Virginia Commonwealth University, School of Business, Richmond, VA, 23284, United States, jdula@vcu.edu, Marie-Laure Bougnol

Anchor points define the transition from the efficient frontier to the non-efficient part of the production possibility set. A recent realization is that these points are prevalent. We propose explanations for this phenomenon.

3 - Banking Efficiency with Stochastic Data
John Ruggiero, University of Dayton, 517 Miriam Hall, Dayton, OH, United States, John.Ruggiero@notes.udayton.edu, Alex Totomanov, Erin Landers

We analyze the technical efficiency of U.S. banks while accounting for statistical noise. This is achieved by aggregation of panel data.

■ SB23

C-Room 208

Modeling Behavior in Operations with System Dynamics

Sponsor: Behavioral Process Management (BPM)
Sponsored Session

Chair: Paulo Goncalves, Visiting Assistant Professor, MIT Sloan School of Management, 30 Wadsworth St. E53-339, Cambridge, MA, 02142, United States, paulog@mit.edu

1 - System Dynamics as a Structural Theory in Operations Management
Andreas Groessler, Associate Professor, Radboud University Nijmegen, Nijmegen School of Management, Nijmegen, 6500 HK, Netherlands, a.groessler@fm.ru.nl

The purpose of the paper is to demonstrate the usefulness (1) of system dynamics as a structural theory for and (2) of system dynamics models as content theories in operations management. The key findings are that, although feedback loops, accumulation processes, and delays exist and are widespread in operations management, often these phenomena are ignored completely or not considered appropriately.

2 - The Dynamic Interaction of First- and Second-Order Improvement
Brad Morrison, Assistant Professor, Brandeis International Business School, 415 South Street, Waltham, MA, 02454, United States, jbm@kurtsalmon.com

A mathematical model is developed to formalize the interaction between first-order improvements that boost output from existing processes and second-order improvements that enhance the capability of underlying processes. Results find tipping points in the dynamics of process improvement, identify perverse behaviors likely to thwart the intentions of practitioners, and show how the feedback structure of process improvement presents challenges to manage the dual pressures to produce and improve.

3 - Project Screening Biases in a Product Development Pipeline
Nitin Joglekar, Boston University, Boston, MA, United States, joglekar@bu.edu, Paulo Figueiredo

Product development pipelines, a special case of a service supply chain, suffer from the backlog bullwhip effect. We illustrate that screening can eliminate such backlog bullwhip. Statistical analysis of simulation results addresses a range of relevant decisions for a two-stage pipeline: the number of starts, screen thresholds, global biases towards frontloading the available resources and local biases while adjusting capacity utilization.

4 - Over-ordering and Channel Stuffing: Behavioral Causes of Product Returns
Paulo Goncalves, Visiting Assistant Professor, MIT Sloan School of Management, 30 Wadsworth St. E53-339, Cambridge, MA, 02142, United States, paulog@mit.edu

We study the problem of channel stuffing, caused by sales force attempts to meet short term individual objectives (e.g. meeting quarterly quotas) to the detriment of long term company goals (e.g., low transportation, returns, obsolescence costs), by developing a formal dynamic model of the interaction of sales effort allocation and channel stuffing and retailer over-ordering behavior through a model-based field study of the agribusiness industry.

■ SB24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Ziena Optimization, Inc. - Recent Developments in the KNITRO Optimization Solver
Richard Waltz, President, Ziena Optimization, Inc. 1801 Maple Ave, Evanston, IL, 60201, United States, waltz@ziena.com

This software demonstration will highlight recent developments in the KNITRO optimization solver. Particular attention will be paid to new techniques being developed for handling mixed-integer nonlinear programs (MINLP). The demo will also provide an overview of how to effectively use KNITRO in a variety of environments and applications.

2 - Lumina Decision Systems, Inc. - Analytica: What It Does That Spreadsheets Can't
Max Henrion, Lumina Decision Systems, Inc., 26010 Highland Way, Los Gatos, CA, 95033, henrion@lumina.com

A rare chance to see Analytica demonstrated by its originator: users prefer Analytica to spreadsheets because of its transparency, flexibility for multiple dimensions, efficient Monte Carlo, scalability and its powerful new Optimizer. Analytica models are typically 10 to 100 times more compact than equivalent spreadsheets, and correspondingly easier to build, understand and audit.

■ SB25

C-Room 210

Panel Discussion: Technology Management in the Service Sector

Sponsor: Service Science
Sponsored Session

Chair: Ruoyi Zhou, Management of Very Complex Service Systems, IBM, 650 Harry Road, San Jose, CA, 95120, United States, ruoyi@us.ibm.com

1 - Panel Technology Management in the Service Sector – Results of the PICMET 07 Symposium
Moderator: Antonie Jetter, Assistant Professor, Portland State University, P.O. Box 751, Eng. & Tech. Management, Portland, OR, 97207, United States, jettera@cecs.pdx.edu, Panelist: Tugrul Daim

During the 2007 PICMET conference on Technology Management, NSF sponsored a one day symposium on Technology Management in the Service Sector. Practitioners from service industries and researchers in technology management discussed critical research needs in the management of complex, technology-based service systems and jointly outlined future research directions. The key result of the symposium and its final report to NSF will be presented in the talk.

■ SB26

C-Room 211

Joint Session DM/ICS/Computational Methods for Data Mining: Statistical Modeling and Machine Learning Algorithms for Data Mining

Sponsor: Data Mining (Sponsored), INFORMS Computing Society, Computational Methods for Data Mining
Sponsored Session

Chair: Seoung Bum Kim, Assistant Professor, University of Texas at Arlington, 420K Woolf Hall, Arlington, TX, 76001, United States, sbkim@uta.edu

1 - Gaussian Process Models with Qualitative and Quantitative Factors
Zhiguang Qian, Assistant Professor, University of Wisconsin at Madison, zhiguang@stat.wisc.edu

Gaussian process models are prevalent in data mining applications. In this work, we extend such models to accomodate both qualitative and quantitative factors. The proposed methodology is illustrated with some real examples.

2 - Identifying Account Sharing Through Keystroke Dynamics Analysis
Sungzoon Cho, Professor, Seoul National University, Seoul, Korea, Republic of, zoon@snu.ac.kr, Seong-Seob Hwang

When online accounts are shared by users, the service provider suffers from lost revenue, membership under-estimation, and impaired customer understanding. In this work, we propose a biometric based approach. Whenever a user types a password for login, keystroke dynamics is measured and collected. An optimal number of clusters is estimated and then the account is classified as shared if it is larger than 1. An experiment involving 25 passwords and 16 users results in 60% to 90% accuracy.

3 - A New Recursive Family of Discrete Power-series Distributions
Bill Corley, Professor, IMSE Dept., The University of Texas at Arlington, Box 19017, Arlington, TX, 76019, United States, corley@uta.edu, Seoung Bum Kim

A new recursive family of discrete power-series distributions involving the generalized hypergeometric function is proposed. The general probability mass function, mean, variance, and probability generating function are given. New extensions of the Poisson, negative binomial, log-series, uniform, binomial, and hypergeometric distributions with an additional parameter are presented as examples.

4 - A General Framework for Monitoring of Dynamic Systems
Kwok-Leung Tsui, Professor, H. Milton Stewart School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA, United States, ktsui@isye.gatech.edu, Wei Jiang

This talk discusses strategies and techniques in data modeling, forecasting, and activity monitoring. We will propose a general strategy for modeling, forecasting, and monitoring of dynamic systems. In particular, we will discuss a statistical process control approach for business activity monitoring. We will also discuss a churn detection procedure for customer profile modeling. Some case studies in telecom and service industries will be used to illustrate the proposed methods.

■ SB27

C-Room 212

Optimization and Statistical Approaches to Data Mining

Cluster: Data Mining (Invited)
Invited Session

Chair: Theodoros Evgeniou, INSEAD, Bd de Constance, Fontainebleau, France, theodoros.evgeniou@insead.edu

1 - Global Optimization and Landscape Analysis for Clustering
Jeffrey Heath, Visiting Assistant Professor, Centre College, 600 West Walnut Street, Danville, KY, 40422, United States, jheath@math.umd.edu, Michael Fu, Wolfgang Jank

We investigate the fitness landscape of clustering problems and provide evidence for why clustering via Gaussian mixtures is a difficult global optimization problem. One of the classical approaches, the Expectation-Maximization algorithm, produces clusters that are only locally optimal. We introduce a new algorithm based on Model Reference Adaptive Search. Numerical experiments illustrate the effectiveness of the proposed algorithm in finding global optima, thereby improving the clustering task.

2 - Information Acquisition in Cost Sensitive Environments
Maytal Saar-Tsechansky, Assistant Professor, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States, Maytal.Saar-Tsechansky@mccombs.utexas.edu

As a data-driven paradigm data mining relies on the availability of data to derive patterns. Traditional data mining and machine learning does not consider acquisition of information that can be used for pattern induction or inference. In many applications, however, the traditional scenario is too simplistic. The talk discusses recent work on information acquisition policies designed to improve a variety of objectives including prediction accuracy and other decision tasks.

3 - Variational Inference for Large-scale Models of Discrete Choice
Jon McAuliffe, University of Pennsylvania, Wharton School, jon@mcauliffe.com, Michael Braun

We introduce variational methods for discrete-choice models, to conduct inference when datasets are too large for MCMC. Rather than using stochastic approximation, variational methods return a deterministic estimator of known functional form. The variational parameters approximate the posterior distribution more parsimoniously than MCMC, and are quicker to compute. The method avoids concerns like assessing MCMC convergence. We derive the algorithm, discuss some theory, and give results.

4 - Convex Optimization Methods for Understanding Customers Preferences and Recommending Products
Theodoros Evgeniou, INSEAD, Bd de Constance, Fontainebleau, France, theodoros.evgeniou@insead.edu

We present two methods for analyzing customer data using optimization and regularization theory. The first extracts a few product features that are important for all people. The second is a generalization of the first that also generalizes well-known methods for collaborative filtering for product recommendations. Experimental results and theoretical justifications show the potential, relative to state of the art methods, of regularization for parameter estimation using optimization techniques.

■ SB28

C-Room 213

Multiple Solutions for Combinatorial Problems

Sponsor: INFORMS Computing Society/ Metaheuristics
Sponsored Session

Chair: Emilie Danna, ILOG, Inc., 889 Alder Avenue, Suite 200, Incline Village, NV, 89451, United States, edanna@ilog.com

1 - Structural Similarity Measures for the VRP
Arne Lokketangen, Arne.Lokketangen@hiMolde.no, David Woodruff

A decision maker might be equally interested in a set of different, good solutions, than in just the optimal solution. There is thus a need to distinguish between good solutions, based on some other concept than quality alone. We produce measures of difference of the type proposed in the Psychology literature . We suggest several such functions for the class of VRP problems, basing our difference on the underlying structure of solutions.

2 - Diversity of Solutions: Methods and Applications
Stefan Voss, University of Hamburg (IWI), Institute of Information Systems, Von-Melle-Park 5, Hamburg, DE, 20146, Germany, stefan.voss@uni-hamburg.de, Peter Greistorfer

Recently considerable interest has been on finding solutions with good objective function values that are different from each other. Based on applications from telecommunications (e.g., 1+1 protection and fault tolerance in the SDH/WDM context), transportation (e.g., minimizing waiting time of transfer passengers) and evolutionary algorithms we illustrate the need for diverse solutions. Methods to determine them are based on MIP formulations as well as effective tabu search implementations.

3 - Selecting a Small Set of Diverse Solutions to Mixed Integer Programming Problems
David Woodruff, Professor, University of California, GSM, One Shields Avenue, Davis, CA, 95616, United States, dlwoodruff@ucdavis.edu, Emilie Danna

When solving a mixed-integer programming model, it is useful to obtain multiple feasible solutions of good quality rather than just one optimal solution. However, it is often impractical in applications to make use of a very large number of solutions. Instead, a small set of diverse solutions is more valuable. Given an oracle that generates a large number of solutions (CPLEX), we introduce several algorithms to select a small subset of solutions with high diversity.

■ SB29

C-Room 214

Interfacing to Coin-OR

Sponsor: INFORMS Computing Society/ICS/COIN-OR
Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

1 - Stochastic Modeling Interface for COIN-OR
Alan King, IBM Thomas J Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, kingaj@us.ibm.com

This talk presents current status and planned initiatives in the open-source COIN-OR respository www.coin-or.org. COIN-OR now contains a repository for stochastic modeling called Stochastic Modeling Interface, or Smi. Currently, Smi contains example code that converts (some version of) SMPS format to Open Solver Interface (Osi) compatible solvers — including Clp, CPLEX, FortMP, GLPK, Mosek, and XPRESS-MP, among others.

2 - COIN-OR/GAMSlinks: Hooking Your Solver to GAMS
Steven Dirkse, GAMS Development Corp., 1217 Potomac St NW, Washington, DC, 20007, United States, sdirkse@gams.com, Stefan Vigerske, Michael Bussieck

The GAMSlinks project at COIN-OR is dedicated to the development of links between GAMS and open source (e.g. COIN-OR) solvers. These links broaden the audience for COIN-OR solvers and provide solver developers with the quality assurance and benchmarking tools that come with GAMS. We show how to use the GAMSlinks project, highlight non-standard features of the present interfaces, give a short introduction on how to link your own solver to GAMS, and speculate about future developments.

3 - CoinMP: Simple C-API Windows DLL Implementation of CLP, CBC, and CGL
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, 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 standard C-API Windows DLL CoinMP.DLL that implements most of the functionality of CLP, CBC, and CGL.

■ SB30

C-Room 2A

Design and Analysis of Reliability Testing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Rong Pan, Assistant Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, Rong.Pan@asu.edu

1 - Optimal Design of Reliability Tests for Multiple Stresses
Rong Pan, Assistant Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, Rong.Pan@asu.edu, Huairui Guo

In this talk, we first review the optimal designs of single stress reliability tests and two-stress reliability tests, which is based on a degenerated single stress design. D-optimal design for multiple-stress reliability tests is then proposed for completed and censored data. Examples are provided for demostrating the proposed method.

2 - Non-linear Experimental Design Considerations for Reliability Testing with Censoring
Eric Monroe, Statistician, Intel Corporation, 5000 W. Chandler Blvd, Mailstop CH2-117, Chandler, AZ, 85226-3699, United States, eric.m.monroe@intel.com

Use Condition assessments for reliability typically require fitting an empirical model based on accelerated testing and extrapolating results to a less severe environmental condition. This presentation explores the importance of experimental design selection in fitting non-linear response surfaces for reliability testing with heavy censoring. Sensitivity analysis for sample size and interval sampling will be examined though a numerical study and compared to alphabetic optimization techniques.

3 - Explore Equivalence of Accelerated Testing Plans Using a Principal Stress Decomposition Approach
Haitao Liao, Assistant Professor, Wichita State University, 1845 Fairmount St., Industrial & Manufacturing Eng Dept., Wichita, KS, 67260-0035, United States, haitao.liao@wichita.edu, Elsayed Elsayed, Zhaojun Li

One challenge in ALT is to determine an efficient stress profile. We explore the equivalence of various ALT plans involving complex stress profiles. A stress decomposition approach is investigated, which decomposes a complex stress profile into principal stress elements. From the results, equivalent optimal test plans can be determined and optimized. The research finding is validated through a resistor ALT experiment involving both electrical and thermal stresses.

4 - Reliability Performance of Repairable Systems
Wendai Wang, Senior Reliability Methods Manager, Applied Materials, 3320 Scott Blvd., M/S 1117, Santa Clara, CA, 95052, United States, wendai_wang@amat.com

Many systems are indeed repairable in service. Reliability methodologies for repairables are so incomplete. Most engineering practices were adopted from non-repairable systems. Many assumptions are used consciously or unconsciously. This talk will review the existing methodologies for repairable systems, present studies on the TBF/TTR of the repairable systems, and provide some conclusions. The presentation is also intended to prompt more researches on reliability of repairable systems.

■ SB31

C-Room 2B

Joint Session HAS/Service Science: Quality and Statistical Decision-making in Healthcare Applications I

Sponsor: Quality, Statistics and Reliability, Health Applications Section, Service Science
Sponsored Session

Chair: Jing Li, Arizona State University, Tempe, AZ, United States, jinglz@umich.edu

Co-Chair: Julie Simmons Ivy, jsimmons@bus.umich.edu

1 - Policies for Prevention and Cure of Cervical Cancer Caused by Human Papilloma Viruses
Natarajan Gautam, Associate Professor, Texas A&M University, 235A Zachry, Mailstop 3131, College Station, TX, 77843, United States, gautam@tamu.edu, Piyush Goel, Hoda Parvin

We consider health care policy issues for prevention and cure of cervical cancer caused by Human Papilloma Virus (HPV) for which individuals can be tested and also given vaccinations. Policymakers are faced with the decision of how many cancer treatments to subsidize, how many vaccinations to be given and how many tests to be performed in each period of a given time horizon. We formulate and heuristically solve a Markov decision process to aid the decision-making.

2 - Theoretical Errors for Individual Measurements, Motivated by Models of Flu Activity
Justin Chimka, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, United States, jchimka@uark.edu, Jia Zhou

Consider situations in which the sample used for process monitoring consists of an individual unit. Our motivation comes from regression model-based control charts for influenza activity, where individual units are absolute values of residuals assumed to have come from gamma distributions. We have developed probability statements for computing true errors associated with statistical process control of continuously distributed individual measurements.

3 - Algorithm Combination for Improved Performance in Biosurveillance
Inbal Yahav, University of Maryland, Robert H Smith School of Business, College Park, MD, United States, iyahav@rhsmith.umd.edu, Galit Shmueli

Statistical research on disease outbreak detection using syndromic data has focused on modeling background behavior and anomaly detection. Such data contain known patterns and thus algorithms often comprise of initial preprocessing before monitoring the resulting residuals using SPC. Most studies combine one preprocessing technique and one control chart. Our approach combines algorithms via LP: We propose a method for combining preprocessing algorithms and one for combining control charts.

■ SB32

C-Room 302

Global Logistics Management

Cluster: Shipping, Maritime, and Supply Chain Logistics
Invited Session

Chair: Kee-hung Lai, Assistant Professor, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China, lgtmlai@polyu.edu.hk

1 - Evaluating Marketing Strategies for International Logistics Zones in Taiwan

Chin-Shan Lu, Professor, Cheng Kung University, No 1, University Road, Tainan, 701, Taiwan - ROC, lucs@mail.ncku.edu.tw

This research empirically evaluates marketing strategies of international logistics zones in Taiwan. Results suggest simplified customs procedures as the most important criterion, followed by efficiency of port operations, port facilities, geographic location, and tax incentives. Theoretical and practical implications of the research findings are discussed.

2 - An Integrated Model for Ship Routing and Berth Assignment with Transshipments

Anthony Pang, Lecturer, The Hong Kong Polytechnic University, M613, Li Ka Shing Tower, Department of Logistics, Hung Hom, HK, Hong Kong - ROC, lgtapang@polyu.edu.hk, Chung-Lun Li

Shipping companies that offer feeder services often seek to coordinate their ship routing and berthing operations. In this work, we consider an integrated model to support joint decisions in ship routing and terminal berth assignment, with some terminals serving as transshipment facilities. We propose a mathematical programming based heuristic, together with column generation techniques and local improvement schemes, for solving the problem.

3 - Characteristics and Trends of the Third Party Logistics Market in Mainland China

Mei Sha, Associate Professor and Deputy Director of Logistics Management program, Shanghai Maritime University, 1550 Pudong Dadao, Shanghai, 200135, China, meisha@cct.shmtu.edu.cn

The paper presents the characteristics and trends of the third party logistics (3PL) Market in Mainland China on the basis of identifying the main factors contributing to the China's logistics development, analyzing 3PL market from demand and supply perspective respectively and putting forward 3PL market structure in Mainland China.

■ SB33

C-Room 303

Urban Transportation Planning Models II: Dynamic Routing with Real-time ITS Information

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Alper Murat, Assistant Professor, Wayne State University, 2051 Manufacturing Engineering Bldg., 4815 Fourth St., Detroit, MI, 48202, United States, amurat@wayne.edu

1 - Dynamic Traffic Rerouting with Feedback Loop from Infrastructure

Andrew Even, M.S. Candidate, Grand Valley State University, 301 W Fulton Street, Grand Rapids, MI, 49504, United States, akeven@gmail.com, Shabbir Choudhu, Charles Standridge

In near future, intelligent transportation system will allow real time feedback to the vehicles traveling in a particular route. In case of a distress condition in the downstream, this algorithm will compute the most cost effective route to get back to the original travel path based on the overall traffic conditions in the surrounding arterial routes.

2 - Enabling Congestion Avoidance in Stochastic Transportation Networks Under ATIS

Ali Guner, PhD Candidate, Wayne State University, 4815 Fourth St., WSU Industrial Eng., Detroit, MI, 48201, United States, arguner@wayne.edu, Madhusalini Saripalle, Ratna Babu Chinnam, Alper Murat

In JIT manufacturing environments, on-time delivery is the key performance measure for dispatching and routing of freight vehicles. In this study, we propose exact and heuristic solution approaches for dynamic vehicle routing. Our basic model is a non-stationary stochastic shortest path problem which uses both real-time recurring congestion and incident information. We present computational results for several network scenarios.

3 - Modeling Incidents for Dynamic Vehicle Routing Applications

Madhusalini Saripalle, PhD Candidate, Wayne State University, 471, Kensington Dr., Apt#228, Rochester Hills, MI, 48307, United States, madhusalini@wayne.edu, Ali Riza Guner, Ratna Babu Chinnam, Alper Murat

Over 50 percent of travel time delays are accountable to non-recurrent congestion such as incidents. Despite its importance, state-of-the-art dynamic routing algorithms assume away the effect of these incidents on travel time. We propose alternative models to estimate incident induced delays which can be integrated with dynamic routing algorithms. These models use real-time information from various ITS sources, such as loop-sensors.

4 - Web Based Data Repository for Collaboration Among ITS Researchers

Visnu Yada, M.S. Candidate, Grand Valley State University, 301 W Fulton Street, Grand Rapids, MI, 49504, United States, vishnu_yada@yahoo.com, Shabbir Choudhu, Charles Standridge

The overall growth in the transportation network, new development in vehicle to vehicle and vehicle to infrastructure communications, and demand for safety has considerably increased the research activity in the related fields. In order to produce the maximum effect, it is essential to provide collaboration opportunities among researchers. This presentation addresses the issue of collaboration over the internet.

■ SB34

C-Room 304

Vehicle Routing

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Maciek Nowak, Assistant Professor, Georgia Southern University, P. O. Box 8154, Statesboro, GA, 30460, United States, mnowak@georgiasouthern.edu

1 - Capacitated Period Routing

David Ronen, Professor of Logistics and Operations Management, University of Missouri-St. Louis, 214 Computer Center Bldg., One University Boulevard, St. Louis, MO, 63121-4499, United States, david.ronen@umsl.edu

With increased productivity and expanding demand less and less spare capacity is available in operations. We designed a system for planning store deliveries at a major retailer. This is a Period (Vehicle) Routing Problem with tight constraints on DC picking volume and on transportation capacities. We took a three-stage approach, at the core of which is an ILP model for assigning store clusters to weekly delivery patterns.

2 - Effects on Benefit of Split Loads for the Pickup and Delivery Problem

Maciek Nowak, Assistant Professor, Georgia Southern University, P. O. Box 8154, Statesboro, GA, 30460, United States, mnowak@georgiasouthern.edu, Chip White, Ozlem Ergun

A decrease in cost has been shown when split loads are allowed for the Pickup and Delivery Problem. We show how the following effect the benefit of split loads: load size, load size variability, origin and destination clustering, and the frequency with which loads share origins or destinations. These effects are shown for both randomly generated problem instances and a real world case.

3 - Approximations to the Length of VRP Problems

Miguel Figliozzi, Assistant Professor, Portland State University, 1930 SW 4th Avenue, Suite 200, Portland, OR, United States, figliozzi@pdx.edu

This presentation discusses approximations to the length of Vehicle Routing Problems (VRP). Formulas to approximate the length of vehicle routes are proposed. Instances with different patterns of customer spatial distribution, time windows, customer demands, and depot locations are used to test the proposed approximations. Expressions for the incremental cost of serving an additional customer or increasing the number of routes are derived and estimated.

4 - Branch-and-price for Dynamic Drayage Vehicle Routing Problem

Guangming Zhang, Northwestern University, 2145 Sheridan Rd C231, Evanston, IL, 60201, United States, g-zhang@northwestern.edu, Alan Erera, Karen Smilowitz

This research explores the dynamic nature of drayage operations. A linear approximation function is embedded in the stochastic formulation to quickly calculate the recourse cost, and a branch-and-price solution method along time horizon is applied to provide timely schedules as well as strategies for practical implementation.

■ SB35

C-Room 305

Crossdocks and Warehouses

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Hector Carlo, Assistant Professor, University of Puerto Rico - Mayaguez, Department of Industrial Engineering, P.O. Box 9043, Mayaguez, PR, 00981, Puerto Rico, hcarlo@uprm.edu

1 - Order Batching and Vehicle Selection in a Parallel-aisle Warehouse with Time-Constraints

Soondo Hong, PhD Student, Dept.. of Industrial and Systems Engineering, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843, United States, hongs@tamu.edu, Brett Peters

We present a small-item order batching model in a parallel-aisle warehouse with multiple constraints and vehicles. An order picker repeatedly travels and collects orders with fixed cycle time and capacity limit. A branch-and-price algorithm is developed for selecting vehicle technologies and batching orders to minimize the total picking time using the S-shape strategy.

2 - Optimal Inbound Trailer Allocation at a Crossdock – Optimizing Operations and Balancing Workload

Claudia Rosales, University of Cincinnati, 523 Lindner Hall P.O. Box 210130, Cincinnati, OH, 45221, United States, rosalecr@email.uc.edu, Michael Fry, Rajesh Radhakrishnan

Transfreight, LLC is a third-party logistics provider that supports Toyota's lean manufacturing operations in North America. Our work provides the optimal allocation of inbound trailers to docks at a crossdocking facility operated by Transfreight. We focus on improving the efficiency of operations as well as balancing workload among crossdock workers. Model implementation is performed using both a spreadsheet-based solver and CPLEX. The advantages/disadvantages of each option are discussed.

3 - Cross-dock Design and Door Assignment Properties

Hector Carlo, Assistant Professor, University of Puerto Rico - Mayaguez, Department of Industrial Engineering, P.O. Box 9043, Mayaguez, PR, 00981, Puerto Rico, hcarlo@uprm.edu, Yavuz Bozer

We examine the optimal shape of a rectangular cross-dock and the best door locations relative to travel distances. Also, several properties of optimal outbound trailer-to-door assignments are identified for certain types of flows. Results for some properties pertaining to alternating doors assignments, and volatile and narrow range trailers are presented.

■ SB36

C-Room 306

Transportation II

Contributed Session

Chair: L Douglas Smith, Professor, University of Missouri-St. Louis, One University Blvd., St. Louis, MO, 63121, United States, ldsmith@umsl.edu

1 - Strategies for Pruning Stochastic Dynamic Networks: An Application to Hazmat Route Selection Problem

Sumeet Desai, University of Houston, 4800 Calhoun Rd, Houston, TX, 77054, United States, sdesai5@uh.edu, Gino Lim

We propose three strategies for pruning stochastic dynamic networks to expedite the process of obtaining optimal routing policies. The strategies for reducing the network size include: use of static upper/lower bounds, preprocessing, and a mix of pre-processing and upper/lower bounds. Our experiments show that while finding optimal routing policies in stochastic dynamic networks, last two of the three strategies have a significant computational advantage over dynamic programming.

2 - Travel Time Estimation Using Regression Trees

Rasaratnam Logendran, Professor, Oregon State University, Dept.. of Industrial and Mfgr. Engr., 118 Covell Hall, Corvallis, OR, 97331-2407, United States, logendrr@engr.orst.edu, Lijuan Wang, Lei Zhang

We report the use of regression trees for reliably estimating travel times on road segments. Several independent variables are considered to include flow rate and occupancy, along with incidents, work zones and weather for non-recurring congestion, and time of day and day of week for recurring congestion. The loop-detector data on PORTAL, for the I5-I205 loop in Portland, Oregon, is used to demonstrate the applicability of regression trees even when the independent variables are correlated.

3 - Neural Networks for Mode Choice for Long Distance Travel in the USA

Isaradatta Rasmidatta, Wilbur Smith Associates, 4925 Greenville Avenue, Suite 1300, Dallas, TX, 75206, United States, Irasmidatta@wilbursmith.com

Long distance travel (more than 50 miles) has been rapidly increasing every year due to economic growth and activity. In order to improve infrastructure investment strategies and their accuracy, the characteristics that influence long-distance trips in USA are analyzed by Neural Networks to specify mode choices.

4 - A Scheduling Model for the Marshalling Station

Shidong Wang, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, wsd03@mails.tsinghua.edu.cn

In Chinese marshalling station, the freight cars will be broken-up or made-up indicated by three scheduling plans with different time horizon: 1.daily plan is a master plan which will consider the capacity of a marshalling station; 2.stage plan is a detail plan which determines the detail sequence of the broken-up or made-up trains for the next 3 or 4 hours; 3. shunting operation plan determines how to break up or make up a specific train. These plans have to consider the resources such as the cars, tracks, locomotives, hump and so on. Up to now, these plans are generated by handwork, in the paper we try to establish two mathematic models according to the decision process of generating these plans: 1.the dispatching model which is applied to the car flow dispatching process; 2. single machine scheduling:1/rj/Eu which is used for the decision of break-up or make-up sequence. The objective is to minimize the total detention time of inbounds cars. By analyzing the complexity of these models, we propose the heuristic algorithm to solve the problems efficiently for the marshalling station. Finally, we introduce a prototype of decision support system to implement the algorithm of models.

5 - Scheduling To Improve System Performance in a Series of River Locks

L Douglas Smith, Professor, University of Missouri-St. Louis, One University Blvd., St. Louis, MO, 63121, United States, ldsmith@umsl.edu, Dirk C. Mattfeld, Robert Nauss

A series of five locks form a transportation bottleneck in the upper Mississippi River navigation system. Scheduling operations for immediate efficiency at individual locks creates problems upstream or downstream and favors some users over others. With computer simulation, we show the effects of scheduling lockage operations with differential consideration to immediate efficiency, future flexibility, and user equity.

■ SB37

C-Room 307

Military OR Applications

Sponsor: Military Applications
Sponsored Session

Chair: James Moore, The Air Force Institute of Technology, AFIT/ENS Bldg 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433-7765, United States, james.moore@afit.edu

1 - Classifying Hyperspectral Imagery via a Novel Method for Augmentation by Contextual Information

Robert Brigantic, Pacific Northwest National Laboratory, 902 Battelle Blvd., P.O. Box 999, Richland, WA, 99352, United States, robert.brigantic@pnl.gov, Lawrence Chilton

This presentation summarizes a method for improved performance of Bayesian classifiers for hyperspectral imagery via a novel method for augmentation by considering contextual information. In particular, we present the use of a modified form of the Iterated Conditional Modes (ICM) method. We show this method can significantly outperform standard Bayesian classification techniques. We then generalize this modified approach for performing hyperspectral imagery classification.

2 - Up, Up, and Away: A Network Flow Approach to a Pilot Scheduling Problem

Anthony Illig, Air Force Institute of Technology, AFIT/ENS, Bldg 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433-7765, United States, Anthony.Illig@afit.edu, August Roesener

We present a network flow linear program to schedule newly commissioned United States Air Force pilots into initial skills training. The solution schedules pilots graduating from different sources at different times to one of each of the courses in the initial skills training sequence: Air and Space Basic Course, Introductory Flight Screening and Undergraduate Pilot Training. The goal of the optimization is to minimize the total number of unproductive days students spend waiting for training.

3 - The Advanced Collaborative System Optimization Model (ACSOM)

Doug Rogers, General Dynamics Land Systems, 38500 Mound Rd., Sterling Heights, MI, 48310, rogersd@gdls.com, Gregory Hartman, Michael Donnell, Jeffrey Czerniak, Stephen Rapp

ACSOM is a tool that mathematically optimizes models representing systems using multi-criteria mathematical optimization (binary). Due to the conflicting nature of criteria there is no single solution that would optimize all objectives simultaneously; a set of optimal non-dominated solutions known as Pareto solutions are determined. ACSOM has been applied to the M-1 Abrams System Enhancement, Future Combat Systems Manned Ground Vehicle and the Marine Corps Expeditionary Fighting Vehicle.

4 - Optimization Challenges to Layered Sensing for Persistent ISR

Djuana Lea, Operations Research Analyst, Air Foce Research Lab/Sensors Directorate, 2241 Avionics Circle, AFRL/SNAT, Bldg 620, Rm 3BW74, WPAFB, OH, 45433, United States, djuana.lea@wpafb.af.mil, Juan Vasquez, Barry Secrest, Olga Mendoza

The Sensors Directorate of AFRL has initiated research in the area of Layered Sensing that seeks to integrate the sensing, processing and control of sensor assets operating at various altitudes and resolutions. We will present an overview of layered sensing and the optimization challenges associated with its implementation. Specifically, optimization problems in the areas of cooperative control, sensor resource management, and algorithm resource management will be addressed.

■ SB38

C-Room 308

Marketing II

Sponsor: Marketing Science
Sponsored Session

Chair: Gary Erickson, Professor, University of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, erick@u.washington.edu

1 - An Analysis of Inflationary and Competitive Click Fraud

Kenneth Wilbur, Assistant Professor of Marketing, University of Southern California, Marshall School of Business, 3660 Trousdale Parkway, ACC 306E, Los Angeles, CA, 90089, United States, kwilbur@marshall.usc.edu, Simon Anderson, Yi Zhu

We use an analytical model to investigate the effects of click fraud. We find three main results. First, when inflationary click fraud is deterministic and known to both firms, it does not alter the auction outcome, firms' advertising costs, or gatekeeper revenues. Second, when inflationary click fraud is stochastic, the high bidder may reduce its budget to hedge against high levels of invalid clicks. Third, we show that competitive click fraud may increase or decrease gatekeeper revenues.

2 - Quality and Advertising in a Vertically Differentiated Market

Elie Ofek, Associate Professor, Harvard Business School, Boston, MA, 02163, United States, eofek@hbs.edu, Zsolt Katona

We examine firms' quality positions when consumers only consider products they are aware of. Under blanket advertising, we identify conditions for one firm to choose a high quality product, but because its rival positions close by, it selects a low ad expenditure to avoid fierce price competition. Under targeted advertising, we identify conditions such that both firms choose high quality products, but advertise to different segments. This can result in a middle pocket of unserved consumers.

3 - Product Durability and Channel Choice Under Extended Producer Responsibility

Sudheer Gupta, Simon Fraser University, 8888 University Drive, Burnaby, BC, Canada, sudheerg@sfu.ca, Ravi Subramanian

As environmental concerns mount, an increasing number of durable goods fall under the umbrella of extended producer responsibility (EPR). We examine the impact of EPR policies on manufacturers' choice of optimal product durability and channel coordination incentives. We show how some commonly used contractual forms, such as two-part tariffs, quantity discounts, leasing, and buy-backs perform under EPR and their effect on the manufacturer's incentive to practice planned obsolescence.

4 - Optimal Pricing and Advertising Policies for an Entertainment Event

Steffen Jorgensen, Department of Business and Economics, University of Southern Denmark, Odense, Denmark, stj@sam.sdu.dk, Peter M. Kort, Georges Zaccour

The paper determines optimal pricing and advertising policies for an entertainment event, taking into account diffusion effects and a last-minute market. We consider a setup where period-by-period constant prices are combined with continuous advertising. The organizers of the event sell tickets at regular price and advertise the event during an initial period of time. If tickets are not sold out by the end of this period, there is a last (short) period before the event in which tickets are sold at a reduced price. In this period no advertising is done. We find that advertising should be decreased over time, as word-of-mouth communication becomes more intensive. Depending on the values of the model parameters, it may be optimal not to advertise at all, to advertise at a positive rate until the end of the regular sales period, or to stop advertising at some earlier instant of time. If word-of-mouth effects are absent, advertising (if any) should be done at a uniform rate. In the last-minute sales period, the organizers implement a feedback pricing policy such that the selected price depends on the number of tickets that have been sold in the regular sales period.

■ SB39

C-Room 309

Health Policy for the Care Delivery

Sponsor: Health Applications Section
Sponsored Session

Chair: Beste Kucukyazici, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A 1G5, Canada, bkucuk@po-box.mcgill.ca

1 - Getting OR Tools into the Hands of Users: Development of a Blood Donor Clinic Simulation

John Blake, Associate Professor, Dalhousie University, Industrial Engineering, P.O. Box #1000, Halifax, NS, B3J 2X4, Canada, john.blake@dal.ca, Sean Sangster, Candy Lipton

Optimizing the flow of donors through blood clinics is a difficult management task because of the competing objectives of minimizing donor delay (and thus keeping donors satisfied and likely to return) while containing the cost of operations. In this paper we present the results of a project designed to give clinic planners tools to assist them in the complex task of balancing customer service requirements with cost minimization strategies.

2 - Evaluating the Potential of Radio Frequency Ablation for the Treatment of Non-small Cell Lung Cancer

Lauren Cipriano, Research Scientist, Institute for Technology Assessment, 101 Merrimac Street, 10th Floor, Boston, MA, 02114, United States, Lauren@mgh-ita.org, Chung Yin Kong, Pamela McMahon, Scott Gazelle, Jo-anne Shepard, Michael Lanuti

Due to high rates of comorbid disease not all early-stage non-small cell lung cancer patients are eligible for potentially curative surgical resection. Radiofrequency ablation of early stage lung cancers has been demonstrated to be safe and effective in small studies, but long term data are unavailable. Using a microsimulation model of lung cancer we determine the effectiveness and cost effectiveness of using radiofrequency ablation to treat patients ineligible for ideal conventional therapy.

3 - Determining Effective Patient Flow Through Petri Nets

Renata Kopach- Konrad, Purdue University Industrial Engineering, 315 N. Grant St., West Lafayette, IN, 47907, United States, rkopach@purdue.edu, Mark Lawley, Imran Hasan

Hospital patient flow has tremendous implications on the delivery of care and on hospital finances. Focusing on overcrowding and resource loading, patient flow models of a hospital are developed using Petri Nets. These models are used to determine the minimum sequence of events leading a hospital from a desirable operating state to an undesirable state such as ambulance diversion. A two-phase mixed-integer programming formulation is used to generate this sequence.

4 - Robust Management of Motion Uncertainty in Radiation Therapy Treatments

Timothy Chan, MIT, 77 Massachusetts Ave., E40-130, Cambridge, MA, United States, tcychan@MIT.EDU, Alexei Trofimov, Thomas Bortfeld, John Tsitsiklis

In the context of patient care for life-threatening illnesses, the presence of uncertainty may compromise the quality of a treatment. In this talk, we present a robust framework to optimize radiation therapy treatments (subject to realistic uncertainties) for cancer patients. We illustrate our results on a clinical case where the uncertainty is due to organ motion during treatment.

■ SB40

C-Room 310

Stochastic Models in Health Care

Sponsor: Health Applications Section
Sponsored Session

Chair: Oguzhan Alagoz, Assistant Professor of Industrial and Systems Engineering, University of Wisconsin-Madison, 3162 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53706, United States, alagoz@engr.wisc.edu

1 - A Markov Decision Process Model for Optimal Timing of Biopsy in Breast Cancer Diagnosis

Jagpreet Chhatwal, University of Wisconsin-Madison, 4126 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53706, United States, jchhatwal@wisc.edu, Oguzhan Alagoz, Elizabeth Burnside

While diagnosing breast caner, 55-85% of the breast biopsies turn out to be benign, resulting in anxiety for the patients and unnecessary treatments. We use Markov Decision Processes (MDP) to find the optimal timing of the biopsy that maximizes the total quality-adjusted expected life of each patient. Our results also show that optimal biopsy decisions are age-dependent.

2 - Identifying the Critical Patient: Finding the Balance Between Undertriage and Overtriage

Serhan Ziya, Assistant Professor, Department of Statistics and Operations Research University of North Carolina, Chapel Hill, NC, ziya@email.unc.edu, Nilay Argon

Two common mistakes during patient triage are undertriage and overtriage, which are assigning a patient respectively a lower and a higher priority than what the patient's condition actually requires. Although a certain level of undertriage and overtriage is unavoidable, one can choose to be lenient towards one way or the other. In this talk, we use queueing models to generate insights on how triage decisions need to be made so as to keep the right balance between undertriage and overtriage.

3 - A Shadow Price Framework for Quantifying Health Care Spending and Discrimination

Chris P. Lee, Assistant Professor, The Wharton School, Univ. of Pennsylvania, 3730 Walnut St., Suite 500, Philadelphia, PA, 19104, United States, cpclee@wharton.upenn.edu, Glenn Chertow, Stefanos Zenios

Has health care spending become excessive? What is your life worth? Does the health care system discriminate based on race? Researchers have tried to address these questions empirically. We take on an alternative approach and use a large-scale, population-based optimization model coupled with observed data to answer these questions.

4 - Optimizing Liver Allocation System Incorporating Patients' Choices and Disease Evolution

Fatih Safa Erenay, PhD Student, University of Wisconsin-Madison, 501 N Midvale Blvd AptC, Madison, WI, 53705, United States, erenay@wisc.edu, Mustafa Akan, Oguzhan Alagoz, Baris Ata

We propose a more efficient liver allocation system considering patient preferences, where efficiency is measured by various performance measures such as number of wasted organs or total quality adjusted life years of patients. We capture the dynamics of disease evolution by a fluid model, whose solution leads to an intuitive dynamic index policy for assigning livers. The indices depend on acceptance probabilities, immediate rewards, and the shadow prices calculated from a dual dynamical system.

■ SB41

C-Room 3A

Optimizing Real Life Networks with Catastrope Consideration

Sponsor: Optimization/ Optimization and Computing in Medicine and Life Sciences
Sponsored Session

Chair: W. Art Chaovalitwongse, Assistant Professor, Rutgers University, 96 Frelinghuysen Rd, Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu

1 - A Dynamic Transportation Decision Support System for Hurricane Evacuation

Tiravat Assavapokee, Assistant Professor, University of Houston, 4800 Calhoun Street, Houston, TX, 77204, United States, tiravat.assavapokee@mail.uh.edu, Arab Naser, Sumana Raghuram

In this work, we describe some mathematical models and heuristics methods for dynamic network optimization based solution framework that effectively integrates the evacuation routing and scheduling and logistics support planning. This tool is expected to provide an intelligent systematic methodology that can be used by transportation planners and emergency management agencies to improve traffic management during hurricane evacuation.

2 - Evacuation Time Estimation in an Emergency Situation for Hospitals

Davood Golmohammadi, Rutgers University, 703 Bevier Rd, Piscataway, NJ, 08854, United States, davood@rci.rutgers.edu, Mohsen Jafari, Haleh Valian

In this paper, a set of functions is presented which estimates the evacuation time in an emergency situation for hospitals instead of developing a complex simulation model. These functions are not for specific layout conditions. They are flexible so that they can be used in any hospital. The functions are applied for 19 different evacuation scenarios in a hospital as part of a case study. The results are compared to the simulation model, which has been already prepared for the hospital in the case study. The results show how these functions create valuable results without using costly simulation models.

3 - Optimization Framework to Support Always-on Streaming Services: Applications to IPTV Service

W. Art Chaovalitwongse, Assistant Professor, Rutgers University, 96 Frelinghuysen Rd, Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu, Meeyoung Cha, Sue Moon, Zhe Liang

We present a novel optimization model for always-on streaming services, which involve multilayer networks. The objective of provisioning always-on services is to minimize the communication cost subject to security and reliability constraints, in the case of operational failures and catastrophic events. IPTV multicasting is a case study in this talk. We propose two new solution approaches: multi-objective greedy search algorithm and column generation framework with branch-and-price procedure.

■ SB42

C-Room 3B

Infectious Disease Prevention and Treatment Models

Cluster: Operations Research in Medicine and Health Care
Invited Session

Chair: Elisa Long, PhD Candidate, Stanford University, 467 Terman Engineering Center, Stanford, CA, 94305, United States, elisa46@stanford.edu

1 - Improving WHO Guidelines: HIV Monitoring Strategies in Resource-Poor Settings

Eran Bendavid, Stanford University, 117 Encina Commons, Stanford, CA, 94305, United States, ebd@stanford.edu, Douglas Owens

The response to the HIV epidemic in Africa is changing from crisis management to a strategic plan. Guidelines about treatment are changing to reflect HIV management as a chronic disease. Monitoring patients with CD4 and viral load counts remain the most important tools for treatment initiation, change, and discontinuation. We present a cost-effectiveness analysis of disease monitoring strategies in South Africa using a simulation model and discuss the implications of our findings.

2 - Optimal Allocation of HIV Prevention and Treatment Resources

Elisa Long, PhD Candidate, Stanford University, 467 Terman Engineering Center, Stanford, CA, 94305, United States, elisa46@stanford.edu, Margaret Brandeau, Douglas Owens

Given a limited budget, the optimal resource allocation among competing HIV prevention and treatment programs can depend on local epidemic factors, such as disease prevalence and the primary transmission modes. We aimed to determine an efficient allocation of funds among interventions including HIV screening, antiretrovirals, preventive and therapeutic vaccines, and male circumcision, and across multiple risk groups. We present our epidemic and economic model and discuss our empirical findings.

3 - Cost Effectiveness of Hepatitis B Screening and Vaccination Among Adult Asian and Pacific Islanders

David Hutton, PhD Student, Stanford University, 380 Panama Street, Stanford, CA, 94305, United States, billdave@stanford.edu, Daniel Tan, Margaret Brandeau, Samuel So

As many as ten percent of adult Asian and Pacific Islanders in the United States are chronically infected with Hepatitis B and about two out of three of those are unaware of their infection. We present a mathematical Markov model that evaluates the cost-effectiveness of screening, treatment, and vaccination policies targeted to Asian and Pacific Islander adults.

4 - Cost Effectiveness of Contact Tracing

Benjamin Armbruster, Stanford University, 121 W. Campus Dr. #1405A, Stanford, CA, 94305, United States, armbruster@stanford.edu, Margaret Brandeau

Contact tracing (also known as partner notification) is a primary means of controlling infectious diseases such as TB, HIV, and STDs. However, little work has been done to determine the optimal level of investment in contact tracing. We develop and apply a simulation model of contact tracing and the spread of an infectious disease among a network of individuals in order to evaluate the cost and effectiveness of different levels of contact tracing.

■ SB43

S-Grand Ball. A (Lev. 2)

2007 Franz Edelman Award Finalists Reprise

Cluster: O.R. Practice
Invited Session

Chair: Brian Denton, Senior Associate Consultant, Mayo Clinic, 200 First St. SW, Rochester, MN, United States, Denton.Brian@mayo.edu

1 - DaimlerChrysler / J.D. Power: Pioneering Scientific Price Customization in the Automobile Industry

Jorge Silva-Risso, Assistant Professor, University of California, Riverside, 201 Anderson Hall, Riverside, CA, 92521, United States, jorge.silva-risso@ucr.edu, Alexei Khavaev, William Shearin, Irina Ionova, Deirdre Borrego

We present a model developed to improve the effectiveness and efficiency of automakers pricing and promotions decisions (about $45 billion each year in the US). The approach is based on a random effects multinomial nested logit model of product, acquisition (purchase, lease) and program-type (rebates, reduced APR, etc.) choice. A hierarchical Bayes structure is used to capture response heterogeneity at the local market level. Chrysler estimates annual savings to be about $500 million.

2 - Procurement Risk Management (PRM) at Hewlett-Packard Company

Venu Nagali, Distinguished Technologist, Hewlett-Packard, 6000 Irwin Road, Mt. Laurel, NJ, 08054, United States, venu.nagali@hp.com, Jerry Hwang, Patrick Scholler

Supply chain risks due to product demand, component cost & availability uncertainties can have a significant impact on a manufacturing company's top- & bottom-line performance. We have employed OR to develop & implement a model, business process, & software in order to measure & manage supply chain risks. In FY'06, the PRM approach helped manage over $7B of HP's spend, resulting in material-cost savings of $128M. Over the past 6 years, >$425M in cumulative total cost savings have been realized.

3 - Operations Research Enhanced Supply Chain Management at ARSC, US Coast Guard

Vinayak Desphande, vinayak@exchange.purdue.edu, Ananth. V. Iyer

We describe a series of projects at the US Coast Guard (USCG) Aircraft Repair and Service Center (ARSC) that demonstrate the value of Operations Research methodologies for efficient Supply-Chain management. These projects provided critical decision support for planning various repair and maintenance activities at ARSC. ARSC has been transformed from a data rich and knowledge poor decision support culture to an OR ingrained decision making environment.

■ SB44

S-Grand Ball. B (Lev. 2)

Teaching Case Competition II

Sponsor: INFORM-ED
Sponsored Session

Chair: Chris Zappe, Interim Dean, Bucknell University, 701 Moore Avenue, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

1 - Presentations of Finalists #3 and #4 for the Eighth INFORMS Case Competition

Chris Zappe, Interim Dean, Bucknell University, 701 Moore Avenue, Lewisburg, PA, 17837, United States, zappe@bucknell.edu

The four finalists for the 2007 INFORMS Case Competition will deliver final presentations of their cases to a panel of judges and the audience. All are welcome to attend and observe these presentations as well as ask questions of the finalists. The winner of the competition will be selected by the judges at the end of the four presentations. The winner and the runners-up will be announced at the INFORM-ED Annual Business Meeting.

■ SB45

S-Capitol Hill (Lev. 3)

Practice of Risk Management

Sponsor: Financial Services
Sponsored Session

Chair: Gill Eapen, Founder and Managing Principal, Decision Options, LLC, 94 Anchorage Circle, Groton, CT, 06340, United States, geapen@decisionoptions.com

1 - SamsungCard Consumer Lending Model (SCLM)

Jaeyung Huh, PhD Senior Manager, Samsung Card Company, 1-7 Yeonji-Dong, Jongro-Gu, Seoul, Korea, Republic of, jaeyung.huh@samsung.com, Woojin Chang, Jae Yong Lee

The available credit risk assessment models are inadequate for the risk management for consumer lending business. We introduce a Samsung Card's consumer lending model. In this model we can predict cash flow, estimate the management indices reflecting the obligors' delinquency transition behavior, set a management goal through the analysis of actual business record, evaluate the portfolio responding to the change of firm's lending strategy, and conduct more efficient portfolio management.

2 - Real Options

Gill Eapen, Founder and Managing Principal, Decision Options, LLC, 94 Anchorage Circle, Groton, CT, 06340, United States, geapen@decisionoptions.com

Traditional finance based on Capital Asset Pricing Model and Discounted Cash Flow analysis does not work well in situations that present a high level of uncertainty and decision flexibility. In such cases, a more holistic approach, decision options analysis incorporates embedded option like characteristics in decisions. Although this approach has been well researched there are still many misconceptions in practice. This paper illustrates why such misconceptions exist and how to overcome them.

3 - Value Based Management

Ian Williams, Decision Options, LLC, 94 Anchorage Circle, Groton, CT, 06340, United States, iwilliams@decisionoptions.com, Gill Eapen

Pharmaceutical Industry invests large amounts in Research and Development on drug candidates exhibiting high levels of uncertainty and decision flexibility. Allocating capital into these research projects is often inefficient either due to the application of traditional techniques or more qualitative processes at work. Through a series of examples, we illustrate how such companies practice better project selection, portfolio management, and enter into collaborative arrangements with partners.

4 - Long-short Portfolio Optimization with Discrete Asset Choice Constraints and Two Risk Measures

Gautam Mitra, Distinguished Professor and Director, CARISMA-Brunel University/ Optirisk Systems, John Crank Building, Uxbridge, UB8 3PH, United Kingdom, gautam.mitra@brunel.ac.uk, Diana Roman, Ritesh Kumar

We consider long-short portfolio optimization in the presence of two risk measures: variance and CVaR and discrete asset choice constraints of (i) buy and sell thresholds (ii) cardinality restriction on portfolio positions. Our model improves upon the classic mean-variance model by controlling both portfolio variance and CVaR. Our long-short extension to the mean-variance-CVaR model incorporates industry practices regarding short decisions. We test models on real data from the FTSE 100 index.

■ SB46

S-Ballard (Lev. 3)

Agent-based Modelling of Energy Markets

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Augusto Ruperez Micola, Research Fellow, IMD - Institute for Management Development, Chemin de Bellerive, 23, Lausanne, 1007, Switzerland, Augusto.RuperezMicola@imd.ch

1 - On Learning in Policy Space by Oligopolists in Electricity Markets

Steve Kimbrough, Professor, Wharton School, 3730 Walnut Street, Suite 500, Room 565, Philadelphia, PA, 19104, United States, kimbrough@wharton.upenn.edu, Fred Murphy

We report on our modeling investigations into bidding by oligopolists in electricity markets. We report in particular on modeling results involving learning in policy space by the oligopolists. In such models, agents are endowed with a consideration set of policies for bidding in the market. The agents then individually engage in learning to discover which policy (or policies) is (are) most profitable.

2 - Adaptive Agents Using Dynamical Systems Learning Algorithm in Electricity Markets

Gerald Sheblé, Professor, University of Iowa, gbsheble@ece.pdx.edu, M.P. Cheong

Electricity market structure is still under design. Market participants are challenged to adapt to changes in the environment. Efforts propose game theory models and evolutionary learning approaches to emulate market participant behaviors. We show data mining to switch between learning schemes. Strategies between companies are modeled. Each firm predicts current and future conditions. Switching criterion between different models seeks to guarantee maximum expected profit over future time horizon. Each scheme is compared with participants that use only one learning scheme.

3 - Investigating the Dynamics in Two-settlement Electricity Markets Using Agent-based Model

Daniel J. Veit, Professor, University of Mannheim, Schloss, Mannheim, BW, 68131, Germany, veit@uni-mannheim.de, Anke Weidlich

We investigate a two-settlement electricity market and its economic outcome in comparison with a single-settlement market. Generators sign strategic forward contracts and are involved in spatial oligopolistic competition in the spot market. The spot market is cleared by an ISO who aims at maximizing welfare. The forward market is cleared using a uniform price mechanism. Our simulations show that the introduction of a forward market leads to lower prices in the spot market.

■ SB47

S-Admiral (Lev. 3)

Forestry II: Harvest Scheduling with Spatial Constraints

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Matthew Thompson, Graduate Student, Department of Forest Engineering, Oregon State University, Corvallis, OR, matthew.thompson@oregonstate.edu

1 - The Effect of Rule Ordering in Heuristic Performance: A Preliminary Examination

Kevin Boston, Oregon State University, kevin.boston@oregonstate.edu, John Sessions

The effect of rule ordering in a simulated annealing heuristic is examined in a tactical harvest scheduling model. The effect is demonstrated by solving a 91-harvest unit for a twenty period problem of approximately 2690 acre problem from a logging plan prepared for the southern portion of the Oregon State University McDonald-Dunn Research Forests. Results for this case study indicate a 14-40% saving in computational time if spatial feasibility is evaluated before calculating the objective function. Quality of the solution was similar in each case.

2 - Diversity Assessment in Pareto Optimal Solutions for Multi-objective Evolutionary Algorithms

Jeff Hamann, Graduate Student, Department of Forest Engineering, Oregon State University, Corvallis, OR, 97339, United States, jeff.hamann@forestinformatics.com

In order to determine stopping criteria in multi-objective forest planning problems, the distribution quality of the Pareto optimal solution set can be examined to ensure adequate diversification and intensification during the solution space search. This paper examines the application of an information theory metric known as entropy to assess the distribution quality of Pareto optimal solutions in a multi-objective evolutionary optimization algorithm applied to a forest planning problem.

3 - Direct Spatial Management of Old Growth Forest Using a Bevers-Hof Linear Programming Approach

Eldon Gunn, Professor, Dept.. of Industrial Engineering, Dalhousie University, P.O. Box 1000, Halifax, NS, B3J2X4, Canada, eldon.gunn@dal.ca

Bevers and Hof pioneered the approach of direct linear programming manipulation of the spatial features of the forest. This paper illustrates the use of that approach to manipulate the amount and connectivity of old growth forest on an actual forest landscape with more than 10,000 stands. The resulting linear programming problems are large but easily solvable.

4 - A Sprint Approach to Large-scale Model I Forest Management Linear Programs

Wei Yang, Graduate Student, Department of Industrial Engineering, Dalhousie University, Halifax, NS, B3J 2X4, Canada, wz209420@dal.ca, Eldon Gunn

The ability of a Model I LP formulation to represent spatial phenomena is becoming increasingly important in an environment where strategic forest management is required to account for a broad variety of forest values. However, these models can easily become quite large. Here we report on the use of an approach similar to Forrest's SPRINT that appears to be well suited to deal with these large models.

5 - Examining Various Tournament Selection Strategies for Spatially Constrained Forest Planning Problems

Matthew Thompson, Graduate Student, Department of Forest Engineering, Oregon State University, Corvallis, OR, matthew.thompson@oregonstate.edu

Most forest planning implementations of Genetic Algorithms have used some form of proportional or ranking-based selection. Use of tournament selection may accelerate the process of evolution and could be a promising strategy for difficult forest planning problems. This research will examine the impact on solution time and quality from using deterministic and stochastic tournament selection strategies for spatially constrained forest planning.

■ SB48

S-Fremont (Lev. 3)

Optimization via Simulation II

Sponsor: Simulation
Sponsored Session

Sigrun Andradottir, Professor, Georgia Tech, Stewart School of ISYE, Atlanta GA 30332, United States, sa@isye.gatech.edu

1 - Univariate Stochastic Root-finding for Monotone, Convex Functions

Samuel Ehrlichman, Cornell University, School of ORIE, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, se52@cornell.edu, Shane Henderson

We study the one-dimensional root finding problem for increasing convex functions. We give algorithms for both exact, and inexact (stochastic), function evaluations. For the stochastic case, we supply a probabilistic convergence guarantee in the spirit of selection-of-the-best methods. The algorithm's worst-case performance bound is an improvement upon that of its close cousin, stochastic binary search, by a constant factor.

2 - Optimizing Importance Sampling Parameter for Portfolios of Credit Risky Assets

Huiju Zhang, Fitch Ratings, One State Street Plaza, New York, NY, United States, huizhang@rhsmith.umd.edu, Michael Fu

We address the problem of finding the optimal importance sampling measure when simulating portfolios of credit risky assets. We apply a gradient-based stochastic approximation method to find the parameters in the minimum variance problem when importance sampling is used. We also employ the CE method to solve the same minimization problem. Numerical results illustrating the variance reduction are presented for the estimation of the portfolios' expected loss, unexpected loss and quantiles.

3 - Combining Quasi-Monte Carlo and Latin Hypercube Methods in Stochastic Optimization

Tito Homem-de-Mello, Associate Professor, Northwestern University, 2145 Sheridan Rd M235, Evanston, IL, 60208, United States, tito@northwestern.edu, Shane Drew

We discuss the use of non-i.i.d. sampling methods when solving stochastic optimization problems by sample average approximations. We focus on two well known techniques – quasi-Monte Carlo and Latin hypercube sampling. We study algorithms that combine these two approaches, and discuss some properties of the resulting estimators. We present numerical results illustrating the behavior of the algorithms for a collection of problems.

4 - Random Search Methods for Continuous Simulation Optimization

Andrei Prudius, PhD Student, Georgia Tech, Stewart School of ISyE, Atlanta, GA, 30332, United States, aprudius@isye.gatech.edu, Sigrun Andradottir

We present several random search methods for solving continuous parameter simulation optimization problems. We show that our methods are globally convergent with probability one, and also provide some numerical results that demonstrate the performance of the proposed approaches.

■ SB49

S-Greenwood (Lev. 3)

Panel Discussion: Issues in Pricing and Revenue Management Education

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Robert Phillips, Nomis Solutions, robert.phillips@nomissolutions.com

1 - Panel Discussion: Issues in Pricing and Revenue Management Education

Moderator: Robert Phillips, Nomis Solutions, robert.phillips@nomissolutions.com, Panelist: Itir Karaesmen, Costis Maglaras, Ioana Popescu, Nicola Secomandi

The purpose of this panel is to discuss what works and doesn't work in teaching pricing and revenue management. In particular, we will address where the topic fits into the overall curiculum. Does it belong in the business school or in the OR department (or both)? Does it deserve an entire course? What should and should not be taught in the subject? Is it likely to become a lasting part of the Business School curiculum (like Ops Mgt.) or not? Is the airline story still relevant?

■ SB50

S-Issaquah A & B (Lev. 3)

New Applications of Pricing and Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Soulaymane Kachani, Professor, Columbia University, 334 Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States, kachani@ieor.columbia.edu

1 - Multi-channel Pricing of Subscription-based Products with Consumer Choice

Ali Sadighian, Columbia University, 313 Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States, as2446@columbia.edu, Soulaymane Kachani, Woonghee Tim Huh

We address the problem of a magazine publisher facing stochastic demand over multiple periods. Magazines are offered through both online and traditional channels, and consumers choose their preferred medium based on a specific choice model (e.g. multinomial logit). We model the dynamics of customer subscription and attrition, and derive optimal pricing and production quantity decisions for magazine publishers.

2 - Memory-dependent Pricing and Product Introduction Timing for Multiple Product Generations

Hasan Arslan, Professor of Information Systems & Operations Management, Sawyer Business School, Stahl Center, 73 Tremont St., 7th floor, Boston, MA, United States, harslan@suffolk.edu, Cyril Shmatov, Soulaymane Kachani

We consider introduction timing and pricing for successive product generations, when demand is impacted by the reference price formed by consumers. We characterize the optimal product introduction time and pricing strategies explicitly for two successive generations, and propose a general quasi-analytic solution. We extend the analysis to a competitive environment.

3 - Price of Anarchy in Quadratic Utility Games

Georgia Perakis, Associate Professor, Sloan School, MIT, 50 Memorial Drive, Cambridge, MA, 02139, United States, georgiap@mit.edu, Jonathan Kluberg

We study quadratic utility games (for example, Cournot, i.e. quantity competition) with linear demand price relation. We present a bound on the price of anarchy (ie. comparison of system profit between centralized and decentralized settings) that depends on the number of players and the maximum market power of the players. The bound is independent of the constraints of the game and hence allows multiperiod competition with fixed capacities over the time horizon as a special case.

4 - Dynamic Pricing and Buyer Learning of Product Availability

Misuk Lee, School of Industrial and Systems Engineering Georgia Institute of Technology, gtg438r@mail.gatech.edu, Anton J. Kleywegt

We consider a process in which a seller with limited inventory sets prices in two time periods, and the buyers decide whether to buy in the first time period, second time period, or not at all. Between the two time periods, buyers obtain additional information about their utilities for the product. There may not be sufficient inventory to satisfy all demand in the second time period. Buyers estimate the probability of obtaining product in the second period. We show that the sequences of buyer decisions converge to an equilibrium, in spite of the observations being dependent on past decisions, and thus being neither independent nor identically distributed.

■ SB51

S-Kirkland (Lev. 3)

Pricing Issues

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Doug Bish, Assistant Professor, Virginia Tech, Dept.. of Industrial and Systems Engg., Blacksburg, VA, 24061-0118, United States, drb1@vt.edu

1 - Complexity Reduction and Price Optimization at a Major Manufacturer of Construction Equipment

Tallys Yunes, University of Miami, Department of Management Science, Coral Gables, FL, United States, tallys@miami.edu, Alan Scheller-Wolf, Masha Shunko, Natalya Trapp, Valerie Tardif, Sridhar Tayur

Companies with broad product lines face a common trade-off: product variety, which entices customers, is positively correlated with elevated costs. We develop an approach to capture customer behavior and complexity costs within an optimization model, and use it to select and price a profitable subset of machines spanning multiple overlapping product lines of a major machinery manufacturer. We present computational results with real data under a number of managerial and strategic scenarios.

2 - Optimal Product-line Design Using Bundling and Pricing

Chi-Guhn Lee, cglee@mie.utoronto.ca

In this research we study a problem of optimizing a product-line with an objective to maximize the total revenue. Logit model is used to define the discrete choice probability, from which the expected revenue generated from a product-line is derived. Case studies have been performed based on consumer survey done among college students.

3 - Optimal Switching Times for Season and Single Tickets in Sports and Entertainment

Julie Swann, Georgia Tech, Industrial and Systems Engineering, Atlanta, GA, United States, julie.swann@isye.gatech.edu, Serhan Duran

We focus on the Sports and Entertainment industries, where event tickets are sold exclusively as season tickets initially or as single events later in the selling horizon. We study the optimal time to switch between the market segments dynamically as a function of the system state. We find the optimal switching is a set of thresholds that depend on the remaining inventory and time left in the horizon. We apply the results to ticket data and identify other RM problems in the industry.

4 - Revenue Management When Supply is Flexible

Doug Bish, Assistant Professor, Virginia Tech, Dept.. of Industrial and Systems Engg., Blacksburg, VA, 24061-0118, United States, drb1@vt.edu, Ebru Bish, Lingrui Liao

We study the revenue management problem under supply-side flexibility. The firm has the option of swapping capacities between the two service classes when demand uncertainty is partially resolved. We determine the structure of an optimal policy, study the impact of supply flexibility on profits, and perform a comparative statics analysis.

■ SB52

S-Leschi (Lev. 3)

Academic Contributions to Railroad Operations Research

Sponsor: Railrway Applications
Sponsored Session

Chair: Christopher Barkan, Associate Professor, University of Illinois at Urbana-Champaign, 1201 NCEL, MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States, cbarkan@uiuc.edu

1 - Estimating Congestion Impacts on Rail Lines via Statistical Methods

Michael Gorman, Associate Professor, University of Dayton, School of Business, Dayton, OH, United States, Michael.Gorman@notes.udayton.edu

As railroads become more and more congested with increasing traffic base, it becomes paramount to estimate the congestion impact of new traffic. Well-tested, specialized simulation software is often used for such predictions. However, simulations have some drawbacks and are time consuming to run. We test the viability of statistical methods as a low cost alternative for prediction the impact of additional trains on train running times. Empirical results are presented.

2 - Trolley Assignment Model for a Container Terminal with a Low Viaduct Horizontal Rail System

Anne Goodchild, Assistant Professor, University of Washington, 121E More Hall, Box 352700, Seattle, WA, 98195, United States, annegood@u.washington.edu, Karthik Mohan

This paper looks at improving the efficiency of an automated system, called the Low Viaduct Horizontal Rail Transportation System (LVRTS) existent at a few container terminals in China. The problem of minimizing the operation time of LVRTS is formulated as a non-linear integer programming problem, and solved using Genetic Algorithms.

3 - Capacity Management for Heterogenous Traffic on Double Track Railroads

Steven Harrod, Assistant Professor, University of Dayton, School of Business Administration, 300 College Park, Dayton, OH, 45469, United States, a2soft@aol.com

A well managed double track railroad was once considered adequate for all traffic needs on North American railroads, but traffic levels are now exceeding even those limits. This presentation discusses capacity management and expansion options for double track lines based upon a discrete time network model analysis.

4 - A Decision Support Framework for Railway Capacity Expansion

Yung Cheng Lai, Graduate Research Assistant, University of Illinois at Urbana-Champaign, B-118 NCEL, MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States, lai3@uiuc.edu, Christopher Barkan

We develop a decision support framework by using multicommodity flow techniques to determine how to allocate money for capacity expansion in the best possible way. Based on estimated future demands, the model can successfully determine the optimal solution regarding which subdivisions need to be upgraded with what kind of engineering options. The benefit of using the decision support framework is substantial for budget management of North American railroads.

■ SB53

S-Medina (Lev. 3)

Facility Location and Computing

Sponsor: Location Analysis
Sponsored Session

Chair: Ho-Yin Mak, University of California, Berkeley, 1117 Etcheverry Hall, University of California, Berkeley, Berkeley, CA, 94720, United States, makho@berkeley.edu

1 - A Two-echelon Inventory-location Problem with Service Considerations

Ho-Yin Mak, University of California, Berkeley, 1117 Etcheverry Hall, University of California, Berkeley, Berkeley, CA, 94720, United States, makho@berkeley.edu, Max Shen

We study the design of a two-echelon spare parts inventory system with stochastic demand and service constraints. Facility location and inventory management decisions are jointly optimized using a mixed integer nonlinear programming formulation. We will discuss the proposed solution algorithm, computational results and some managerial insights.

2 - Impact of Cost Uncertainty on the Location of Facilities in a Supply Chain

Seokjin Kim, Assistant Professor of Management, Millersville University, Department of Business Administration, P.O. Box 1002, Millersville, PA, 17551-0302, United States, skim@millersville.edu, Mozart Menezes, Rongbing Huang

We develop a location model for a distribution center on a demand-populated unit line between two suppliers to minimize the production, inbound and outbound transportation costs of one unit of a product. We first assume that two suppliers' production costs are deterministic, and then consider a probabilistic version where the production cost of one supplier follows a distribution. We propose properties of optimal locations and also characterize some distributions under which the properties hold.

3 - Facility Reliability with Site-specific Failure Probabilities

Lezhou (Roger) Zhan, CitationShares Management, 5 American Ln, Greenwich, CT, 06831, United States, zhan@ufl.edu, Max Shen, Mark Daskin

We consider the problem of locating facilities to minimize the expected facility, transport, and failure-to-serve costs when candidate locations have site-specific failure probabilities. Several models are formulated and solution algorithms are outlined. Computational results are provided as are insights obtained from exercising the models.

4 - Approximation Algorithms for the Fixed-Hub Single Allocation Problem

Dongdong Ge, Stanford Univeristy, 37 angell ct, Apt 201, stanford, 94305, United States, dongdong@stanford.edu, Jiawei Zhang, Yinyu Ye

we discuss the fixed-hub single allocation problem. In the model hubs are fixed and fully connected; and each terminal node is connected to a single hub which routes all its traffic. The goal is to minimize the cost of routing the traffic in the network. This paper presents linear programming-based algorithms that deliver both high quality solutions and a theoretical worst case bound. The algorithms are based on a new randomized rounding method, which might be of interest on its own.

■ SB54

S-Queen Anne (Lev. 3)

Models for Designing Service Systems and Understanding Customer Behavior

Sponsor: Applied Probability
Sponsored Session

Chair: Laurens Debo, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu

1 - Customer Herding in Queuing Services

Senthil Veeraraghavan, Asst Professor, Wharton School, Philadelphia, PA, United States, senthilv@wharton.upenn.edu, Laurens Debo

When choosing between service providers whose quality is common knowledge, customers trade off waiting times with service values. Rational customers also examine queue lengths at two competing service providers to make a decision. Customers may ignore their private information and herd. We model herding behavior of customers, in a two-server queuing model. We find that it may be rational in equilibrium to ignore private information and choose the service provider with the longer queue.

2 - Design and Analysis of Diagnostic Call Centers

Xiaofang Wang, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, xiaofanw@andrew.cmu.edu, Laurens Debo, Alan Scheller-Wolf, Stephen Smith

At health insurance company-owned nurse lines as well as many other call centers, diagnostic accuracy is a key performance measure in addition to caller waiting time. Since longer service entails higher accuracy but also more congestion, the manager must decide on the optimal service depth to guide a diagnostic process between an agent and caller. We model these diagnostic call centers, provide structural properties of the optimal solution and managerial insights.

3 - The Value of Congestion

Laurens Debo, Tepper School of Business, Carnegie Mellon Universitry, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu, Christine Parlour, Uday Rajan

We provide a model in which a queue for a good communicates the quality of the good to consumers. Agents observe the queue length and a private signal (good or bad) about the good. We find that under specified conditions, both a high quality firm and a social planner maximizing consumer surplus prefer a low service rate to a high one, due to the information externality.

4 - Strategic Information Transmission in Service Systems

Achal Bassamboo, a-bassamboo@northwestern.edu, Gad Allon, Itai Gurvich

Many call center use recorded announcements that encourage callers to wait for an agent to become available, or describe the current state of the system. We study a model of interaction between the customers and the service provider, in a setting where their incentives are misaligned, and where unverifiable, costless and non-binding information can be provided to the customer by the service provider.

■ SB55

S-Ravenna (Lev. 3)

Joint Session AAS/TSL: Advances in Airline Decision Support Systems

Sponsor: Aviation Applications, Transportation Science & Logistics
Sponsored Session

Chair: Diego Klabjan, University of Illinois at Urbana-Champaign, 205 North Mathews Avenue, Urbana, IL, 61801, United States, klabjan@uiuc.edu

1 - Airport Ground Staff Optimization

Peng Duan, Sabre Holdings, peng.duan@sabre.com, Tina Shaw

Traditionally the airport ground staff rostering problem is usually carried out in several stages and built upon aggregate demand. In this work, we present an integrated solution approach working with disaggregate tasks. The solution approach includes a heuristic and a post optimization algorithm. We discuss the integration of shift assignment stage and task assignment stage, and how different running modes and complex business rules are handled.

2 - A Generic Column-generation-based Framework for Airline Planning

Thomas Schickinger, Product Manager, Lufthansa Systems, Fritschestr. 27-28, Berlin, BE, 10585, Germany, thomas.schickinger@lhsystems.com

In this talk we report on recent developments of a framework for airline optimization problems. The core of this framework consists of generic components for solving LP and IP problems, and provides an extensible implementation of a column-generation based solver. We show how this generic part is adapted to different crew and aircraft planning problems and how the structure of the problem at hand is exploited by approximation techniques and problem-specific control of the path search.

3 - An Optimization Model for Negotiating Airlines Hard-block Code-share Agreements

Ahmed Abdelghany, Assistant Professor, College of Business, Embry-Riddle Aeronautical University, 600 S. Clyde Morris Blvd., Daytona Beach, FL, 32114, United States, abdel776@erau.edu, Khaled Abdelghany

Code-sharing enables airlines to expand their network and service frequency without additional resources. This paper presents an optimization model to negotiate airlines hard-block code-share agreements. The model determines optimal number of allocated seats and revenue split strategies for all possible code-sharing partners in the different markets. The model captures the trade-off between incremental revenue from code-sharing demand and lost revenue due to displacement of existing passengers.

4 - Some New Concepts for Solving Airline Scheduling Problems

Tina Shaw, Chief Scientist, Sabre Holdings, SABRE $ 1 E. Kirkwood Blvd., Southlake, TX, 76092, United States, tina.shaw@sabre.com

Large-scale IP problems in the airline scheduling arena are typically solved using column generation and specialized branching techniques, such as branching on follow on. We discuss several variations to branch on follow on and their application; including the network implications when using a shortest path pricing problem for delayed column generation. We introduce a new branching concept that can be extended in a number of ways to branch on other aspects not previously considered.

■ SB56

S-Wallingford (Lev. 3)

Auction Design

Cluster: Auctions
Invited Session

Chair: Peter Popkowski-Leszcyc, Associate Professor of Marketing, University of Alberta, 4-20 F School of Business, Edmonton, AB, T6G 2R6, Canada, ppopkows@ualberta.ca

1 - Let the Market Decide the Price: The (Non-)Use of Buy-now Price in Online Auctions as a Value Signal

Kursad Asdemir, University of Alberta, School of Business, Edmonton, AB, Canada, kursad.asdemir@ualberta.ca, Chun Qiu, Peter Popkowski-Leszcyc

A buy-now price is a feature frequently used by sellers in online auctions. We study buy-now price as a value signal that influences the bidders' beliefs. A rational expectations equilibrium in which high and low buy-now prices are not used is derived. A high buy-now price is detrimental to the seller; because it raises a bidder's expectation of the value; and reduces the credibility of the seller's signal. We provide experiments that support our results.

2 - The Effect of Product Class on the Usage of Buy-now Price in Online Auctions

Chun Qiu, Assistant Professor, McGill University, Desautels Faculty of Management, Montreal, QC, Canada, chun.qiu@mcgill.ca, Peter Popkowski-Leszcyc, Kursad Asdemir

We study the moderating effects of product class and ease of assessing the value of an item on the effectiveness of buy-now prices in online auctions. Buy-now prices may serve different purposes, which vary depending on the product class. In particular, buy-now prices may serve as external reference prices for high-end high uncertain products. On the other hand buy-now options may serve to accelerate sales for low-end products. We provide empirical results to support our conjectures.

3 - When Zero Search Cost is too High: What Does it Take to Make Consumers Search?

Ernan Haruvy, The University of Texas at Dallas, School of Management, SM 32, 2601 North Floyd Road, Richardson, TX, United States, eharuvy@utdallas.edu, Peter Popkowski-Leszcyc

We examine individual choice between pairs of simultaneous auctions that are either ex-ante identical or that differ in one of the following respects: direct incentives to search, shipping costs, minimum starting bid, duration and secret reserve. We also included an incentive to search for some of the pairs. We investigate the extent to which individuals bidding in these auctions choose optimally over auctions, the extent they switch between auctions, and factors that influence these outcomes.

4 - Procurement Auctions with Costly Supplier Qualification Screening

Zhixi Wan, PhD candidate, University of Michigan, 701 Tappan Street, Ann Arbor MI 48109, United States of America, wanzhixi@umich.edu, Damian Beil

We consider reverse auctions in combination with supplier qualification screening to determine which qualified supplier will be awarded a contract. The buyer seeks to minimize the contract payment plus qualification costs. We explore benefits of qualifying some suppliers only after the auction, and the role offully prequalified incumbents.

■ SB57

S-Columbia (Lev. 4)

Optimization in the Internet

Sponsor: INFORMS Telecommunications Section
Sponsored Session

Chair: Hui Liu, Distinguished Member of Technical Staff, Verizon Communications, 40 Sylvan Road, Waltham, MA, 02451, United States, hui.liu@verizon.com

1 - Internet Service Resource Optimization

Marcelo Torres, Akamai Technologies, Inc, 8 Cambridge Center, Cambridge, MA, 02139, United States, mtorres@akamai.com, Andrew Vakhutinsky

We describe a cost optimization model that can be applied to establish location usage targets and control traffic to meet performance requirements within a distributed Internet service platform. We describe the common structure used to price resource utilization per deployed location. The structure of the model shares much in common with a large scale stochastic mathematical program. We conclude by describing how the model can be applied to manage resource costs across a billing period.

2 - Wavelength Routing, Assignment and Translation in an All-optical Network

Dave Allen, Distinguished MTS, Verizon, 2400 North Glenville, Richardon, TX, 75082, United States, dave.allen1@verizon.com

An all-optical network requires selection of routes and wavelengths between nodes. Even in an optimized design, wavelength contention on fibers can occur, requiring expensive design modifications. We present a novel method to optimize routing, wavelength assignment and translation at user-specified nodes so that overall cost is minimized. The model is applicable to both new designs and incremental changes. Results for 1+1 protection show significant savings compared to expedient selections.

3 - Delivery of Video-on-demand Over a Transport Channel with Limited Capacity

Peter Kubat, Distinguished MTS, Verizon Technology, 40 Sylvan Rd, Waltham, MA, 02451, United States, peter.kubat@core.verizon.com

Two video-on-demand delivery schemes (a) streaming and (b) fast load and store are compared. It is shown that under moderate traffic loads fast load and store method is more efficient, namely having a better throughput, less blocking and provides a better transport utilization.

4- Decentralized Load Balancing

Marco Bijvank, VU University Amsterdam, De Boelelaan 1081a, Amsterdam - 1081 HV, Netherlands, mbijvank@few.vu.nl, Vivek Rai, Wemke van der Weij

Current IT services are built using three tier architectures where requests arriving at web servers are routed to application servers that are further routed to a database. A load balancer is required to route these requests to the application servers. The objective is to design decentralized load balancing algorithms based on partial load information such as power of two choices, thresholding based algorithms, and age based server selection. We use an MDP formulation for our analysis.

■ SB58

S-Pike (Lev. 4)

Institutions, Innovation and Entrepreneurship

Sponsor: Organization Science
Sponsored Session

Chair: Raghu Garud, Penn State University, rgarud@psu.edu

1 - Structuring Intellectual Property: The Case of Carbon Nanotubes

Mike Lounsbury, University of Alberta, Michael.Lounsbury@ualberta.ca, P. Devereaux Jennings, Tyler Wry

In this paper, we examine the sources of intellectual property development in the carbon nanotube (CNT) field-one of the most well developed areas of nanotechnology. While much intellectual property research focuses on patent level analysis, we underscore the importance of patent categories as key cognitive elements that organize the different knowledge domains within the world of CNT patenting. We investigate a number of factors that may contribute to patent creation including spatial characteristics related to geographic clustering and the role of universities and corporations, and knowledge structure characteristics including importance, generality, density, and centrality. Our

results indicate that, at least in the context of the CNT field, spatial characteristics have limited explanatory value, while the knowledge structure characteristics of density of patents within patent categories and the centrality of categories in the overall knowledge structure are robust drivers of patent creation. We discuss the importance of patent category analysis and the need to seek integration across various theoretical traditions that span socio-cognitive approaches, evolutionary economics and economic geography.

2 - Conferences as Venues for the Configuration of Emerging Organizational Fields: The Case of Cochlear Implants
Raghu Garud, Penn State University, rgarud@psu.edu

I examine how conferences can be occasions for the configuration of emerging organizational fields by describing three that I attended during the development and commercialization of cochlear implants. These conferences served as venues for a variety of activities to unfold ranging from the exchange of information to the enactment of technological possibilities. A full appreciation of conferences as holistic events, I argue, offers us a particularly valuable entry point into gaining a deeper understanding of how new fields are assembled in real time.

■ SB59

S-Seneca (Lev. 4)

Empirical Research in Supply Chain Management

Sponsor: Technology Management
Sponsored Session

Chair: Aleda Roth, Professor, Clemson University, College of Business & Behavioral Science, Clemson, United States, aroth@clemson.edu

1 - The State of Global Leanness: Insights from Long-range Inventory-turnover Data
Richard Schonberger, 177 107th Ave. NE, #2101, Bellevue, WA, 98004, United States, sainc17@qwest.net

At least 15 years of inventory-turnover data for more than 1,200 global manufacturers, retailers, and distributors provide insights into the changing state of leanness among select groups of those companies. More probing analysis suggests widespread over-emphasis on internal applications of the lean core, in contrast to the much greater lean opportunities that reside in the supply pipelines.

2 - Effect of Supply-demand Base Adaptivity on Business Performance
M. Murat Kristal, Assistant Professor, York University, Schulich School of Business, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, mkristal@schulich.yorku.ca, Aleda Roth

We empirically investigate the underlying structure of supply-demand base adaptivity in terms of exploration and exploitation activities, and assess its effect on business performance. Our evidence suggests that exploratory adaptivity activities are as important as those of exploitative adaptivity. Though pressured by short-term performance measures, supply chain managers should not be forced to focus only on short-term efficiency plans for their supply chains.

3 - Does ISO 9000 Reduce Quality Risk? A Longitudinal Study
John Gray, Assistant Professor, Ohio State University, Fisher College of Business, Columbus, OH, 43210, United States, gray.402@osu.edu, Aleda Roth, Enno Siemsen

ISO 9000 certification is often considered a proxy for strong quality capability. However, empirical support for the effect of ISO 9000 on quality performance has been mixed. In this research, we use multiple years of Food and Drug Administration inspection data to determine if, in fact, ISO 9000 reduces quality risk. We assess quality risk before, during and after ISO 9000 certification on a sample of firms in the medical device industry.

4 - Feedback for Process Improvement in B2B E-commerce: Constructs and Measurement
Hua-Hung(Robin) Weng, Doctoral Student, Clemson University, College of Business and Behavioral Scien, 101 Sirrine Hall, Clemson, SC, 29634-1305, United States, whua@clemson.edu, Aleda Roth, Janis Miller

Feedback systems are important for quality improvement because they offer companies the opportunity to interface with customers and suppliers, and as a result believed to facilitate the double-loop learning. The purpose of this research is to present a conceptual model of B2B feedback systems, B2B service quality, and customer satisfaction. Using Roth and Menor's rigorous, two-stage approach, we operationally define the key constructs and operational measures with good psychometric properties.

■ SB60

S-University (Lev. 4)

Entrepreneurship

Sponsor: Technology Management
Sponsored Session

Chair: Moren Levesque, Associate Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, levesque@engmail.uwaterloo.ca

1 - Research Collaboration Netwroks and Innovation Output
David Deeds, dxd054000@utdallas.edu, Irem Demirkan

We explore the evolution of co-authorship networks of the firms in the biotechnology industry. We use social network theory to develop a model of the structure and dynamics of interorganizational research collaboration networks. This paper also demonstrates how this evolution affects focal firms' successive performance in terms of the firms' innovative output.

2 - Valuation of Startup Firms Under Market, Technology and Time Uncertainties
Leonardo Santiago, Assistant Professor, Federal University of Minas Gerais - UFMG, Production Engineering Department, Av. Antonio Carlos, 6627.Pampulha., Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br, Henrique Mendes Silva

We consider the problem of valuating a startup firm in the early stages of its creation under market, technology, and development time uncertainties. Our model takes into account the management value of the startup development process, and the opportunity created by those uncertainties. We analyze the impact of these uncertainties on the value of a startup and discuss the model's practical implementation.

3 - Timing Managerial Hires for New Venture Expansion
John Angelis, Case Western Reserve University, 2680 Euclid Heights Blvd., #107E, Cleveland, OH, 44106, United States, john.angelis@case.edu

As entrepreneurs develop their new business ventures, they typically face a larger pool of qualified managerial candidates to help them successfully grow these ventures. But delaying top management hiring limits the speed at which these ventures can expand. We investigate this timing-of-hiring and talent-availability tradeoff and offer recommendations as to when and who entrepreneurs should hire.

4 - Entrepreneurial Types and Economic Growth
Moren Levesque, Associate Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, levesque@engmail.uwaterloo.ca, Maria Minniti

Economic growth models focus on R&D expenditure due to its ability to produce technological change. But they fail to account for the exceptional growth exhibited in recent year by country such as China where R&D expenditure is virtually non-existing and for the lack of growth observed in countries such as Japan where R&D expenditure is significant. We show that the presence of a high number of imitative (not incurring R&D expenditure) entrepreneurs can be sufficient to generate economic growth.

Sunday, 1:30pm - 3:00pm

■ SC01

C-Room 602

Supply Chain Management III

Contributed Session

Chair: Alex Ruiz-Torres, University of Texas El Paso, 500 W. University Ave., El Paso, TX, 79902, United States, aruiztor@utep.edu

1 - RFID Selection and Implementation: An Expert Panel
Moderators: Peter Haug, Professor of Operations, Western Washington University, Department of Decision,Sciences, 516 High Street, Bellingham, WA, 98225.9077, United States, peter.haug@wwu.edu, Stella Hua, Professor, Western Washington University, Manufacturing and Supply Chain Managemen, stella.hua@wwu.edu, Panelist: Doug Newell, Mike Nichols, Mark Wehrle

This panel discusses experiences with RFID technology. The panelists will concentrate on three topics: 1) long-term strategies on RFID selection and implementation; 2) integration of RFID into ERP systems; and 3) impact of RFID on supply chain performance. The panelists are Doug Newell, Naval Supply Systems, SUBASE Bangor; Mike Nichols, Global RFID Systems Manager, Intermec; Mark Wehrle, IBM Client Manager, Boeing Commercial Airplanes. The moderators are Professors Peter Haug and Stella Hua.

2 - Designing Semiconductor Supply Chains using a New Hybrid Push-pull Model with Multiple Pulling Point

Seung-Hwan Kim, Arizona State University, 809 W.Grove Pkwy #1102, Tempe, AZ, 85283, United States, shkim@asu.edu, John Fowler, Joong-In Kim, Dan Shunk

We present a new hybrid push-pull supply chain design model with multiple pulling points, in the context of semiconductor products, processes, and organization forms. Feasible areas for placing pulling points are generated by product-process-organization form matrix. Then feasible designs are mathematically formulated and encapsulated into a model-based decision support tool. Robust and cost-effective designs against various external factors are identified based on user-specific scenarios.

3 - A Process Oriented Model for Assessing Usability of Supplier Selection Methods

Cuneyt Altinoz, Assistant Professor, East Carolina University, 3134 Bate Building, ECU, Greenville, NC, 27858, United States, altinozc@ecu.edu, Scott Dellana

Since supplier selection is an applied practice, it is critical that researchers consider and incorporate usability elements in their work if the proposed methodologies will ever be adopted for use in industry. In this paper, we integrate focus group interviews with the existing usability literature to explore the requirements for successful adoption and continued use of supplier selection methodologies. We also propose a usability model to guide researchers.

4 - The Product Warranty and Quality as Competitive and Coordinate Strategies

Yue Dai, Associate Professor, School of Management, Fudan University, Shanghai, China, Guoshun Road 670, Shanghai, 200433, China, yuedai2002@gmail.com, Sean Zhou

We study the product quality and warranty strategies of a two-echelon supply chain, while the demand is warranty-sensitive and the warranty cost is shared between the supplier and the retailer. We consider both cases when the product warranty is determined by the supplier and by the retailer. For each case, we derive the existence and uniqueness of a Nash equilibrium. We compare the performance of the decentralized and centralized systems and analyze the impact of channel coordination.

5 - Outsourcing Decision Considering Production Failure and Operating Costs

Alex Ruiz-Torres, University of Texas El Paso, 500 W. University Ave., El Paso, TX, 79902, United States, aruiztor@utep.edu, Farzad Mahmoodi

This paper presents a model that considers two critical characteristics relevant to the outsourcing decision-making process: failure costs due to not meeting the production requirements (resulting in lost orders and customers), and operating costs attributed to managing the internal and outsourced production systems. The proposed model determines the optimal manufacturing network consisting of in-house and contract manufacturers.

■ SC02

C-Room 603

Empirical Research

Cluster: Supply Chain
Invited Session

Chair: Vinayak Deshpande, Purdue University, 4024 Rawls Hall, West Lafayette, IN, 47907, United States, vinayak@purdue.edu

1 - A Demand Forecasting Model Using Financial Indicators and Experts' Input

Vishal Gaur, Cornell University, vg77@cornell.edu, Nikolay Osadchiy, Sridhar Seshadri

We propose a forecast evolution model to investigate the correlation between the sales volume of a retailer and the state of the economy, characterized by the return on an aggregated financial index. We test this model on a panel data of sales forecast evolution for 214 US retailers over 10 years, each year containing multiple forecasts of varying terms. Our model is useful for demand forecasting, operational planning, and hedging demand risk.

2 - An Empirical Investigation into the Causes of Airline Flight Delays

Kamalini Ramdas, Ramdask@Darden.virginia.edu, Jonathan Williams

We examine why airlines differ systematically in their on time performance. By testing fundamental queuing theory results via regression analysis, we quantify how expected delays increase with aircraft utilization, and also how capacity flexibility and variance in travel time along a route impact flight delays at any level of aircraft utilization. We also analyze scenarios that provide useful insights into airline scheduling decisions.

3 - Structural Estimation of Retail Demand Under Unobserved Out of Stocks

Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris Hall #417, New York, NY, 10027, United States, molivares@columbia.edu, Eric Bradlow, Christian Terwiesch, Andres Musalem, Daniel Corsten

We develop a structural model to measure the effect of stock-outs on retail sales. We use a random coefficient logit model of consumer choice and estimate it using Bayesian methods. The methodology is tested using actual data on sales and availability of a product category (shampoo) collected from multiple stores of a Spanish retailer.

4 - Impact of Flight Schedules on Airline Flight Delays: An Empirical Investigation

Vinayak Deshpande, Purdue University, 4024 Rawls Hall, West Lafayette, IN, 47907, United States, vinayak@purdue.edu, Mazhar Arikan

We analyze Airline on-time performance data posted by FAA. On-time performance is significantly affected by flight schedules set by airlines. We use the newsvendor model to test several hypotheses on airline scheduling policies.

■ SC03

C-Room 604

Service Outsourcing, Procurement, and Contract Design

Cluster: Supply Chain
Invited Session

Chair: Fuqiang Zhang, Assistant Professor, University of California, Irvine, CA, United States, fzhang@uci.edu

1 - Outsourcing Service Processes to a Common Service Provider Under Price and Time Competition

Gad Allon, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu, Awi Federgruen

In many industries, firms consider the option of outsourcing an important service process associated with the goods or services they bring to the market. We develop analytical models to characterize the benefits and disadvantages of outsourcing in service industries in which the retailers compete with each other in terms of the price they charge and/or the waiting time expectations and standards which they adopt and sometime advertise.

2 - Quality and Information Asymmetry in Service Outsourcing

Fuqiang Zhang, Assistant Professor, University of California, Irvine, CA, United States, fzhang@uci.edu

This paper studies how to design service outsourcing contracts with quality consideration and the presence of asymmetric information. The results suggest that outsourcing companies can use relatively simple and yet robust contracts to assure a high level capacity and quality service even when they do not have perfect information about the service provider.

3 - Push or Pull? Auctioning Supply Contracts

Cuihong Li, University of Connecticut, School of Business, Storrs, CT, United States, Cuihong.Li@business.uconn.edu, Alan Scheller-Wolf

Consider a buyer that sources from multiple potential suppliers via a competitive bidding process. The suppliers have heterogeneous production costs, which are private information. The buyer faces uncertain demand, and the winning supplier has to invest in production capacity before this uncertainty is resolved. We analyze and compare the outcomes of auctions for push and pull contracts.

■ SC04

C-Room 606

Tutorial: When More is Better

Cluster: Tutorials
Invited Session

1 - When More is Better

David Simchi-Levi, Professor, Massachusetts Institute of Technology, 77 Massachusetts Ave., Building 1-171, Cambridge, MA, 02139, United States, dslevi@mit.edu

A supply chain setting is inherently characterized by interactions between multiple products and agents seeking to maximize their own utility. In this presentation we use an axiomatic approach to explore the impact of product variety on customer demand, product price, system revenue and inventory levels. These results are applied to two supply chains. The first is a decentralized

multi-retailer system where each retailer sells a single product and retailers compete on price. The second supply chain is a single retailer selling multiple competitive products. We use the insight from our analysis to answer the question of whether more consumer choices is better for the customers or the seller.

■ SC05

C-Room 607

Nicholson Student Paper Prize Competition, I

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Max Shen, Associate Professor, University of California, Department of IEOR, Berkeley CA 94720-1777, United States of America, shen@ieor.berkeley.edu

1- Percentile Optimization for Markov Decision Processes with Parameter Uncertainty
Erick Delage, Stanford University edelage@stanford.edu

Abstract not available at this time.

2- Adaptive Jackknife Estimators for Stochastic Programming
Amit Partani, University of Texas, partani@mail.utexas.edu

We discuss an adaptive jackknife estimator to reduce bias. It does not require a priori knowledge regarding the order of bias. We discuss convergence properties and apply it in the context of Monte Carlo-based simulation procedures in stochastic programming. We provide a bias reduction strategy for the optimality gap estimator of a candidate decision and optimal cost estimator based on the adaptive estimator. Computational results are presented to evaluate the performance of the adaptive estimator.

3- Encouraging Cooperation in Sharing Supermodular Costs
Nelson Uhan, Ph.D Candidate, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue, E40-130, Cambridge MA 02139, United States of America, uhan@mit.edu, Andreas Schulz

The least core value of a cooperative game is the minimum penalty for defection that encourages agent cooperation. We study complexity and algorithmic aspects of the least core value of cooperative games with supermodular costs. We also provide motivation for studying these games by showing that a particular class of optimization problems has supermodular optimal costs. This class includes many problems in machine scheduling, and more generally, combinatorial optimization.

■ SC06

C-Room 608

Operations Management and Security

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Noah Gans, OPIM Dept. - Wharton - Penn, 3730 Walnut St, Suite 500, Philadelphia, PA, 19104, United States, gans@wharton.upenn.edu

1 - Economic Analysis of the Registered Traveler Program
Alan Scheller-Wolf, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu, Vineet Kumar, Ramayya Krishnan

The registered traveler program allows participants to use special, faster lines for security checks if they submit additional information to the government. We use a game-theoretic framework to model such travelers who value shorter wait times, but face a loss of utility if they reveal private information. We find conditions under which having a registered traveler program is socially suboptimal, and characterize the optimal level of information revelation when such a program is desirable.

2 - Economics of Supply Chain Security Management
Mehmet Sekip Altug, PhD Candidate, Columbia University, 3022 Broadway, Uris Hall 4J, New York, NY, 10027, United States, msa2104@columbia.edu

We motivate the important problem of security management within supply chains. We approach the problem in a game theoretical setting distinguishing it from risk management problems. By defining it as a special case of Interdependent Security Problem, we show the existence of Nash Equilibrium for both the non-cooperative and the cooperative case between industry and the government. We propose to study different ways to coordinate the actions of supply chain partners with government initiatives.

3 - Pricing and Production Planning Under Supply Uncertainty with Multiple Customer Segments
Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, Syracuse, NY, 13244, United States, bkazaz@syr.edu, Brian Tomlin, Nenad Jukic

We consider a firm that determines the production quantity, but obtains only a fraction due to supply uncertainty. The realized amount is allocated to two customer segments (high and low-level). The price for high-level customers is set before production occurs, and the price for low-level customers is determined after observing the supply. Using a poly-instantiated database, high-level customers have access to both prices, however, low-level customers can access the price only at their level.

4 - Securing the Containerized Supply Chain: An Economic Analysis of C-TPAT
Nitin Bakshi, Doctoral Student, Univ. of Pennsylvania, 3730 Walnut Street, Ste 500, Philadelphia, PA, 19104, United States, nbakshi@wharton.upenn.edu, Noah Gans

Companies that comply with the Customs-Trade Partnership Against Terrorism (C-TPAT) take extra security measures with their shipping containers and, in return, enjoy preferential treatment at entry points into the US. We model C-TPAT as a Stackelberg game, characterize the structure of the equilibrium, and provide comparative statics results.

■ SC07

C-Room 609

Contemporay Issues in Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Kamran Moinzadeh, Professor, U. of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, kamran@u.washington.edu

1 - A Single Period Model with Multiple Ordering Opportunities and Fixed Ordering Cost
Kamran Moinzadeh, Professor, University of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, kamran58@comcast.net, Yong-Pin Zhou, Apurva Jain

We consider a fixed-life cycle product with random demand. Orders can be placed at any time, and the replenishment cost has both fixed and variable components. At the end of the product's life cycle, leftover has salvage value and shortage incurs penalty cost. Examples of such products exist in retailing, hi-tech products, and healthcare. We first propose an optimal replenishment policy for a single retailer location, and then expand to include the case with one supplier and many retailers.

2 - Bullwhip Mitigation with Advance Forecast Sharing and Order Updates
Hau Lee, Professor, Stanford University, Graduate School of Business, Stanford, CA, 94305, United States, lee_hau@gsb.stanford.edu, Li Chen

How does advance demand information reduces the supply chain bullwhip effect? How about if the retailer simply places advance orders but updates it over time? Using a very general demand model, we can show that both can reduce the bullwhip, but the advance order update approach eliminates the need for the supplier to guess the retailer's underlying ordering policy.

3 - Inventories with Multiple Supply and Demand Sources and Networks of Queues with Overflow Bypasses
Jeannette Song, Duke University, Fuqua School of Business, Durham, NC, 27708, United States, jssong@duke.edu, Paul Zipkin

Consider an inventory system with several supply sources having different costs and leadtimes. Under a plausible heuristic policy, the supply system becomes a network of queues with a special routing mechanism called an overflow bypass. The solution has a simple product form.

4 - Advance Orders and Market Segmentation in a Multi-product Supply Chain
Ozalp Ozer, Stanford University, Stanford, CA, 94305, United States, oozer@stanford.edu, Holly Lutze

We consider a generalized model of a multi-product manufacturer selling to multiple non-identical retailers over a finite planning horizon. Retailers place orders for immediate delivery or place orders in advance of their needs, thereby accepting a particular demand lead time. We determine an optimal menu of demand lead times and corresponding payments that maximize the manufacturer's profit. We explore the impact of design issues, such as postponement, on optimal contract parameters.

■ SC08

C-Room 611

Measuring Risks and Benefits of Mitigation Strategies

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Sanjay Kumar, University of Texas at Dallas, Richardson, TX, United States, Skumar@utdallas.edu

1 - A DEA-based Method for Uncertain Productions

Regina Fuchs, University of Hohenheim, Lehrstuhl Industriebetriebslehre (510A), Schloss, Osthof Nord, Stuttgart, 70599, Germany, regfuchs@uni-hohenheim.de

Production is often influenced by uncertain variables which cannot be quantified. Thus at different moments we may observe different values of output for the same input and vice versa. This contribution discusses a DEA-based methodology that considers this uncertainty in efficiency measurement. Instead of comparing one single observation for each plant with the production possibilities we will use a sample of observations, which describes the production possibilities of the plant itself.

2 - Cost-benefit Analysis of Supply Chain Risk Management Strategies

Arief Adhitya, Research Engineer, Institute of Chemical and Engineering Sciences, 1 Pesek Road, Jurong Island, Singapore, 627833, arief_adhitya@ices.a-star.edu.sg, Rajagopalan Srinivasan, Iftekhar Karimi

Today's supply chain operations are subject to various risks. Supply chain risks can be quantified in terms of potential loss of money, time, or material through simulation. Consequently, risk management strategies can be optimized through a simulation-optimization methodology and evaluated by performing a cost-benefit analysis. In this paper, the proposed approach is demonstrated using a refinery supply chain case study.

3 - A New Dual Representation of Entropic Risk Measures

Andrew Lim, Associate Professor, IEOR Department, 4141 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States, lim@ieor.berkeley.edu, Peng Li, George Shantikumar

We present a new duality result for entropic risk measures which generalizes in a non-trivial way the well known relationship between relative entropy and exponential utility.

■ SC09

C-Room 612

Joint Session Homeland/DAS: Decision Models for Homeland Security

Cluster: Homeland Security, Decision Analysis
Invited Session

Chair: Robin Dillon-Merrill, Assistant Professor, Georgetown University, 418 Old North, Washington, DC, 20057, United States, rld9@georgetown.edu

1 - Using Probabilistic Terrorism Risk Modeling For Regulatory Benefit-Cost Analysis

Henry Willis, Policy Researcher, RAND Corporation, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15217, United States, hwillis@rand.org, Tom LaTourrette

The White House Office of Management and Budget directs agencies to use benefit-cost analyses to evaluate proposed regulations. However, data and methods for estimating the benefits of terrorism security regulations cannot at present support such analysis. This paper demonstrates a framework for using probabilistic terrorism modeling in a break-even analysis of a regulatory action and discusses how this type of analysis can be further integrated into the regulatory review process.

2 - Optimal Resource Allocation for Defense of Multiple Targets

Vicki Bier, University of Wisconsin-Madison, Dept.. of Industrial and Systems Eng., 1513 University Avenue, Madison, WI, 53706, bier@engr.wisc.edu, Jaime Menoyo, Naraphorn Haphuriwat

Allocating a fixed budget to defense of multiple targets is a challenging task. We apply a rigorous model to the problem of identifying optimal allocations. In particular, we explore how the optimal allocation depends on the cost effectiveness of security investments, the defender's valuations of the targets, and the defender's uncertainty about the attacker's target valuations. Our results show that the cost effectiveness of defensive investment has a huge impact on the optimal allocation.

3 - Bioterrorism Risk Analysis

Gregory Parnell, Professor of Systems Engineering, United States Military Academy, Mahan Hall 432, West Point, NY, 10996, United States, gregory.parnell@usma.edu

This presentation reports on the National Research Council Study on Methodological Improvements to the Department of Homeland Security's Biological Agent Risk Analysis. Over the past year, the committee reviewed the DHS bioterrorism risk methodology and provided recommendations for improvement. The committees recommendations will also influence DHS's strategic, integrated Chemical, Biological, Radiological and Nuclear risk assessment due in June 2008.

4 - Challenges in Security Risk Analysis

Robin Dillon-Merrill, Assistant Professor, Georgetown University, 418 Old North, Washington, DC, 20057, United States, rld9@georgetown.edu, Robert Liebe

Security decisions must be based on threat scenario likelihoods, facility vulnerabilities, and the impacts of a successful attack in terms of mission loss, personnel loss, and economic loss. While the need for a threat x likelihood x consequence approach is well documented, implementing such a process is not simple. This presentation discusses several approaches to risk-based decision making as well as organizational consequences and challenges encountered implementing the processes.

■ SC10

C-Room 613

Algorithms, Complexity and Computational Issues in Inventory Games

Cluster: Inventory
Invited Session

Chair: Mahesh Nagarajan, Asst. Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, v6t 1z2, Canada, mahesh.nagarajan@sauder.ubc.ca

1 - Cost Allocation for Joint Replenishment Models

Jiawei Zhang, Assistant Professor, New York University, 44 West 4 st., suite 8-66, New York, NY, 10012, United States, jzhang@stern.nyu.edu

We consider the one-warehouse multiple retailer model with a submodular joint setup cost. We focus on how the cost, under an optimal power-of-two policy, should be allocated to the retailers. This question generates an interesting class of cooperative games. We prove that such cooperative games have non-empty cores. The key to our results is a strong duality theorem for the one-warehouse multiple retailer problem under power-of-two policies.

2 - Inventory Centralization Games with Price-dependent Demand and Quantity Discount

Xin Chen, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States, xinchen@uiuc.edu

Consider a distribution system consisting of a set of retailers, which are facing a single period price dependent demand of a single product. The retailers may place joint orders and share inventory to reduce their operating costs. Under rather general assumptions, we prove that the resulting inventory centralization game has a nonempty core. We also show how to compute an allocation in the core.

3 - Solving Partially Observable Markov Decision Processes (POMDP) by Computational Geometry

Hao Zhang, Assistant Professor, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, 90089, United States, hao.zhang@marshall.usc.edu

The POMDP model has wide applications but is often hampered by the intractability of the solution algorithms. We show that this problem can be decomposed into several standard problems in computational geometry. Thus, any advancement on the latter can improve the efficiency in solving the former. The proposed method provides a new perspective to the POMDP problem.

4 - Stable Coalitions in Inventory Games

Mahesh Nagarajan, Asst. Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, v6t 1z2, Canada, mahesh.nagarajan@sauder.ubc.ca

We analyze consider a class of inventory games in which players have incentives to form coalitions. We analyze stable outcomes in such games as fixed points of suitably defined set valued maps. This framework captures several of the existing dynamic concepts of stability, faciltates efficient, exact and approximate characterizations, where calculating the set of stable outcomes is usually computationally intractable.

■ SC11

C-Room 614

Manufacturing Complexity Management for Product Variety

Cluster: Manufacturing
Invited Session

Chair: Jack Hu, University of Michigan, Hayward St., 2250 G.G. Brown, Ann Arbor, MI, 48109, United States, jackhu@umich.edu

Co-Chair: Jeonghan Ko, University of Michigan, 2350 Hayward St., 2250 G.G. Brown, Mechanical Engineering, Ann Arbor, MI, United States, jeonghan@umich.edu

1 - On the Boundaries of Mass-customization: A Real World Case Study

Silvia Ponce, Associate Professor, HEC Montreal, 3000, Ch. Cote-Ste-Catherine, Montreal, QC, H3T 2A7, Canada, Silvia.Ponce@hec.ca, Valerie Paquin

Mass-customization departs from traditional production systems and manufacturing strategies as described by Hayes & Wheelwright's product-process matrix and Skinner's focused-factories. Trade-offs between variety and volume, and among manufacturing-outputs, seem meaningless. Ulrich's theory of boundary critique helps to understand a real-world case showing that mass customization boundaries are not always sharp.

2 - Complexity Analysis of Assembly Supply Chain Configurations

Hui Wang, Graduate Student Research Assistant, University of Michigan, 1932 White Oak Ln, Ypsilanti, MI, 48198, United States, johnwang@umich.edu, Jack Hu, Goker Aydin

We propose a metric for the complexity of an assembly chain. This 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 - Managing The Product Variety Through Information Sharing: A Case Study from the Automotive Industry

Sang Hwa Song, Professor, University of Incheon, 7-46 Songdo-dong, Yeonsu-gu, Incheon, 406840, Korea, Republic of, songsh@incheon.ac.kr, Seockjin Hong, Taebok Kim

Manufacturers are trying to increase product variety to improve customer service levels. Many researches focused on managing supply since the increased variety means the increased complexity which causes problems in supply chain. These efforts include component modularity and delayed customization strategy. However, managing supply complexities typically entails costs. Instead we present a demand side management method based on the case study in the automotive industry.

4 - Measuring Complexity in Mid-range Products

Kevin Caskey, Associate Professor, State Univ of New York at New Paltz, 1 Hawk Drive, School of Business, New Paltz, NY, 12561, United States, caskeyk@newpaltz.edu

Product complexity impacts sourcing. For mid- complexity and volume products, we have found that some manufacturers prefer to source locally while others source from lower cost countries. Complexity includes: size, capturing the density of the design network or the number of engineering specifications; frequency, quantifying how often and how much of the design is altered; precision, measuring tightness of design specifications. We will discuss complexity measures and initial field results.

■ SC12

C-Room 615

Distributed Computing and Stochastic Models

Cluster: Scheduling
Invited Session

Chair: Jay Sethuraman, Associate Professor, Columbia University, Dept.. of IEOR, New York, NY, 10012, United States, js1353@columbia.edu

1 - An Optimizing Scheduler for Large-Scale Stream-Based Distributed Computer Systems

Joel Wolf, IBM Research, IBM T.J. Watson Research Center, Hawthorne, NY, 10532, United States, jlwolf@us.ibm.com, Nikhil Bansal, Lisa Fleischer, Kirsten Hildrum, Deepak Rajan

Stream processing systems pose unique scheduling challenges. Jobs process unending streams of data. The same job may be done in multiple ways, and may be interconnected in various ways to other jobs. This is very different from traditional scheduling. We present a mathematical overview of a scheduler for a distributed stream processing system. The scheduler chooses which jobs to accept, how to connect them, how much processing to allocate to them, and how to distribute this work on the system.

2 - Stochastic Scheduling Subject to Preemptive-repeat Breakdowns with Incomplete Information

Xian Zhou, Associate Professor, The HK Polytechnic University, AMA Department, Hung Hom, Kowloon, Hong Kong - ROC, maxzhou@polyu.edu.hk, Xiaoqiang Cai, Xianyi Wu

We address a stochastic scheduling problem subject to preemptive-repeat machine breakdowns with incomplete information on the processing times and machine up/downtimes. We investigate the probabilistic characteristics of the model and apply the results to derive the optimal static and dynamic policies for a large class of performance measures. Under proper conditions, the optimal dynamic policies can be determined by one-step reward rates.

3 - Analysis of Join-the-Shortest-Queue Routing in Web Server Farms

Mor Harchol-Balter, Associate Professor, Carnegie Mellon University, Computer Science Dept., 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, harchol@cs.cmu.edu, Varun Gupta, Ward Whitt, Karl Sigman

We present the first analysis of the Join-the-Shortest-Queue task assignment policy for Web server farms. Web server farms involve Processor-Sharing servers. This work introduces a new technique: Single-Queue-Approximation (SQA), and uses the technique to prove some interesting insensitivity properties for Web server farms.

■ SC13

C-Room 616

Integer Programming and Applications

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Yanjun Li, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States, li14@purdue.edu

1 - Maximum Commonality Problems: Applications and Analysis

Milind Dawande, Associate Professor, University of Texas at Dallas, School of Management, Richardson, TX, 75083, United States, milind@utdallas.edu, Vijay Mookerjee, Subodha Kumar, Chelliah Sriskandarajah

Motivated by applications in extreme programming, we discuss algorithmic results for the problem of assigning pairs of developers to modules so as to maximize a graph-theoretic notion of commonality — a measure of the extent to which common developers work on related modules — subject to a load-balancing constraint.

2 - Simple-set Cutting Planes for Mixed-integer Programming

Ismael Regis de Farias JR., State University of New York, Dept.. of Ind. and Syst. Eng., 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu, Ming Zhao

We present extensions of mixed-integer rounding (MIR) and mixing-MIR inequalities to mixed-integer programming. In addition, we show how to apply our mechanism to generate inequalities in nonconvex nonlinear and mixed-integer nonlinear programming.

3 - A Greedy Bound for the Change-making Problem

Ping Heidi Huang, PhD Candidate, Krannert School of Management, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States, huang74@exchange.purdue.edu, Kwei Tang, Thomas Morin

The goal of the generalized changing-making problem is to minimize the total cost of using a set of coins to make a change. We obtain a greedy bound that exists in all coin systems, and then propose a partial greedy method. Its run time is independent of the change amount. The greedy bound can also be used in testing whether a coin system is canonical, and it outperforms existing bounds. Finally, an algebraic structure of compositions is presented to simplify the analysis of large coin systems.

■ SC14

C-Room 617

Systems of Systems Optimization

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: William Crossley, Associate Professor, Purdue University, School of Aeronautics and Astronautics, 315 N Grant St, West Lafayette, IN, 47907-2023, United States, crossley@purdue.edu

1 - Systems of Systems Optimization Applied to Simultaneous Aircraft Design and Fleet Allocation
Paul Frank, The Boeing Company, P.O. Box 3707, MC 7L-21, Seattle, WA, 98124-2207, United States, paul.d.frank@boeing.com, Evin Cramer, John Sabino, Sharon Arroyo

We examine optimization issues for systems of systems. This includes addressing the tradeoff of the strength of the central authority versus component autonomy and predictive modeling of components' input-output responses. The problem of simultaneous aircraft design and fleet allocation is used to illustrate a solution approach to these issues.

2 - Allocation of Variable Resources as a System of Systems Problem
William Crossley, Associate Professor, Purdue University, School of Aeronautics and Astronautics, 315 N Grant St, West Lafayette, IN, 47907-2023, United States, crossley@purdue.edu, Muharrem Mane

This study investigates the problem formulation of resource allocation and aircraft design as a System of Systems problem. The presence of a yet-to-be-designed aircraft in the problem statement makes this problem one of allocation of variable resources. The resulting statement is a Mixed-Integer, Non-Linear Programming (MINLP) problem. The study uses a problem in the context of fractional operations and investigates the impact of a new, yet-to-be-designed aircraft on the fleet operating cost.

3 - Aircraft Sizing & Allocation as a System-of-systems Problem via Surrogates & Multiobjective Design
Joshua Frommer, The Boeing Company, P.O. Box 3707 MC 0R-MK, Seattle, WA, 98124-2207, United States, joshua.b.frommer@boeing.com, William Crossley

Choosing the best mixture of systems to provide desired capabilities is a system-of-systems problem. A multiobjective MINLP problem formulation describes simultaneous aircraft sizing and fleet allocation to maximize a capability objective and minimize a cost objective. Surrogate models replace the analysis for predicting characteristics of new aircraft, and a genetic algorithm generates solutions to the problem. This formulation allows a fleet-level assessment of a new aircraft technology.

4 - Modeling Multiple Infrastructure Systems
Srinivas Peeta, Professor, Purdue University, Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, peeta@purdue.edu, Pengcheng Zhang

This presentation focuses on the analysis of multiple infrastructure systems from a holistic view using the system of systems framework. The interactions among the various systems are analyzed from spatial economics perspective under both equilibrium and dynamic disequilibrium settings. Application of proposed models in network design and infrastructure security problems is briefly discussed.

■ SC15

C-Room 618

Games, Equilibrium, and Variational Inequality Problems

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

Chair: Paul Tseng, Professor, University of Washington, Department of Mathematics, Box 354350, Seattle, WA, 98195-4350, United States, tseng@math.washington.edu

1 - Parallel Optimization and the Toolkit for Advanced Optimization
Todd Munson, Dr., Argonne National Laboratory, Mathematics and Computer Science Divisio, Argonne National Laboratory, Argonne, IL, 60439, United States, tmunson@mcs.anl.gov

We begin by presenting information on the design and implementation of the Toolkit for Advanced Optimization (TAO), and how the reuse of common optimization components is facilitated within the framework. We then discuss the some of the algorithms bundled with TAO for solving complementarity and optimization problems. Results for these methods are given along with an indication of their parallel performance.

2 - MPEC Approaches to Estimation of Pricing Games
Che-Lin Su, Post-Doc Research Fellow, CMS-EMS, Kellogg School, Northwestern Univ, CMS-EMS, Kellogg School of Management, 580 Leverone Hall, 2001 Sheridan Road, Evanston, IL, 60208-2014, United States, c-su@kellogg.northwestern.edu, Kenneth Judd

Maximum likelihood estimation of structural models is regarded as computationally difficult. This impression is due to a focus on the Nested Fixed-Point method. The NFXP approach is inappropriate for estimating games since it requires finding all Nash equilibria of a game for each parameter vector considered. We present an MPEC approach to the structural estimation problem. We illustrate with an example that the MPEC approach is immediately applicable to games with multiple equilibria.

3 - Some Continuity Properties of Affine Variational Inequalities
Stephen Robinson, Professor, University of Wisconsin-Madison, ISyE/UW-MADISON, 1513 University Ave Rm 4161A, Madison, WI, 53706-1539, United States, smrobins@wisc.edu

We present some results about continuity of solutions of affine variational inequalities when the polyhedral convex sets over which they are posed may change. Certain matrix classes make these properties possible, and we demonstrate some of these relationships. This permits identification of entire classes of problems whose solutions remain stable when resource or performance constraints change.

4 - Linear Complementarity Problems: Matrix Classes, Algorithms and EP-theorems
Tibor Illes, Associate Professor, Eotvos Lorand University, Pázmány Péter Sétány 1/C, Budapest, Hungary, illes@cs.elte.hu

In this talk we compare pivot and interior point algorithms for different classes of linear complementarity problems (LCP).Using duality theorem of LCP in EP-form, we generalize our algorithms in the following way: we start to solve LCP, without apriori information about the property of the matrix (sufficiency, bisymmetricity, positive definitness) . We either solve the LCP problem, or solve its dual problem, or give a certificate that the input matrix is not sufficient.

■ SC16

C-Room 619

Discrete Optimization

Contributed Session

Chair: Yash Aneja, Professor, University of windsor, 401 Susnet, Odette School of Business, Windsor, ON, N9B3P4, Canada, aneja@uwindsor.ca

1 - Computational Performance of a New Disaggregated Formulation of the Generalized Assignment Problem
Ishwar Murthy, Professor, IIM Bangalore, IIM Campus, Bannerghatta Rd, Bangalore, KA, 560076, India, ishwar@iimb.ernet.in, Saby Mitra, Sam Ransbotham

We present a new disagregated formulation of the Generalized Assignment Problem (GAP). We also introduce strong inequalities which are specific to this formulation. We test the strength of this formulation on standard benchmark problems. We show the new formulation to be significantly stronger than other known formulations.

2 - Comparison of Linear Formulations of the 0-1 Quadratic Knapsack Problem
Richard Forrester, Assistant Professor, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States, forrestr@dickinson.edu

There exists a variety of linear formulations of 0-1 Quadratic Programs in the literature, each designed with an emphasis for either conciseness or strength of the continuous relaxation. In this talk we examine a number of different linear models of the 0-1 Quadratic Knapsack Problem, including those that combine the attributes of conciseness and bounding strength. Extensive computational results are presented, and they indicate the superior formulation.

3 - Cardinality Cuts: Extension to General Integer Variables
Osman Oguz, Bilkent University, 06800 Bilkent, Ankara, Turkey, ooguz@bilkent.edu.tr

It is usually assumed that valid inequalities/cuts are usable for integer programs with general integer variables, based on transformation of integer variables into 0-1 variables. We show that the cardinality cuts developed recently, may be used for problems with general integer variables without resorting to variable transformation.

4 - Revisiting the Greedy Approach to Submodular Set Function Maximization
Pranava Goundan, Consultant, Analytics Operations Engineering, 111 Devonshire Street, 8th Floor, Boston, MA, 02109, United States, pranava@alum.mit.edu, Andreas Schulz

We consider maximizing a nondecreasing submodular set function over matroids. Classical results on the greedy algorithm to solve this problem assume the

existence of an optimal oracle that identifies at each step an element of maximum incremental value to the solution. With only an approximate oracle, we generalize the performance bounds of the greedy algorithm. Thereby we reinterpret, unify, and improve on results for generalized assignment, combinatorial auctions and related problems.

5 - Pure Fixed Charge Transportation Problem: A Polyhedral Study
Yash Aneja, Professor, University of windsor, 401 Susnet, Odette School of Business, Windsor, ON, N9B3P4, Canada, aneja@uwindsor.ca, Yogesh Agarwal

We give a set covering formulation of the Pure Fixed Charge Transportation Problem (PFCTP). Here we are given m sources and n sinks with a(i) units available at source i, and b(j) units needed at sink j. There is a fixed cost f(i,j) to open the route from i to j, and unlimited amount can be be shipped on this open route with no variable cost. We give conditions for a constraint to be a facet and provide a branch-and-cut algorithm. Some computational experience with this approach is presented.

■ SC17

C-Room 620

Social and Technical Aspects of Information Assurance

Sponsor: Information Systems Society
Sponsored Session

Chair: Raj Sharman, Assistant Professor, SUNY, Buffalo, NY, 325 F. Jacobs Management Center, Buffalo, NY, 14260, United States, rsharman@buffalo.edu

1 - Information Theoretic Approach for Characterization of Network Traffic
Sanjay Goel, Assistant Professor, SUNY, ALbany, NY, 1400 Washington Avenue, Albany, NY, 12222, United States, goel@albany.edu, Adnan Baykal

This work presents a novel approach of deep packet inspection by using algorithmic complexity for classification of packet content. Complexity is inherently incomputable however measures for approximating complexity are available. Complexity is computed for packet payload to classify them as benign or malicious. Intrusion data from the 1999 DARPA dataset is used for validation of the approach. This measure that may be useful for detection of previously unknown attacks.

2 - Specifying Digital Forensics: Formalizing Forensics Policies
Barbara Endicott-Popovsky, Director, Center for Information Assurance and Cybersecurity (CIAC), University of Washington, Box 354985 4311-11th Ave NE, Seattle, WA, 98199, United States, endicott@u.washington.edu, Deborah Frincke, Carol Taylor

Digital forensic practice is often ad-hoc and generally lacks widely accepted models or principles. As the field matures, advances are needed in how forensic capabilities are specified, implemented and verified. In this paper we propose a method for specifying forensic properties borrowed from the computer security domain. Our previous work stated forensic policies informally; here we formalize forensics policies in order to add preciseness and eliminate potential fuzziness in policy definition.

3 - Critical Risk Factors Affecting the Effectiveness of Public Health Information Systems Infrastructure
Raj Sharman, Assistant Professor, SUNY, Buffalo, NY, 325 F. Jacobs Management Center, Buffalo, NY, 14260, United States, rsharman@buffalo.edu, Radhika Kasturi, Shambhu Upadhyaya, Insu Park, Deepa Velu, H. R. Rao

This study explores factors affecting hospital information infrastructure in the context of emergencies. Specifically, this study addresses issues relating to risks to hospital information infrastructure, infrastructure effectiveness, mitigating factors across stakeholders and how disasters affect the stakeholders' perception of risks? This study develops a framework on risk mitigation with a goal of reducing risks and costs relating to provisioning of health services by hospitals during major critical incidents.

■ SC18

C-Room 201

Topics in Mixed Integer Nonlinear Programming

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Jeff Linderoth, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706-1572, United States, jtl3@lehigh.edu

1 - Conic Mixed-integer Programming with Bounded Integer Variables
Vishnu Narayanan, University of California, Berkeley, IEOR Department, UC Berkeley, 4141 Etcheverry Hall (Mail Code 1777), Berkeley, CA, 94720, United States, vishnu@ieor.berkeley.edu, Alper Atamturk

We present valid inequalities for conic mixed-integer programs with bounded integer variables via sequence independent lifting. We also analyze the special case of binary variables and present computational results on solving these problems.

2 - Heuristics for Mixed Integer Nonlinear Programming
Kumar Abhishek, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States, kua3@lehigh.edu

We present extensions of well-known primal heuristics for mixed integer linear programming such as feasibility pump, local branching and RINS, to mixed integer nonlinear programs. The heuristics have been implemented within FilMINT, a branch-and-cut solver for MINLPs. Results of detailed computational experiments will be presented.

3 - MIQCP: In Between QCP and MILP
Christian Bliek, Principal Scientist, ILOG, 1681 HB2 Route des Dolines, Valbonne, 06560, France, bliek@ilog.fr

A natural approach for solving Mixed Integer Quadratically Constrained Programs (MIQCP) is to solve a Quadratically Constrained Program (QCP) at each node in the tree. An alternative is to solve them as MILP using branch and cut. In this talk, we will describe and compare both approaches, which are now implemented in ILOG CPLEX.

■ SC19

C-Room 203

ICS Leading Edge Tutorials

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Robert Dell, Professor, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States, Dell@nps.edu

1 - Critical Thinking for Complex Network Systems: Trends, Tools, and Techniques for the OR Analyst
David Alderson, Assistant Professor, Naval Postgraduate School, Operations Research Department, 1411 Cunningham Rd, Monterey, CA, 93943, United States, dlalders@nps.edu

Recent attention toward the large-scale structure of many important complex network systems has led to the proliferation of new theories that attempt to explain, predict, and control their ongoing development and behavior. This tutorial will present the origins, contributions, and trends in the emerging field of network science. It will contrast the predominant perspective in the existing network science literature with that of decision science and highlight opportunities for contribution.

2 - (Almost) Transparent Parallel and Distributed Optimization
Pascal Van Hentenryck, Brown University, Box 1910, Providence, RI, United States, pvh@cs.brown.edu

The availability of commodity multi-core and multi-processor machines and the inherent parallelism in optimization applications offer significant opportunities for high-performance systems. They also present a fundamental challenge: how to exploit parallelism transparently to speed up optimization algorithms. This tutorial shows how to parallelize optimization algorithms almost transparently by using advanced programming language concepts.

■ SC20

C-Room 204

Multiattribute Utility: Theory and Practice

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, Industrial and Ent. Systems Engineering, 104 S. Mathews Ave, Urbana, IL, 61801, United States, aliabbas@uiuc.edu

1 - Invariance Relations for N-switch Utility Functions with Multiple Attributes

Ali Abbas, Assistant Professor, University of Illinois at Urbana-Champaign, Industrial and Ent. Systems Engineering, 104 S. Mathews Ave, Urbana, IL, 61801, United States, aliabbas@uiuc.edu

We extend Pfanzagl's invariance principle to multiple attributes. We discuss invariance on all attributes; a proper subset; and invariance with identical shift parameters. We show that any continuous and monotonic MAU with mutual utility independence is an invariant utility function to a multivariate transformation. We discuss the functional equations whose solutions yield n-switch multiattribute utility functions between multivariate lotteries when modified by monotonic transformations.

2 - Using MAU to Build Consensus for Addressing a Major Environmental Problem

Lee Merkhofer, lmerkhofer@comcast.net

The Faro Mine in the Canadian Yukon has, reportedly, created a toxic nightmare that will pose risks for hundreds of years and cost millions to manage. Multi-attribute utility analysis is being used to engage technical experts, the government, and impacted parties in a collaborative process to evaluate alternatives for addressing the problem.

3 - Multiattribute Utility as a Mixture of Exponential Utilities and Stochastic Dominance

Ilia Tsetlin, Assistant Professor of Decision Sciences, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, ilia.tsetlin@insead.edu, Robert L. Winkler

Suppose that a decision maker prefers more of any attribute to less, and prefers combining good random variables with bad ones. We show that her utility is then a mixture of multiattribute exponential utilities. We consider dominance implications for multivariate distributions and relations to multiattribute utilities based on various independence assumptions. The results can be important for utility assessment and decision making.

4 - Normative Decision Making with Multiattribute Targets

James Matheson, SmartOrg Inc., 855 Oak Grove Ave, Menlo Park, CA, 94025, United States, jmatheson@smartorg.com, Ali Abbas

A normative multiattribute target is a deterministic region in the space of multiattribute outcomes and has two properties: (1) the probability the outcome lies within it is equal to the expected utility, and (2) all outcomes within the target region are preferred to all outcomes outside it. These properties lead to a unique characterization of multiattribute targets in terms of the value aspiration equivalent, which extends the duality between probability and utility to multiple attributes.

■ SC21

C-Room 205

Graphical Models for Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Barry Cobb, Virginia Military Institute, Scott Shipp Hall, Lexington, VA, United States, cobbbr@vmi.edu

1 - Arc Reversals in Hybrid Bayesian Networks with Deterministic Variables

Esma Nur Cinicioglu, PhD Candidate in Operations Management, University of Kansas School of Business, 1300 Sunnyside Avenue, Summerfield Hall, Lawrence, KS, 66045-7585, United States, esmanur@ku.edu, Prakash P. Shenoy

We discuss arc reversals in hybrid Bayesian networks with deterministic variables. Hybrid Bayesian networks contain a mix of discrete and continuous chance variables. A chance variable is said to be deterministic if its conditional distributions have zero variances. Arc reversals are important in making inferences in hybrid Bayesian networks and influence diagrams.

2 - Maximum Likelihood vs. Least Squares for Estimating Mixtures of Truncated Exponentials

Antonio Salmeron, Associate Professor, University of Almeria, Carrera de Sacramento s/n, Almeria, AL, E-04120, Spain, antonio.salmeron@ual.es, Helge Langseth, Thomas Nielsen, Rafael Rumi

Mixtures of truncated exponentials (MTEs) have become one of the main tools for dealing with discrete and continuous variables simultaneously in probabilistic graphical models. Existing estimation methods for MTEs are based on least squares (LS). In this work we compare them with numerical maximum likelihood (ML) estimation, with the aim of determining whether or not the LS approximation can be used to substitute ML in more elaborated procedures.

3 - Computing the Full Distribution of the Max of Two Gaussians Using Hybrid Bayesian Networks

Prakash P. Shenoy, Distinguished Professor, University of Kansas School of Business, 1300 Sunnyside Avenue, Summerfield Hall, Lawrence, KS, 66045-7585, United States, pshenoy@ku.edu, Esma Nur Cinicioglu

We describe a procedure for computing the full distribution of the max of two Gaussians using hybrid Bayes nets. We represent the max of two Gaussians as a Bayesian network, convert it to a mixture of Gaussians Bayesian network, and use the Lauritzen-Jensen algorithm to compute the full distribution exactly.

4 - Evaluating Influence Diagrams Using Decision Circuits

Debarun Bhattacharjya, Stanford University, Terman Engineering Center, Stanford University, Stanford, CA, 94305, United States, debarunb@stanford.edu, Ross Shachter

We introduce decision circuits as a means to exploit the local structure as well as the conditional independence found in decision problems and to improve the performance of influence diagram analysis. We build on the probabilistic inference algorithms using arithmetic circuits to represent Bayesian belief networks as developed by Darwiche.

5 - Influence Diagrams for Pricing and Capacity Planning Under Uncertainty

Barry Cobb, Virginia Military Institute, Scott Shipp Hall, Lexington, VA, United States, cobbbr@vmi.edu

Influence diagrams are used to model capacity and pricing decisions for a monopolist facing uncertain demand. We examine how the optimal solution changes based on the timing of demand information and the flexibility to augment initial capacity. Comparisons are made to analytical solutions available in economics literature.

■ SC22

C-Room 206

JFIG Paper Competition Finalists I

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Sunil Kumar, Standord University, skumar@stanford.edu

1 - JFIG Paper Competition Finalists

In these two sessions the finalists of the 2007 JFIG paper competition will present their research. The paper competition is organized by the Junior Faculty Interest Group (JFIG) forum in INFORMS. JFIG was created in 2001 to promote the career development of tenure-track faculty in INFORMS. The goals of the paper competition are to encourage research among junior faculty and to increase the visibility of research conducted by junior faculty within the fields of operations research and management science. Six finalists are selected by the award committee and their papers are presented in these two sessions. The papers submitted for the competition are evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. Winners are announced at the JFIG lunch on Sunday at the INFORMS Annual Meeting.

■ SC23

C-Room 208

Behavioral Issues in Market Design

Sponsor: Behavioral Process Management (BPM)
Sponsored Session

Chair: Elena Katok, Associate Professor, Penn State University, 465 Business Building, Penn State University, University Park, PA, 16802, United States, ekatok@psu.edu

1 - Rank versus Price Feedback in Open Auctions
Wedad Elmaghraby, UMD, Van Munching Hall, College Park, MD, United States, Wedad_Elmaghraby@rhsmith.umd.edu, Elena Katok

Via interviews with auction practitioners, we learned that the use of rank feedback is increasing and now overshadows the use of full disclosure feedback. Practitioners have found that rank feedback stimulates more aggressive behavior from suppliers, particularly those that are in second or third place, since a supplier does not have to be the least cost supplier, but merely one of the least cost bidders. In this talk we report on experiments ran in the Netcentricity Behavioral Lab.

2 - Supply Contracts with Competition
Richard Engelbrecht-Wiggans, eplus17@uiuc.edu, Elena Katok, Valery Pavlov

We present and analytical and an experimental investigation of several supply chain contracts, with full and incomplete information. Our main finding is that with cometition, wholesale price contracts can perform well, and in some cases better than coordinating contracts.

3 - An Experimental Investigation of Buyer Determined Auctions
Elena Katok, Associate Professor, Penn State University, 465 Business Building, Penn State University, University Park, PA, 16802, United States, ekatok@psu.edu, Ernan Haruvy

We present a laboratory study of buyer determined auctions with non-monetary exogenous attributes. We find that generally sealed-bid auctions generate higher buyer surplus levels than dynamic auctions. We also find that when suppliers' non-monetary attributes are known to all suppliers, dynamic auctions perform particularly poorly.

4 - Corporate Budgeting: Lindahl Auctions and Return-on-investment Auctions
Matthias Hild, matthias@hild.org

Company-internal markets suffer from imperfect competition and externalities, while VCG mechanisms create a complex bidding task in the case of heterogeneous resources. We propose two auction designs in which truth-telling is weakly dominant in the limit. The first operationalizes Lindahl's markets with individualized prices, the second adjusts quantities based on return-on-investment bids. Both designs build on Ausubel's payment rule and Shor's subgradient algorithm.

■ SC24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - GAMS Development Corporation - Rapid Application Prototyping with GAMS
Steven Dirkse, GAMS Development Corp., 1217 Potomac St NW, Washington, DC, 20007, United States, 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: a Sudoku calculator sure to impress friends and family!

2 - AMPL Optimization LLC - Enhanced Solver Support in the AMPL® Modeling Language
Robert Fourer, Professor, Northwestern University, Dept. of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu

AMPL has set the standard for optimization modeling languages that handle complex models naturally and large models efficiently. AMPL's co-developer will give a quick but lucid tour of AMPL's current solver support, with emphasis on less well-known enhancements for global optimization and for constructs such as logical constraints, discrete and semi-continuous variable domains, and piecewise-linear functions.

■ SC25

C-Room 210

Service Science: Research and Practice

Sponsor: Service Science
Sponsored Session

Chair: Fugee Tsung, Dept.. of Industrial Eng & Logistics Mgt, HK Univ. of Science & Technology, Clear Water Bay, Kowloon, HK, Hong Kong - ROC, season@ust.hk

1 - Introduction to Service Science: A Research Perspective
Robin Qiu, Associate Professor, Penn State University, 30 E. Swedesford Road, Malvern, PA, 19355, United States, gxq102@gv.psu.edu

Service can not be held, and is typically intangible, perishable, difficult to port, hard to measure, and co-production with customers. This talk introduces a new thinking of design and deployment of competent and competitive service systems by taking account of service's unique characteristics. It aims to help promote and advance Service Science that will empower enterprise service systems and make them highly adaptable and sustainable to the service environment to meet the future challenge.

2 - Service Six Sigma
Fugee Tsung, Dept. of Industrial Eng & Logistics Mgt, HK Univ. of Science & Technology, Clear Water Bay, Kowloon, Hong Kong - ROC, season@ust.hk

Since 1997, Citibank has begun its Six Sigma initiative for defect reduction and cycle time reduction. After that, AIG, American Express, Bank of America, JPMorgan, Chase, Merrill Lynch and Vanguard are all in various stages of Six Sigma deployment. People now realize that Six Sigma is every bit as applicable to service processes as it is to manufacturing. This talk will give an introduction to Service Six Sigma and demonstrate some real cases from the service industry in Hong Kong and China.

3 - Preventing Piracy: The Role of Service Enhancements versus Digital Rights Management.
Rajiv Sinha, Center for Services Leadership, Arizona State University, Box 874106, Tempe, AZ, United States, rajiv.sinha@asu.edu, Collin Sellman, Raghu Santanam, Fernando Machado

Piracy is considered to be a serious problem for digital content providers. Based on 3 econometric studies conducted over 4 years, we demonstrate that service enhancements by content providers (such as content management and content delivery) are significantly more effective than Digital Rights Management (DRM) in reducing music piracy and increasing consumers' Willingness to Pay for legal downloads.

4 - Service Outsourcing: Information Asymmetry and Service Quality
Justin Ren, Boston University School of Management, 595 Commonwealth Ave, Boston, MA, United States, ren@bu.edu, Fuqiang Zhang

In this paper we study service outsourcing under information asymmetry. Particularly, there is a user company and a service provider that does outsourcing work for the user company. However, the service provider's cost structure is not perfectly observed by the user. Our results suggest that outsourcing companies can use relatively simple and yet robust contracts to assure a high level of capacity and service quality even when they do not have perfect information of the service provider.

■ SC26

C-Room 211

Tutorial: Innovation Science: Frameworks and Industrial Practices

Sponsor: Data Mining (Sponsored)
Sponsored Session

1 - Innovation Science: Frameworks and Industrial Practices
Andrew Kusiak, Professor, University of Iowa, 3131 Seamans Center, Industrial Engineering, Iowa City, IA, 52242-1527, United States, andrew-kusiak@uiowa.edu

The research and practice of innovation are fragmented and centered on specific cases. The tutorial contributes to better understanding of the process of innovation by the introduction of basic models. The ideas outlined in the tutorial provide a roadmap for areas of future studies of innovation. The emphasis is on data driven innovation. Some of the concepts introduced in the tutorial are illustrated with industrial innovation practices.

■ SC27

C-Room 212

Recommendation and Personalization

Cluster: Data Mining (Invited)
Invited Session

Chair: Zan Huang, Assistant Professor, Pennsylvania State University, 419 Business Building, University Park, PA, 16870, United States, zanhuang@psu.edu

1 - Filling in the Component Ratings That the Users Left Out
Ramayya Krishnan, rk2x@andrew.cmu.edu, Nachiketa Sahoo

Collection of multi-component ratings from the users often results in missing values for the components. A dataset collected from Yahoo! Movies shows that 32% of the records had missing values for the component ratings. We demonstrate a method to elicit user-ratings for these components from the user's and his peers, other observed ratings. We also argue that this task is a generalization of the task of predicting unknown ratings in one component rating collaborative filtering.

2 - Optimizing Composition of the Consideration Set to Maximize Payoffs From Web-based Personalization
Monica Johar, msjohar@email.uncc.edu, Sumit Sarkar

We study the problem of optimally designing the composition of the consideration set for firms engaging in web personalization, in order to maximize payoffs over an interaction period T. An important decision problem faced by firms is how to choose between advertising items that help learn about a consumers preferences in order to better profile the customer (i.e., advertisements towards learning) versus advertising items that are targeted for immediate sales (advertisements towards sales).

3 - Providing Better Recommendations by Using Aggregate Ratings
Alexander Tuzhilin, New York University, Stern School, New York, NY, United States, atuzhili@stern.nyu.edu, Akhmed Umyarov

This talk describes a method that uses aggregate ratings provided by various segments of users for various categories of items to derive better estimations of unknown individual ratings. This is achieved by converting the aggregate ratings into constraints on the parameters of a selected rating estimation model. It is shown that these additional constraints reduce rating estimation errors resulting in better rating estimations.

4 - Selectively Acquiring Ratings for Product Recommendation
Zan Huang, Assistant Professor, Pennsylvania State University, 419 Business Building, University Park, PA, 16870, United States, zanhuang@psu.edu

We propose proactively acquiring ratings from customers for a newly introduced product to quickly improve the accuracy of the predicted ratings generated by a collaborative filtering recommendation algorithm for the entire customer population. We propose an active learning sampling method that is generic to any recommendation algorithm for this rating acquisition problem and report experimental results on movie rating data.

■ SC28

C-Room 213

Integer Programming Models and Applications

Cluster: Joint Cluster Metaheuristics/ ICS: Metaheuristics
Invited Session

Chair: Haibo Wang, School of Business School, Texas A&M International University, P.O.Box 451373, Laredo, TX, 78045, United States, hwang@tamiu.edu

1 - Integer Programming Formulation for Graph and Network Optimization Problems
Bahram Alidaee, Professor, The University of Mississippi, School of Business Administration, University, MS, 38677, United States, balidaee@bus.olemiss.edu, Haibo Wang, Mustafa Altinakar

Graph and networks optimization have been powerful tools in solving complex problems arising in social sciences, mathematics, engineering, and sciences. Formulating a graph problem as a natural integer program (IP) is often a challenging task. The present study provides a unified framework for IP formulation of graph optimization problems. Application of the framework in several areas including homeland security, disasters management, coding theory, etc. will be discussed.

2 - Multi-skilled Workforce Constrained Preventive Maintenance Scheduling
Hongman Gao, Assistant Professor, King College, 1350 King College Road, Bristol, TN, 37620, United States, hgao@king.edu, Bahram Alidaee, Haibo Wang

We present a new integer programming (IP) model without computing craft-combinations for multi-skilled workforce constrained preventive maintenance (PM) scheduling.Comparison of the computational efforts of the new IP model with the existing model to obtain optimal solutions for 45 small and 36 large scale problems shows the increased effectiveness of the new IP model to yield optimal solutions.The new IP model reduces the average optimality gap for the test problems from 0.240% to 0.005%.

3 - The Page Ranking and Path Analysis of Web Site Traffic
Mark Lewis, Associate Professor, Missouri Western State University, mlewis14@missouriwestern.edu, Barbara Jo White

A new approach for rank ordering web pages by calculating the Most Common Paths (MCP) as created over time by web site traffic is presented. MCP refers to a sequencing of web pages into a maximal linear ordering according to the number of votes made by users moving to a new page from a referring one, as recorded in a transition matrix. The approach to discover the MCP utilizes server-side, anonymous, non-intrusive means to collect and analyze web user traffic.

4 - Simple, Fast Heuristics Based on Preferable Intervals for the Single-Sink, Fixed-Charge Transportation
Runchang Lin, Assistant Professor, Texas A&M International University, 5201 University Blvd, CH 313 M, Laredo, TX, 78041, United States, rlin@tamiu.edu, Haibo Wang, Bahram Alidaee, Gary Kochenberger

A new concept of preferable intervals is introduced and utilized in the context of single-sink fixed-charge transportation problems (SSFCTP). Properties of optimal solutions to the SSFCTP are investigated and necessary conditions for selecting suppliers are obtained in terms of preferable intervals. Several heuristics of polynomial time complexity are provided. Computational results are given showing that proposed method is both efficient and effective.

■ SC29

C-Room 214

New COIN-OR Projects

Sponsor: INFORMS Computing Society/ICS/COIN-OR
Sponsored Session

Chair: Kipp Martin, Professor, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States, kipp.martin@chicagogsb.edu

1 - The COIN-OR Optimization Services Project
Kipp Martin, Professor, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States, kipp.martin@chicagogsb.edu, Robert Fourer, Jun Ma

Optimization Services (OS) provides a set of standards for representing optimization instances, results, solver options, and communication between clients and solvers in a distributed environment. We provide source code for libraries that implement OS standards. The project includes an executable, OSSolverService, for communicating instances (OSiL XML format, AMPL nl format, MPS format) to solvers. Software is provided for communication with Cbc, Clp, Cplex, Glpk, Ipopt, Knitro, and LINDO.

2 - POAMS: The Platform for Object-algebraic Modeling Systems
Leo Lopes, University of Arizona, University of Arizona - SIE, Tucson, AZ, United States, leo@sie.arizona.edu, Victor Foulk

POAMS is a non-commercial, object-oriented linear optimization modeling environment leveraging the versatility of Python. It is a test bed for new modeling constructs and offers set-based modeling syntax and instance level manipulation capabilities. POAMS also provides access to external data sources such as Excel, OpenOffice.org, and most DBAPI 2.0 databases, as well as computational environments such as MATLAB, and R.

3 - Creating a Testbed of Industry Problems for OR Model and Algorithm Development
Ben Lowe, Bell Labs Ireland, Alcatel-Lucent, Blanchardstown Industrial Park, Blanchardstown, Dublin 15, Ireland, blowe@alcatel-lucent.com, Robin Lougee-Heimer

Many researchers are challenged with developing algorithms and models for industrial problems — without representative data and information related to the market characteristics that make the problem real. (Data access can influence the applicability and impact of research.) We propose an approach to exchanging real problems and data between solution seekers & solution providers using an open-source philosophy.

■ SC30

C-Room 2A

System Reliability Modeling and Optimization I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qianmei (May) Feng, Assistant Professor, University of Houston, Houston, TX, United States, qmfeng@uh.edu

1 - Network Optimization with High Failure Probability Using Redundancy Allocation
Paola A. Hernandez-Ramirez, MSE Student Department Industrial Engineering, University of Puerto Rico at Mayaguez, University of Puerto Rico at Mayaguez, Industrial Eng. Department PO.Box9043, Mayaguez, PR, 00681, Puerto Rico, paitohr@yahoo.com, Noel Artiles-Leon

This research develops a methodology to optimize the reliability of a network whose arcs are not necessarily in series or in parallel and have low known reliability. Network reliability is improved by using redundant arcs with a budgetary restriction. Two heuristic optimization algorithms are used and

compared to solve this redundancy allocation problem: a genetic algorithm and an algorithm developed by the authors based on sequential integer linear programming.

2 - Design and Maintenance Optimization of Multi-state Parallel Systems

Zhigang Tian, Assistant Professor, Concordia Institute for Information Systems Engineering, Concordia University, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca, Gregory Levitin, Ming J. Zuo

The design and maintenance optimization of multi-state parallel systems is studied. The key point is technical and organizational actions can affect the state transition rates of a multi-state component, and thus affect the state distribution of the component and the availability of the system. An approach is presented to determine the optimal versions and numbers of components and the optimal set of technical and organizational actions to optimize the system cost and availability.

3 - New Performance Measures for Multi-state System Reliability

Kailash Kapur, Professor, University of Washington, Industrial Engineering, Seattle, WA, 98195, United States, kkapur@u.washington.edu, Carlos Solorio Magana

Most of the systems degrade over time and have multiple levels of performance. The traditional binary models are not realistic to capture the accurate level of performance of these systems. We present some new measures for system performance where the system and the components have multiple levels of performance. These measures combine traditional reliability measures in terms of probability with economics using utility theory from the viewpoint of the customer.

4 - A Two-stage Approach for Solving Multi-objective System Reliability Optimization Problems

Haitao Liao, Assistant Professor, Wichita State University, 1845 Fairmount St., Industrial & Manufacturing Eng Dept., Wichita, KS, 67260-0035, United States, haitao.liao@wichita.edu, Zhaojun Li

This research addresses multi-objective system reliability optimization problems. A two-stage approach is proposed to facilitate the optimization process. The first stage identifies implicit solutions followed by the second stage that selects only limited explicit solutions. A multi-objective heuristic method and a relative efficiency evaluation method are applied to reduce the size of Pareto optimal solutions for such system reliability optimization problems.

5 - Concurrent Quality and Reliability Optimization for MEMS

Qianmei (May) Feng, Assistant Professor, University of Houston, Houston, TX, United States, qmfeng@uh.edu, Hao Peng, David Coit

The new technology of MEMS shows great promise for many critical applications. For a MEMS system designed with degrading components, quality and reliability need to be both considered concurrently over the product life cycle to benefit the manufacturer and the consumer. By rewarding the high system reliability and penalizing the quality loss, we developed probability and optimization models for a MEMS system to determine the burn-in period, specification limits, and system replacement intervals.

■ SC31

C-Room 2B

Joint QSR/Simulation Session

Sponsor: Quality, Statistics and Reliability, Simulation
Sponsored Session

Chair: Hong Wan, Purdue University, 315 N. Grant Street, West Lafayette, IN, United States, hwan@purdue.edu

1 - Strong: A Response-surface-based Algorithm in Simulation Optimization

Hong Wan, Purdue University, 315 N. Grant Street, West Lafayette, IN, United States, hwan@purdue.edu, Kuohao Chang, Jeff Hong

Response Surface Methodology (RSM) is a metamodel-based optimization method that has been used widely in simulation optimization. However, the method is not automated and does not have convergence guarantee. This paper propose STRONG algorithm that takes a similar framework as RSM but solves these two problems traditional RSM has. Combining with appropriate experimental designs, STRONG has the potential of handling high-dimensional problems efficiently.

2 - Metamodeling for Cycle Time-throughput-product Mix Surfaces

Feng Yang, Assistant Professor, West Virginia University, Morgantown, WV, 26505, United States, Feng.Yang@mail.wvu.edu, Mustafa Tongarl, Bruce Ankenman, Barry Nelson, Jingang Liu

A simulation-based methodology is proposed to map the mean of steady-state cycle time as a function of throughput and product mix for manufacturing systems. Nonlinear regression models motivated by queueing analysis are assumed for the underlying response surface. To insure efficiency and control estimation error, simulation experiments are built up sequentially using a multistage procedure to collect data for the fitting of the models.

3 - Distribution-free Tabular CUSUM Charts with Quick-and-dirty Autoregressive Variance Estimators

Joongsup Lee, PhD Student, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, jlee@gatech.edu, Christos Alexopoulos, David Goldsman, Kwok-Leung Tsui, James Wilson, Seong-Hee Kim

We present the Quick-and-dirty autoregressive (QDARVE) and overlapping standardized time series (OSTS) methods for the estimation of the variance parameter required for the distribution-free tabular CUSUM (DFTC) chart. Then we investigate the performance of DFTC with estimated parameters. Our experimental results show that the performance of DFTC with estimated parameters is comparable to the known parameter case.

4 - A Simulation-based Technique to Estimate Component Residual Life for Gamma Prior

Santanu Chakraborty, Purdue University, 144 E Stadium Avenue, Apt # 710, West Lafayette, IN, 47906, United States, santanu@purdue.edu, Nagi Gebraeel, Mark Lawley, Hong Wan

In this work we derive an expression for the residual life distribution of a linear degradation model with iid normal error and gamma distributed stochastic parameter, using Bayesian updating technique. We also propose a simulation based algorithm to estimate the residual life. Finally, we extend our application to monitoring the degree of stenosis in the Arterio-Venous access of hemodialysis patients, to predict the time of next intervention.

■ SC32

C-Room 302

Panel Discussion: Seth Bonder's Keynote Address: Some Thoughts on Our Profession

Cluster: Rebuttal Session on Seth Bonder's Keynote
Invited Session

Chair: Lawrence Seiford, Professor and Chair, University of Michigan, 1205 Beal Avenue, Ann Arbor MI 48109-2117, United States of America, seiford@umich.edu

1 - Panel Discussion: Seth Bonder's Keynote Address: Some Thoughts on Our Profession

Moderator: Lawrence Seiford, Professor and Chair, University of Michigan, 1205 Beal Avenue, Ann Arbor MI 48109-2117, United States of America, seiford@umich.edu, Panelist: Brenda Dietrich, Saul I. Gass, Leon McGinnis

The Keynote address is expected to present some controversial ideas and recommendations. In this session panelists will provide their reactions regarding the utility and feasibility of the ideas and recommendations, and then all attendees will be provided the opportunity to participate in the debate.

■ SC33

C-Room 303

Urban Transportation Planning Models III: Computational and Theoretical Extensions of the UTP Paradigm

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: David Boyce, Professor Emeritus, University of Illinois at Chicago, Chicago, IL, 60607, United States, dboyce@uic.edu

1 - New Computational Results on Solving the Sequential Procedure with Feedback

David Boyce, Professor Emeritus, University of Illinois at Chicago, Chicago, IL, 60607, United States, dboyce@uic.edu, Christopher O'Neill, Wolfgang Scherr

This talk presents findings for alternative feedback solution procedures applied to a 1,000 zone model. Three methods were tested: NaÔve Feedback (no averaging of trip matrices or link flows); Averaging with Constant Weights, applied to the trip matrices; Method of Successive Averages (MSA), also applied to trip matrices.

2 - Developing and Calibrating the Transims Model: A Case Study of Chittenden County, Vermont

Adel Sadek, Associate Professor, Center Co-Director, University of Vermont, Computer Science Department, 33 Colchester Avenue, Burlington, VT, 05405, United States, asadek@cems.uvm.edu, Ross Gortner, Shan Huang, Stephen Lawe, John Lobb

This paper describes the development and calibration of the Transportation Analysis and Simulation System (TRANSIMS), an agent-based model for transportation and air quality forecasting, for Chittenden County, Vermont, an area of about 1,400 square kilometers and a population of 146,000. Lessons learned in the process are summarized and discussed.

3 - An Integer Programming Approach for Synthetic Population Generation

Jessica Guo, Assistant Professor, University of Wisconsin, 1206 Engineering Hall, 1415 Engineering Drive, Madison, WI, 53706, United States, jyguo@wisc.edu

This study proposes an integer programming (IP) model for synthetic population generation (SPG). The SPG is a problem of creating a microdata set to represent the individual households and their members in a population for the purpose of microsimulation. The proposed IP formulation will be presented and illustrated using US census data. The empirical results will be compared with those obtained by the conventional solution approach based on the iterative proportional fitting procedure.

4- Calibration of Mesoscopic Traffic Simulation Models Using Population Based Evolutionary Algorithms

Fabrice Marchal, Laboratory of Transportation Economics (LET), Lyon, France, fabrice.marchal@let.ish-lyon.cnrs.fr

This paper presents a methodology to calibrate dynamic traffic simulation models with real data acquired from traffic counts and travel time measurements acquired from GPS devices. The methodology is demonstrated on the city of Lyon with the mesoscopic traffic simulation tool METROPOLIS that features a departure time choice model based on the work of W.Vickrey. The methodology calibrates the demand and supply parameters as well as the departure time choice parameters.

■ SC34

C-Room 304

Topics in Vehicle Routing

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Okan Ozener, H. Milton Stewart School of Industrial and Systems Engineering at the Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, orsan@gatech.edu

1 - Allocating Costs in Inventory Routing Problem

Okan Ozener, H. Milton Stewart School of Industrial and Systems Engineering at the Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, orsan@gatech.edu, Ozlem Ergun, Martin Savelsbergh

We consider an inventory routing problem where a single product is distributed to several customers from a single facility over a finite or infinite horizon. Assuming that the historical delivery routes and the volumes delivered to each customer with these routes are known, we attempt to identify the high cost customers. This information may be of value when allocating costs to the customers, marketing to new customers, or revisiting the routing/volume decisions.

2 - Constructing Fixed Routes for Vehicle Routing Problems with Stochastic Demands

Emrah Uyar, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, United States, emrah@gatech.edu, Martin Savelsbergh, Alan Erera

We study the construction and operation of fixed routes for delivery problems with uncertain customer demands. A customer may or may not place an order on a particular delivery day; the probability that a customer places an order is known. Sample-based feasibility evaluation techniques are developed to accommodate delivery time windows. A novel feature is the flexibility, at the operational level, for a customer to be visited by one of two vehicles.

3 - Stochastic Combinatorial Truckload Procurement Auctions

Shervin AhmadBeygi, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, 48109, United States, shervin@umich.edu, Amy Cohn, Damian Beil, Amitabh Sinha, Richard Chen

We consider a stochastic multi-commodity-flow formulation in order to solve the winner determination problem for combinatorial procurement auctions in which the carrier costs are uncertain. This research has implications in the areas of applied transportation planning, auction theory, and stochastic programming.

4 - Fixed Tours vs. Complete Reoptimization Strategies for the Online Inventory Routing Problem

Ricardo Giesen, Assistant Professor, Universidad Catolica de Chile, Vicuna Mackenna 4860, Macul, Santiago, Chile, giesen@ing.puc.cl, Patrick Jaillet, Hani Mahmassani

We study strategies for the online inventory routing problem (OIRP). We propose two decomposition approaches for the OIRP, in which a simplified version of either the control or the routing side is solved first, and then that solution is used as a soft constraint when solving the other. For each approach, different rolling horizon strategies are proposed. The performance of proposed strategies is simulated and the impacts of using real-time information are discussed.

■ SC35

C-Room 305

Facility Logistics I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Sunderesh Heragu, Professor and Duthie Chair in Engineering Logistics, University of Louisville, Room 309, JB Speed Building, Department of Industrial Engineering, Louisville, KY, 40292, United States, s.heragu@louisville.edu

1 - A Design Model for Optimized Unit-load Warehouse Aisles

Russell Meller, Hefley Professor of Logistics, University of Arkansas, Center for Engr Logistics and Distrb., 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, rmeller@uark.edu, Kevin Gue, Letitia Pohl

Newfound attention is being placed on unit-load warehouse aisles due to the introduction of new aisle designs that have been shown to reduce the travel times by up to 20 per cent. These aisle designs are constructed to minimize single- or dual-command for a given space. However, there is a need for a design model that can consider the uniqueness of each unit-load warehouse's storage, space and throughput constraints. We present such a model and compare its results to a traditional design.

2 - Identifying Likely Efficiency Improvement Paths for Warehouses in Data Evelopment Analysis

Andrew Johnson, Assistant Professor, Texas A&M University, 237K Zachry Engineering Center, Department of Industrial and Engineering, College Station, TX, 77843, United States, ajohnson@tamu.edu

Inefficiency, as measured by the input oriented data envelopment analysis model, assumes two warehouses that can reduce different inputs by the same proportion are equally inefficient. A new directional distance model (DDM) has recently been developed that allows contraction of inputs at different rates. However, methods for identifying the direction of improvement are currently lacking. We will discuss how to identify the direction to use in the DDM for the case warehouse evaluation.

3 - Open Queuing Network Model for Autonomous Vehicle Storage and Retrieval Systems (AVSRS)

Sunderesh Heragu, Professor and Duthie Chair in Engineering Logistics, University of Louisville, Room 309, JB Speed Building, Department of Industrial Engineering, Louisville, KY, 40292, United States, s.heragu@louisville.edu, Cai Xiao

We discuss application of an open queuing network model for a warehouse with multiple storage levels. The storage and retrieval are done by autonomous vehicles that are restricted to travel within a designated level. To move pallet loads between different levels, a mechanism to transfer the pallet load from a vehicle to an elevator and from the elevator to another vehicle at another level is assumed to be available.

■ SC36

C-Room 306

Measuring and Managing Risk, Vulnerability and other Emergency Measures

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yueyue Fan, Assistant Professor, University of California, Department of CEE, Davis, CA, 95616, United States, yyfan@ucdavis.edu

1 - An Efficiency Measure for Dynamic Networks with Application to the Internet and Vulnerability

Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts, Finance and Operations Management, Isenberg School of Management, Amherst, MA, 01003, United States, nagurney@gbfin.umass.edu, Qiang Qiang

In this paper, we propose an efficiency measure for dynamic networks, including the Internet, which captures demands, flows, and costs over time, and which allows for the identification of the importance of the nodes and links and their rankings. We provide both continuous time and discrete time versions of the efficiency measure. We illustrate the efficiency measure for the time-dependent Braess paradox and demonstrate how it can be used to assess the most vulnerable nodes and links.

2 - Flexibility and Fragility in Supply Chain Network Design
Michael Lim, Northwestern University, Department of IE/MS, Northwestern University, Evanston, IL, 60208, United States, m-lim2@northwestern.edu, Mark Daskin, Achal Bassamboo, Sunil Chopra

We examine the impact of disruptions on alternative chained manufacturing/product configuration. We introduce fragility to quantify the change in system performance resulting from a disruption. Simulation insights for both node and link failures are discussed as is a decomposition scheme for systems with multiple disruptions.

3 - Flexibility of Intermodal Freight Transport Network
Lichun Chen, University of Maryland, University of Maryland, College park, MD, 20742, United States, lcchen@umd.edu, Elise Miller-Hooks

The problem of measuring flexibility (i.e. ability to continue operations, adapt to changing circumstances and return to normal operations) of intermodal freight transport networks is addressed. Results of experiments conducted to illustrate the proposed flexibility concept and proposed methodology for its characterization are given for the freight transport corridor between New York and Washington.

4 - Reinforcement Learning in Post-disaster Management and Response
Yueyue Fan, Assistant Professor, University of California, Department of CEE, Davis, CA, 95616, United States, yyfan@ucdavis.edu

Post-disaster relief and rescue activities are often carried out when information about damages is not completely revealed. In this situation, decisions need to be made simultaneously as the environment being learned. In this presentation, we will introduce reinforcement learning that integrates exploring and exploiting the environment and will demonstrate its potential applications in post-disaster management and response activities through examples of goal finding and resource allocation.

■ SC37

C-Room 307

Social Network Analysis Methods for Military Operations

Sponsor: Military Applications
Sponsored Session

Chair: Marcus Perry, Assistant Professor, Florida International University, 10555 West Flagler Street EC 3172, Miami FL 33174, United States, perrym@fiu.edu

1 - Characterizing and Detecting Unrevealed Elements of Network Systems
James Leinart, Air Force Institute of Technology, 2950 Hobson Way, Bldg 641, Wright Patterson AFB, OH, 45433, United States, james.leinart@afit.edu, Richard Deckro, James Moore, David Denhard, Robert Mills, Marcus Perry

A method to identify hidden nodes that connect network components is presented. A procedure to reconstruct networks from partial information using a stochastic observation process is also introduced. Associated analysis includes network characteristics impacting reconstruction, and accuracy assessment of the reconstructed network. The procedure implements causality, reconstructability analysis and graph theoretic concepts.

2 - Critical Node Detection in Sparse Graphs
Ashwin Arulselvan, University of Florida, 1111 SW 16th Avenue, #106, Gainesville, FL, 32601, United States, ashwin@ufl.edu, Clayton Commander, Panos Pardalos, Lily Elefteriadou

In the critical node detection problem, we seek a set of nodes in a graph with a specific cardinality whose deletion results in maximum disconnectivity. The problem has applications in several fields including biomedicine, telecommunications, and military strategic planning.

3 - Applying the Key Player Problem Negative to Clandestine Networks
Travis Herbranson, Captain, U. S. Air Force, Travis.Herbranson@maxwell.af.mil, Richard Deckro, James W. Chrissis, Jonathan T. Hamil

We introduce new models based on the key player problem negative that model network disruption. The mathematical programs we developed generate sets to lengthen paths, fragment networks, and create isolated components. The sets identify key nodes and arcs whose removal from the network has the potential to cause effective disruption.

4 - Detecting Edge Structure in Noisy Networks
Marcus Perry, Assistant Professor, Florida International University, 10555 West Flagler Street EC 3172, Miami, FL, 33174, United States, perrym@fiu.edu, Richard Deckro

In this talk, we present a tractable hypothesis testing framework for detecting, characterizing and estimating edge-set structure and strengths between vertices in an undirected network. It is assumed that the edge set is only observable through a noisy adjacency matrix. Application of the proposed method can provide analysts with valuable insight into the true edge structure with a given level of confidence. The proposed method is demonstrated using a real-world terrorist friendship network.

■ SC38

C-Room 308

Marketing III

Sponsor: Marketing Science
Sponsored Session

Chair: Gary Erickson, Professor, University of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, erick@u.washington.edu

1 - The Dimensions of Reputation in Electronic Markets
Anindya Ghose, aghose@stern.nyu.edu, Arun Sundararajan, Panos Ipeirotis

Prior studies of word-of-mouth have examined their impact on market outcomes using the average numerical rating reported by prior buyers. Our study is based on the conjecture that the information in textual feedback plays a substantial role in establishing reputation and the pricing power of sellers. This paper is the first study that integrates economic and text mining techniques toward a more complete analysis of the information captured by word-of-mouth systems.

2 - Next Generation (seriously) Sales Force Allocation and SC Network Design
Alan Dybvig, Owner, Dybvig Consulting, 77 Adams Drive, Princeton, NJ, alan@dybvigconsulting.com, Jon Hosking

Lodish et al described an Edelman-prize winning modeling approach addressing how large the sales force should be and how it should be deployed in INTERFACES (18:1 Jan-Feb 1988, review suggested). By making a variety of changes to the original model's formulation, important benefits accrue including: i) a response curve-driven, optimal enterprise-wide, continuous planning and budgeting modeling capability and ii) next generation supply chain network design functionality.

3 - When Quantity Matters: A Multivariate Tobit Model
Sri Duvvuri, Assistant Professor, University of Iowa, S348 PBB, Iowa City, IA, 52242, United States, sri-duvvuri@uiowa.edu

Integrating quantity decisions into the choice framework is essential to overcome the selectivity bias and infer consumer behavior more accurately. We propose a multivariate tobit model that simultaneously accounts for purchase incidence and quantity decisions of consumers across multiple categories. We estimate a Hierarchical Bayes econometric specification of this complex model using MCMC methods. Scanner panel data across several categories are used for model calibration.

4 - Selecting Distribution Channel Strategies for Non-profit Organizations
Annie Niu, University of Alberta, PhD Program, School of Business, Edmonton, AB, T6H 4M5, Canada, rniu@ualberta.ca, Ignacio Castillo, Xuan Zhao

Many non-profit organizations have been turning to commercial activities to increase revenues due to declining government/donor support. By selling products or services related to its institutional mission using a particular distribution channel strategy, a non-profit organization might reach more people. We analyze how a non-profit organization should select its distribution channel strategy under certain market conditions and consider a non-profit organization's channel strategy when competing with a fully integrated or decentralized for-profit channel.

■ SC39

C-Room 309

System Approach to Healthcare Delivery System

Sponsor: Health Applications Section
Sponsored Session

Chair: Yuehwern Yih, Professor, Purdue University, School of Industrial Engineering, 315 N Grant Street, West Lafayette, IN, 47907, United States, yih@purdue.edu

1 - A Simulation of ER Operation and Its Impact on Hospital Diversion

Tze Chao Chiam, Graduate Assistant, Purdue University, School of Industrial Engineering, 315 N. Grant Street, Rm 210, West Lafayette, IN, 47907, United States, tzechao@purdue.edu, Yuehwern Yih

This research studies the impact of operation of an ER on hospital diversion. It also investigates the relationship between time of diversion and the ease for the ER to resume normal working conditions. Although not widely studied, diversion has great impact on the quality of care as well as ER operation.

2 - A Regression Tree Approach for Assessing Perceived Usefulness of Computerized Clinical Reminders

Sze-jung Sandra Wu, Graduate Assistant, Purdue University, School of Industrial Engineering, 315 N Grant Street, West Lafayette, IN, 47907, United States, swu@purdue.edu, Mark Lehto, Bradley Doebbeling, Yuehwern Yih

Computerized clinical reminders (CCRs) are useful tools for alerting healthcare providers of upcoming or overdue events. We conducted a cross-sectional survey of CCRs users from 104 different VA facilities using a 5-point Likert scale. The survey data were analyzed using a cross-validated regression tree algorithm to measure the factors affecting clinician's perceived usefulness of CCRs.

3 - A Simulation Study of the Effects of Patient Dispatching Rules in a Centralized Check-in Process

Daiki Min, Graduate Assistant, Purdue University, School of Industrial Engineering, 315 N Grant Street, West Lafayette, IN, 47907, United States, dmin@purdue.edu, Yuehwern Yih

This study examines how patient dispatching rules in a centralized check-in affect the performance of outpatient clinics. To investigate the performance of dispatching rules, simulation experiments have been conducted with three different rules which include newly proposed Flow rate-based rule, FIFO and EDD. The simulation results provide guidelines for designing centralized check-in on the criteria of clinic makespan, patient tardiness for appointment and patient waiting time for check-in.

4 - Assessment of UHF Passive RFID for Workflow Analysis in a Clinical Environment

David Frankenfield, Graudate Assistant, Purdue University, School of Industrial Engineering, 315 N Grant Street, West Lafayette, IN, 47907, United States, dfranken@purdue.edu, Daiki Min, Yuehwern Yih

In the attempt to collect data for the purpose of workflow analysis many healthcare organizations have been exploring the possible opportunities of utilizing Radio Frequency Identification (RFID) technology. Our research consists of a technology assessment conducted to identify factors that impact the use of UHF passive RFID technology and optimal sensor network design in clinical environments. The analysis concludes with identifying obstacles and what is necessary to ensure system reliability.

■ SC40

C-Room 310

Advances in Health Care Operations Research

Sponsor: Health Applications Section
Sponsored Session

Chair: Martin Puterman, Professor, University of British Columbia, Sauder School of Business, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, marty@chcm.ubc.ca

1 - Liver Transplantation Timing with Ambiguous Health Transition Probabilities

David Kaufman, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, davidlk@engr.pitt.edu, Andrew Schaefer

The living-donor model (LDM) for the optimal timing of liver transplantation requires the estimation of underlying health transition probabilities from clinical data. Such estimation may be a source of ambiguity. We account for ambiguity in a robust DP formulation of the LDM in which the decision-maker plays a max/min sequential game against nature. Structural results and a robust modified policy iteration algorithm are presented. Numerical examples with clinically obtained data are discussed.

2 - Service Allocation in a Network of Hospitals

Pablo Santibanez, Planner, Business Engineering, Fraser Health Authority, #102 - 10334 152A Street, Surrey, BC, V3R 7P8, Canada, pablo.santibanez@fraserhealth.ca, Kenneth Yip, Georgia Bekiou

This talk presents a service allocation model developed to support a long-term planning exercise in Fraser Health, a British Columbia Health Authority with a population of over 1.5 million and overseeing the operation of 12 acute care hospitals in a vast geographic region. An optimization model is used to decide the clinical service mix and capacity to be allocated at each hospital in the network in every decision period, based on population needs and leading clinical practices.

3 - Optimizing Patient Movement Within a Hospital

Jonathan Patrick, Assistant Professor, University of Ottawa, 163 Fifth Ave, Ottawa, ON, K1S2M8, Canada, jonathan.patrick@sauder.ubc.ca, Martin Puterman

Capacity planning within hospitals remains largely a matter of reaction and budgetary limitations. We seek to help hospital administrators balance the cost of base capacity against overtime. Recognizing that capacity requirements depend on patient scheduling and placement policies, we build a model that determines the optimal patient scheduling and placement as well as the resource capacity required to meet pre-specified service targets (usually in the forms of wait time targets).

4 - Forecasting Radiation Therapy Demand for Head and Neck Cancers in British Columbia

Greg Werker, PhD Student, Sauder School of Business, UBC, 3869 W 18th Avenue, Vancouver, BC, V6S1B4, Canada, greg.werker@sauder.ubc.ca, John French, Antoine Saure

The British Columbia Cancer Agency (BCCA) has difficulty dealing with highly variable demand for radiation therapy (RT) treatment. We develop models for predicting RT starting volumes. Data from the BCCA patient database were used in regression models to examine patient data and other upstream indicators that may be useful in predicting RT starting volumes. We found that a basic model using site admits from the prior three months is a good predictor for RT starting volumes.

■ SC41

C-Room 3A

Joint Session B&SB/HAS: Optimization in Biology

Sponsor: INFORMS Computing Society/ Bioinformations & Systems Biology, Health Applications Section
Sponsored Session

Chair: Stephen Billups, Associate Professor, University of Colorado at Denver and Health Science Center, Dept.. of Mathematical Sciences, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States, Stephen.Billups@cudenver.edu

1 - A Special Case of the Euclidean Distance Problem that Arises in the Protein 3-Dimensional Conformation

Changhui Choi, Post Doc., The University of Colorado at Denver, Campus Box 170, Denver, CO, 80217-3364, United States, laplacia@hotmail.com, Samuel Burer

The protein 3-dimensional conformation problem is to predict the 3-dimensional structure that a protein takes in a certain fluid. We solve one of the sub-problems, which looks for the 3-dimensional coordinates of atoms that satisfy all the given equality and inequality distance constraints. This problem can be formulated as quadratically constrained quadratic programming problems. We solve this problem via semidefinite programming relaxations and some local search methods.

2 - An Optimization Model for Owl Habitat Reserve Management

Bala Krishnamoorthy, Washington State University, 103 Neill Hall, P.O. Box 643113, WSU, Pullman, WA, 99164-3113, United States, kbala@wsu.edu, Natalie Baerlocher, David Allen

We develop a model for the problem of designing habitat reserve areas to support endangered species. For the Northern Spotted Owl (NSO), we model the occupancy of a patch of land by a 0-1 variable. We develop a function called the Habitat Connectivity Index (HCI), which measures the overall suitability of a habitat to sustain the owls. The decisions of which patch is to be sustained and which cleared from among candidate ones is modeled as a non-linear integer program that maximizes HCI.

3 - Analyzing Time Course Microarray Data With Temporal Uncertainty

Stephen Billups, Associate Professor, University of Colorado at Denver and Health Science Center, Dept.. of Mathematical Sciences, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States, Stephen.Billups@cudenver.edu

When conducting time-course microarray experiments, one is usually interested in measuring time relative to some biological process of interest. But, it is often difficult to measure this biological time accurately. Such temporal uncertainty negatively impacts both the accuracy and power of data analysis. In this talk, I will describe a method for handling temporal uncertainty based on the premise that microarray data itself can be used to refine our estimates of biological time.

4 - Classification of Drug Activities for the Treatment of Prostate Cancer Using MILP

Metin Turkay, Asst. Prof., Koc University, Department of Industrial Engineering, Sariyer, Istanbul, 34450, Turkey, mturkay@ku.edu.tr, M. Emre Ozdemir, Pelin Armutlu, Pinar Kahraman, Halil Kavakli

An important consideration in structure based drug design is the early estimation of drug activities using molecular descriptors. We address early prediction and classification of activities of drug candidates using the MILP based hyper-box approach with partial least squares regression to determine the most significant molecular descriptors of the drug molecules for an efficient classification. Our results indicate that it is possible ti obtain a 100% classification accuracy.

■ SC42

C-Room 3B

OR Models for Infectious Diseases

Cluster: Operations Research in Medicine and Health Care
Invited Session

Chair: Atul Bhandari, Post-Doctoral Associate, University of Pittsburgh, 1178c Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States, abhandari79@gmail.com

1 - Analysis of Disease Transmission and Mitigation Strategies in a Point-of-Dispensing

Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Chien-Hung Chen, Joesph Wu

We consider a local outbreak of a highly infectious disease (e.g., smallpox, pneumonic plague, pandemic flu), analyze the potential of disease propagation within a vaccination/drug distribution clinic, and provide insights on how to minimize this risk. We will demonstrate how mathematical modelling can help quantify this risk and assist in the design of an emergency clinic, and show the use of a real-time simulator for mounting an effective monitoring and response against such an event.

2 - Analyzing the Control of Mosquito-borne Diseases by a Dominant Lethal Genetic System

Michael Atkinson, Institute for Computational and Mathemat, Stanford, CA, 94305, United States, mpa33@stanford.edu, Paul Coleman, Zheng Su, Nina Alphey, Luke Alphey, Lawrence Wein

We formulate a model to assess the impact on the spread of mosquito-borne diseases of a strategy that releases male insects homozygous for a lethal genetic trait. A dynamic model for the female mosquito population, which incorporates the competition for female mating between released mosquitoes and wild mosquitoes, density-dependent competition during the larval stage, and realization of the lethal trait either before or after the larval stage, is embedded into a human-vector epidemic model.

3 - Stopping Pandemic Flu: Government & Community Interventions in a Multi-community Model

Karima Nigmatulina, MIT, Cambridge, MA, United States, knigmatu@MIT.EDU, Richard Larson

Using a new model of infection spread between contiguous heterogeneous communities we evaluate the implementation and timing of primarily non-pharmaceutical intervention strategies. We also include changes in human behavior by introducing a feedback parameter into the model. We find, among other conclusions, that spatial quarantine and isolation strategies are unlikely to succeed.

4 - The Effect of Adherence and Toxicity on HIV Therapy Initiation

Andrew Schaefer, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, schaefer@engr.pitt.edu, Mark Roberts, Steven Shechter, Andrew Schaefer, R. Scott Braithwaite

Highly active anti-retroviral therapy (HAART) can extend the lifetime of an HIV patient, but at the cost of introducing a toxic element to the body. Further complicating this issue is that patients rarely adhere to HAART perfectly. Combining the effects of poor adherence and toxicity allows the body's resistance to HAART to develop rapidly leading to poor patient outcomes. We use a discrete event simulation to examine how poor adherence and toxicity can lead to delaying the initiation of HAART.

■ SC43

S-Grand Ball. A (Lev. 2)

Show Me the Money: Managing Value in Software and Systems Development

Cluster: O.R. Practice
Invited Session

Chair: Peri Tarr, IBM Watson Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States, tarr@us.ibm.com

1 - Value in Development Organizations: A Complex Systems View

Clay Williams, IBM Watson Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States, clayw@us.ibm.com, Tim Klinger, Peri Tarr

We discuss a framework for exploring the alignment between business and technology goals and for mapping these goals to projects using development governance patterns. These patterns are then applied to the organization performing the development projects. We describe how concepts from complex systems theory can be used to understand the behavior of these organizations and to help develop a valuation model for the projects underway within the organization.

2 - Building IT Services Contract Portfolios with Value-at-risk Analysis

Robert Kauffman, W. P. Carey Chair in Information Systems, Arizona State University, W. P. Carey School of Business, Tempe, AZ, 85287, United States, rob7585@gmail.com, Ryan Sougstad

We analyze a value-at-risk model for trade-offs between contract profits and losses in service-level agreements for IT and software services management. We model contract duration and cost driver correlations, and illustrate how managers can control risk by forgoing revenue-maximizing contracts in lieu of more conservative service-level commitments, yet achieve higher profitability. Our research offers a financial economics basis for IT services governance.

3 - Assessing the True Value of Enterprise IT Projects

Joseph Kramer, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States, kramerjo@us.ibm.com, Vijay Iyengar, Ignacio Terrizzano, John Vergo, Dan Milch

Traditionally managing value in software development has been focused on controlling cost, time, function and quality. We posit that true value is assessed when an organization understands the interplay between the project portfolio and the enterprise level business model. In this paper we illustrate a Portfolio Management method that leverages a business decomposition technique (CBM) to simultaneously address value, uncertainty and resources. A running example illustrates our approach.

4 - Risk-averse Forward Indicator Metrics for Valuing and Managing R&D Projects

Scott Mathews, Assoc. Technical Fellow, The Boeing Company, P.O. Box 3707 MS 42-50, Seattle, WA, 98124, United States, scott.h.mathews@boeing.com

Executing well on R&D projects is fundamental to implementing corporate strategic intent and a demanding management task also. New methods and metrics derived from real options technology can provide a mathematical foundation for an engineering-like approach to risk identification and quantification, investment effectiveness, and forward-looking value assessment. These tools enhance the R&D project managers confidence in risk reduction and value shaping through targeted incremental investments.

5 - APM - Theory and Practice

Gil Nechushtai, Research Stuff Member, IBM, IBM Research Lab, Haifa University, Haifa, 31905, Israel, GILN@il.ibm.com, Eli Luboshitz, Pablo Srabstein, Emmanuel Zarpas, Jacek Maryan

Application Portfolio Management (APM) is an approach for managing current investments in IT applications as a portfolio that can be optimized and aligned with business benefit. While APM borrows ideas from financial investments, still there are significant differences that challenge traditional PM techniques. In this session, we will present a practical approach and a system for APM. We will discuss theory and practice as well as future work and the applicability for other kinds of portfolios.

■ SC44

S-Grand Ball. B (Lev. 2)

Bring OR into your Local High School: Mission Not Impossible

Sponsor: INFORM-ED
Sponsored Session

Chair: Kenneth Chelst, Department Chair, Wayne State University, Industrial and Manufacturing Engg., 4815 Fourth St., Detroit, MI, 48201, United States, kchelst@wayne.edu

1 - Bring OR to Local High Schools: Mission Not Impossible & NSF $3 Million

Kenneth Chelst, Department Chair, Wayne State University, Industrial and Manufacturing Engg., 4815 Fourth St., Detroit, MI, 48201, United States, kchelst@wayne.edu, David Goldsman, Donna Llewellyn

We present OR activities designed to enrich high school math. The session will provide guidance as to how to reach out to your local high schools and offer short workshops. The goal of INFORMS is to create an OR network interested in outreach. All attendees who commit to outreach receive the book Does this line ever move? Everyday Applications of OR.We will also discuss a $3 million NSF grant we received to develop and implement a yearlong math course based on OR starting in MI and NC.

■ SC45

S-Capitol Hill (Lev. 3)

Trading Strategies and Hedge Funds

Sponsor: Financial Services
Sponsored Session

Chair: Ivilina Popova, Assistant Professor, Seattle University, 901 12th Avenue, Seattle, WA, 98122, United States, popovai@seattleu.edu

1 - The Art and Science of Creating a Trading Strategy

Elmira Popova, Associate Professor, The University of Texas at Austin, 1 University Station C2200, ETC 5.120, Austin, TX, 78712, United States, elmira@mail.utexas.edu, Ivilina Popova

A quant joining a trading team is expected to use his theoretical knowledge and create a profitable trading strategy. Having walked the path from theoretical idea to trading platform, we illustrate the hard process of trading strategy creation. The end result - a platform that generates signals and executes trades - could be a product of art and science. We identify practical questions and attempt answers. We present the general framework, and the individual steps to creating a strategy.

2 - Scenario-based and Mean-variance Hedge Fund Portfolio Allocation with High Watermarks

Ivilina Popova, Assistant Professor, Seattle University, 901 12th Avenue, Seattle, WA, 98122, United States, popovai@seattleu.edu, David Morton

In this analysis we show that using a scenario-based approach for portfolio allocation is preferable to a mean-variance approach when constructing a fund of hedge funds. The performance fee charged by hedge funds is often linked to high watermarks and if the objective is to increase the fees received, the utility function should incorporate a subsistence level. We show that the scenario-based approach is the better methodology when optimizing utility functions with subsistence levels.

3 - High-frequency Trading in the Presence of Long-term Stochastic Dependencies

Alexander Galenko, Graduate Student, University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States, agalenko@mail.utexas.edu, Ivilina Popova, Elmira Popova

We model the long term stochastic dependencies via co-integration and prove a necessary and sufficient conditions theorem. This theoretical result is then used to construct a trading strategy which performance will be presented.

4 - Active Equity Managers in the U.S.: Do the Best Follow Momentum Strategies?

Woo Chang Kim, PhD Candidate, ORFE, Princeton University, E312, ORFE, E-Quad, Princeton University, Princeton, NJ, 08544, United States, wookim@princeton.edu, John M. Mulvey

Empirical evidence shows that momentum strategies have outperformed passive equity benchmarks, especially since publication of the momentum effects. This paper discusses the role of momentum in the performance of active equity managers. We show that the performance of the best managers in the growth and core domains are highly correlated with momentum strategies at the industry level, whereas the worst performing managers has low correlation with momentum.

■ SC46

S-Ballard (Lev. 3)

Pricing and Risk Management in Energy Markets

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Shi-Jie Deng, Assc. Professor, Georgia Inst. of Tech., 755 Ferst Dr., Atlanta, GA, United States, deng@isye.gatech.edu

1 - Pricing Weather Derivatives: A Multicommodity Market Equilibrium Approach

Yongheon Lee, Graduate Student, IEOR Dept. University of California at Berkeley, Berkeley, CA, 94720, United States, yhlee@newton.berkeley.edu, Shmuel Oren

Risk averse agents are exposed to correlated price and quantity risk in single commodities, which in turn are correlated with weather. They hedge their revenue risk using price based instruments on their commodity and weather derivatives. The equilibrium price of the weather derivative emerges from the supply by the issuer who attempts to controls the risk premium on these derivatives and the net demand resulting from the revenue hedging activities of the commodity traders.

2 - Continuous-time Optimal Stopping Formulation of Power Plant Valuation with Start-up Costs

Jieyun Zhou, Graduate Student, Georgia Institute of Technology, 500 Northside Cir NW, Apt. PP4, Atlanta, GA, 30309, United States, jieyun@gatech.edu, Shi-Jie Deng

We propose a real options model for valuing electric power plants which have fixed generation costs. Under a general continuous-time electricity price model and operational characteristics such as a convex start-up cost structure in the number of re-starts, we derive a market-based valuation and the corresponding optimal operational strategy.

3 - Capacity Investment in Electricity Markets: Perfect Competition

Gul Gurkan, Associate Professor, Tilburg University, Warandelaan 2, Tilburg, 5037 AB, Netherlands, ggurkan@uvt.nl, Yves Smeers, Ozge Ozdemir

We analyze investment choices of firms using a two-stage game; capacities are installed in stage one and production takes place in an energy-only market at stage two. Under deterministic demand, we show equivalence of the two-stage game and a single optimization problem. Under demand uncertainty, we essentially have a two-stage stochastic game and an equilibrium point can be found by solving a two-stage stochastic program. Extensions to a forward capacity .. and .. with reliability markup.

4 - Electricity Price Curve Modeling by Manifold Learning

Shi-Jie Deng, Assc. Professor, Georgia Inst. of Tech., 755 Ferst Dr., Atlanta, GA, United States, deng@isye.gatech.edu, Jie Chen, Xiaoming Huo

We propose a novel non-parametric approach for the analysis and prediction of electricity price curves by applying the manifold learning methodology. Cluster analysis is employed to identify characteristics of the price curve shape. The proposed price curve model performs well in forecasting both short-term price such as the day-ahead prices and longer term price such as the week-ahead prices. The forecast accuracy is demonstrated by numerical results.

■ SC47

S-Admiral (Lev. 3)

Forestry III: Transportation and Logistics

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Mikael Ronnqvist, Department of Finance and Management Science, Norwegian School of Economics, NHH, Helleveien 30, NO-5045, Bergen, Norway, mikael.ronnqvist@nhh.no

1 - Integrating Road Building Decisions in Harvest Scheduling Models

Victor Valdebenito, School of Forest Resources, The Pennsylvania State University, 236 Forest Resources Building, University Park, PA, 16802, United States, vav112@psu.edu, Marc McDill

We incorporated road building decisions in a mixed integer harvest schedule model, where two different potential road network structures were used as model inputs. In one case, the potential road network is allowed to have cycles, while in the other case the potential road network follows a simpler dendridic structure. For each of these scenarios, different formulations were evaluated, considering the tradeoff produced in quality of solution and computational effort required.

2 - Harvesting with Uncertain Price Scenarios
Martin Quinteros, Sloan School of Management, Massachusetts Institute of Technology, E53-356, Cambridge, MA, 02142, United States, mquinter@mit.edu, Andres Weintraub, Monique Guignard, Laureano Escudero, Antonio Alonso-Ayuso

We present a tactical problem where main decisions are blocks to harvest each period and access roads to build. Future prices and demands are uncertain, reflected through scenarios for each period with estimated probabilities. We present a coordinated branching approach to this MIP which efficiently finds a solution that maximizes expected returns while guaranteeing feasibility under all scenarios. We compare with a classical deterministic approach using data from a Chilean forest industry.

3 - Hard Wood Supply Chain Tactical Planning in a Furniture Company Using a Time Decomposition Approach
Mustapha Ouhimmou, FORAC, CIRRELT, University Laval, Quebec, PQ, G1K7P4, Canada, mustapha.ouhimmou@cirrelt.ca, Sophie D'Amours

We study the wood supply chain tactical planning problem of an integrated furniture company. The goal is to define manufacturing and logistics policies that allow the company to have a competitive level of service at minimum cost. Supply chain planning is formulated as a large MIP model. We solved small size MIP problems and propose a heuristic using a time decomposition approach for larger problems. Computational results are reported as well as an application to a real industrial case.

4 - Global Carbon Markets and Implications for Forestry
Darek Nalle, Assistant Professor, University of Idaho, Dept.. of Forest Products, Moscow, ID, 83844, United States, nalle@uidaho.edu, Miguel Henry

The new commodity of carbon may be difficult to value in that its contract prices are largely a function of evolving regulations within separate market places about the globe. Opportunities and challenges in maximizing NPV from a carbon portfolio will be highlighted, using the University of Idaho's membership in the Chicago Climate Exchange as a specific example.

5 - Optimization of Forest Fuel Logistics
Mikael Ronnqvist, Department of Finance and Management Science, Norwegian School of Economics, NHH, Helleveien 30, NO-5045, Bergen, Norway, mikael.ronnqvist@nhh.no, Mikael Frisk

The use of forest fuel in combined heat and power plants is increasing, and procurement and transportation of fuel is a large part of the overall cost. The planning must consider different chipping systems that can be located at harvest areas, terminals or mills and a large variation in demand. Several truck systems are included and there are specific capacities for both transportation and chipping. We describe DSS together with results from a case study at a large forest company in Sweden.

■ SC48

S-Fremont (Lev. 3)

Simulation Modeling; and Tutorial on Agent Based Simulation

Sponsor: Simulation
Sponsored Session

Chair: Michael Kuhl, Associate Professor, Rochester Institute of Technology, Industrial & Systems Engineering Dept., 81 Lomb Memorial Drive, Rochester, NY, 14623, United States, mekeie@rit.edu

1 - Pathwise Estimation of Greeks for Options with Discontinuous Payoff
Nan Chen, Chinese University of Hong Kong, 709A, William Mong Engineering Building, Chinese University of Hong Kong, Shatin, Hong Kong - ROC, nchen@se.cuhk.edu.hk, Jeff Hong, Guangwu Liu

Estimating Greeks for options with discontinuous payoffs, such as digital options and barrier options, could be challenging when no closed forms exist. In this paper we establish analytical forms of Greeks for options with discontinuous payoffs, in terms of conditional expectations and also propose a nonparametric method to estimate Greeks based on these analytical forms. The method can be easily implemented and is valid for general diffusion models.

2 - A Cyber Attack Simulator for Evaluating Information Fusion Network Security Tools
Michael Kuhl, Associate Professor, Rochester Institute of Technology, Industrial & Systems Engineering Dept., 81 Lomb Memorial Drive, Rochester, NY, 14623, United States, mekeie@rit.edu, Kevin Costantini, Katie McConky, Moises Sudit

Cyber security techniques such as Information Fusion are being developed to identify and assess cyber threats on computer networks. A Cyber Attack Simulator is developed to model networks and to simulate cyber attacks over time. The resulting data in the form of Intrusion Detection System alerts can be used to test Information Fusion tools including fusion engines, threat and impact assessment tools, and sensor management strategies.

3 - Tutorial on Agent-based Modeling and Simulation
Charles Macal, Argonne National Laboratory, 9700 S. Cass Ave., Bldg 900-DIS, Argonne, IL, 60439, United States, 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.

■ SC49

S-Greenwood (Lev. 3)

Product Assortment Optimization

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Paat Rusmevichientong, Assistant Professor, Cornell University, 221 Rhodes Hall, Ithaca, NY, 14853, United States, paatrus@cornell.edu

1 - An Adaptive Algorithm for Dynamic Assortment Optimization
Paat Rusmevichientong, Assistant Professor, Cornell University, 221 Rhodes Hall, Ithaca, NY, 14853, United States, paatrus@cornell.edu, Max Shen, David Shmoys

We consider the problem of dynamic assortment optimization. In our model, a retailer does not have any prior knowledge about the demand for each product, and must learn the demand by offering different product assortments and observing customer purchases. We propose an adaptive algorithm that integrates demand learning with assortment optimization, and establish convergence properties of the algorithm. Numerical results validate the performance of the algorithm.

2 - Optimal Assortment Planning Under Dynamic Substitution: A Homogeneous Population Model and Extension
Dorothee Honhon, University of Texas, Dorothee.Honhon@mccombs.utexas.edu

We consider the problem of determining the optimal assortment and inventory levels for a discrete set of products with varying prices and costs in order to maximize expected profit in a single-period setting. Customer preferences are modeled through the definition of consumer types, where a type is a ranking of the potential products by order of preference. We first address the case in which all customers are of the same type, extend the results to more general choice models.

3 - Dynamic Assortment Planning
Rene Caldentey, Prof., New York University Stern School of Business, 44 West 4th str., New York, NY, 10012, United States, rcaldent@stern.nyu.edu, Felipe Caro

We investigate optimal assortment planning strategies for a retailer with limited shelf space. Market demand is stochastic in terms of (a) the pattern of customers' arrival and (b) their preferences over the menu of products. The retailer's objective is to maximize the long-term value of the retail business by dynamically adjusting the menu of products in display together with their prices.

4 - A Product Line Extension Problem with Inventory Considerations
Shan Li, PhD Candidate, Department of Industrial Engineering & Operations Research, University of California, Berkeley, Berkeley, CA, 94720, United States, lisapine@berkeley.edu, Max Shen

We consider a product line extension introduction problem in an integrated inventory (supply) and diffusion (demand) framework. The model determines whether and when to introduce the line extension and the corresponding production quantities, while accounting for substitution, diffusion and market segmentation effects.

■ SC50

S-Issaquah A & B (Lev. 3)

Game Theoretical Models of Competitive Networks

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Nicolas Stier-Moses, Assistant Professor, Columbia Business School, Uris 418, New York, NY, 10027, United States, ns2224@columbia.edu

Co-Chair: Asu Ozdaglar, Professor, EECS/MIT, 77 Massachusetts Avenue, Cambridge, MA, United States, asuman@mit.edu

1 - Competition in Prices and Service Level Guarantees
Gabriel Weintraub, Columbia Business School, gweintraub@columbia.edu, Ramesh Johari

We consider a model of oligopoly competition for service industries where providers choose prices and service level guarantees. Consumers are sensitive to the sum of price and the congestion experienced. We show that this game can be reduced to standard oligopoly models, greatly simplifying the analysis. For example, for loss systems it is equivalent to a standard pricing game with constant marginal costs. We conclude by comparing this game to one where firms set prices and investment levels.

2 - Quantifying the Loss of Profit in Price Competition for Differentiated Products
Georgia Perakis, Associate Professor, Sloan School, MIT, 50 Memorial Drive, Cambridge, MA, 02139, United States, georgiap@mit.edu, Amr Farahat

We provide bounds on the ratio of decentralized to centralized profits in price competitive markets with substitutable differentiated products. The lower bound is based on the minimum eigenvalue of the demand sensitivity matrix and the upper bound is based on comparing diagonal elements of two derived matrices. We then develop simpler bounds based on the maximum market clout. We show this bound is typically not too large.

3 - Social Learning with Partial Observations
Asu Ozdaglar, Professor, EECS/MIT, 77 Massachusetts Avenue, Cambridge, MA, United States, asuman@mit.edu, Daron Acemoglu, Munther Dahleh, Ilan Lobel

We study a model of social learning with partial observations from the past. Each individual receives a private signal about the correct action he should take and also observes random samples of past actions. We characterize conditions under which asymptotic learning occurs and study the role that asymmetry between conditional signal distributions plays on asymptotic learning.

4 - Stackelberg Routing in Competitive Networks
Nicolas Stier-Moses, Assistant Professor, Columbia Business School, Uris 418, New York, NY, 10027, United States, ns2224@columbia.edu, Jose Correa

We consider an oligopolistic network game where one player has more market power than the rest. The almost-monopolistic player can predict what price-taker players will do. Hence, it can make decisions before others, which allows us to use the framework of Stackelberg games. Instead of studying Nash equilibria as previous work has done, we make use of Stackelberg equilibria, and identify easy-to-characterize strategies for the leader that have good performance guarantees.

■ SC51

S-Kirkland (Lev. 3)

Dynamic Pricing and Revenue Management: New Models

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Serhan Ziya, Assistant Professor, Department of Statistics and Operations Research University of North Carolina, Chapel Hill, NC, ziya@email.unc.edu

1 - Dynamic Pricing of Fashion Goods: The Effect of Risk-sharing Between Retailers and Suppliers
Itir Karaesmen, University of Maryland, College Park, MD, United States, ikaraes@rhsmith.umd.edu

Our research brings together two important practical issues in fashion retail: Dynamic ricing and vendor-supplier relations. We determine the optimal price path for a single fashion good given a risk-sharing contract between a vendor and a supplier. We show how the optimal price path is different for the vendor when the vendor ignores the contract terms in making pricing decisions. We study different forms of contracts and discuss their impact on dynamic pricing.

2 - A Model of Consumer Inertia with Applications to Dynamic Pricing
Xuanming Su, University of California, Haas School of Business, Berkeley, 94720, United States, xuanming@haas.berkeley.edu

Consumers often wait until the last minute before making a purchase. This indicates strategic behavior if they can secure a last-minute discount. Yet, consumers sometimes wait even when doing so is suboptimal (e.g., there may be higher prices or lower availability later). We show that such behavior is consistent with several well-established behavioral regularities and study its implications on dynamic pricing strategies.

3 - Innovative Pricing Strategies Under Strategic Consumer Behavior
Yossi Aviv, Professor, Washington University, The Olin School of Business, Campus Box 1133, 1 Brookings Dr., St. Louis, MO, 63130, United States, aviv@olin.wustl.edu

In recent years, there has been an increasing interest in using OR models to explore strategic consumer behavior in the context of revenue management. In this talk, we will discuss ways in which sellers can adopt creative pricing schemes to optimally price products in the face of strategic consumer behavior. Such innovative pricing schemes should be tailored to discourage strategic waiting for price discounts, but should not harm the sellers' ability to segment customers.

4 - Coordinating Positioning and Pricing in a Supply Chain
Garrett van Ryzin, Columbia University, 412 Uris Hall, New York, NY, 10027, United States, gjv1@columbia.edu, Wei Ke

We study the incetives to optimally differentiate and price products in a supply chain when manufacturers sell through intermediaries (retailers). The model has interesting implications for category management and related supply chain contracting mechanisms.

■ SC52

S-Leschi (Lev. 3)

Rails to the Sea: Current Issues in Railway-port Interchange (Roundtable)

Sponsor: Railway Applications
Sponsored Session

Chair: Steven Harrod, Assistant Professor, University of Dayton, School of Business Administration, 300 College Park, Dayton, OH, 45469, United States, a2soft@aol.com

1 - Matching and Forecasting US Inland Trade
Bengt Muten, Principal, Global Insight, 24 Hartwell Ave, Lexington, MA, 02421, United States, bengt.muten@globalinsight.com

We have matched and reconciled a number of public and private date sources to show and forecast commodity flows through US ports by ultimate origin, destination, and commodity. The author will present some of the data sources, describe the methodology used to match them, discuss assumptions, and present samples of the results.

2 - Advances and Operating Strategies for Green Intermodal Container Terminals
Vaibhav Govil, Transportation Analyst, JWD Group, DMJM Harris, 300 Lakeside Drive, Suite #750, Oakland, CA, 94612, United States, Vaibhav.Govil@dmjmharris.com

The author discusses recent advances in automation for intermodal container terminals. The paper describes benefits of automation in relation to the environment, safety, increasing terminal throughput, and decreasing operating costs. There is analysis about different operating strategies and intermodal terminal layouts that consider a broad range of factors.

3 - How Ports and Railroads Must Work Together to Support Projected Traffic Growth
Larry St. Clair, Port of Tacoma, P.O. Box 1837, Tacoma, 98401, United States, lstclair@portoftacoma.com

As cargo growth continues in the Pacific Northwest, what investments must be made by the ports, railroads, the state of Washington and other rail stakeholders to ensure the rail system remains fluid? Included - Future plans for the Port of Tacoma facility build out. - The current rail capacity in the state. - The role of the state of Washington in assisting ports and railroads. - The Class I railroad expansion plans as understood at present.

4 - Driving the Renaissance of Rail Transportation with Marine Container Growth
Cary Helton, VP Service Planning, CSX Transportation, 500 Water St., Jacksonville, FL, 32202, United States, cary_helton@csx.com

Rail transportation planning for intermodal traffic as a result of expanding global trade and the subsequent import and export growth. Creating service and value for the evolving intermodal customer.

■ SC53

S-Medina (Lev. 3)

Location, Allocation, and Computing

Sponsor: Location Analysis
Sponsored Session

Chair: Tingting Cui, UC Berkeley, 4141 Etcheverry Hall, UC Berkeley, Berkeley, CA, 94720, United States, tingting@ieor.berkeley.edu

1 - Solving the Min-max Multi-depot Vehicle Routing Problem
John Carlsson, Stanford University, 238 Ayrshire Farm Ct, apt. 201, Stanford, CA, 94305, United States, johnnyc@stanford.edu

The Multi-Depot Vehicle Routing Problem is a generalization of the Single-Depot Vehicle Routing Problem in which vehicles start from multiple depots and return to their depots of origin at the end of their assigned tours. The traditional objective in MDVRP is to minimize the total length of all the tours. We explore the notion of minimizing the maximal length of a tour in MDVRP (min-max MDVRP). A comparison of the computational implementations for different heuristics is included.

2 - Finding Equitable Convex Partitions and Resource Allocation Applications
Benjamin Armbruster, Stanford University, 121 W. Campus Dr. #1405A, Stanford, CA, 94305, United States, armbruster@stanford.edu, Yinyu Ye, John Carlsson

Motivated by a multi-depot vehicle routing heuristic and other resource allocation problems, we look at the problem of equitably partitioning a convex polygon and a set of n points. We seek a partition of the polygon into n convex pieces of equal area, each containing one point. We demonstrate a new algorithm that finds an exact solution to our problem in O(Nn log N) time or arithmetic operations, where n is the number of points, m the number of vertices of the polygon, and N:=n+m the sum.

3 - On the Reliable Facility Location Problem
Tingting Cui, UC Berkeley, 4141 Etcheverry Hall, UC Berkeley, Berkeley, CA, 94720, United States, tingting@ieor.berkeley.edu, Max Shen

We consider the problem of locating facilities to minimize the expected facility, transport, and capacity reservation costs when candidate locations are subject to failure with certain probilities. Various modeling and solution techniques are outlined with extensive computational studies.

4 - Fortifying the Existing Unreliable Facilities and Monotonic Optimization
Lezhou (Roger) Zhan, CitationShares Management, 5 American Ln, Greenwich, CT, 06831, United States, zhan@ufl.edu, Max Shen

We consider the problem of fortifying the existing unreliable facilities. Various modeling and solution techniques, including a monotonic branch-reduce-bound algorithm, are outlined with extensive computational studies.

■ SC54

S-Queen Anne (Lev. 3)

Joint Session AP/ICS: Approximate Dynamic Programming I

Sponsor: Applied Probability, INFORMS Computing Society
Sponsored Session

Chair: Sandjai Bhulai, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, sbhulai@few.vu.nl

1 - Cost Function Approximation Methods in Dynamic Programming
Huizhen Yu, Postdoctoral Researcher, Univ. of Helsinki, P.O. Box 68 (Gustaf Hallstromin Katu 2b), University of Helsinki, Helsinki, 00014, Finland, janey.yu@cs.helsinki.fi, Dimitri Bertsekas

We overview approximate dynamic programming methods, which are suitable for very large-dimensional problems. The cost function is approximated by simulation and projection on a low-dimensional subspace generated by basis functions. Recent extensions involving Q-learning algorithms for optimal stopping problems, and general linear systems of fixed-point equations will also be discussed.

2 - Average-Cost Approximate Dynamic Programming for the Control of Birth-Death Processes
Dennis Roubos, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, droubos@few.vu.nl, Sandjai Bhulai

Approximate dynamic programming when applied to average-cost decision problems with a countably infinite state space suffers from several computational issues. In particular, the algorithm may converge to non-stable solutions and requires knowledge on the average cost in advance. We address these issues by providing a theoretical basis for the approximation structure such that the unique stable solution will be attained. We illustrate this for the broad class of birth-death processes.

3 - Policy Evaluation Algorithms Using Function Approximations
Angelia Nedich, Assistant Professor, University of iIllinois at Urbana Champaign, 104 S Mathews Avenue, Urbana, IL, 61801, United States, angelia@uiuc.edu

We consider policy evaluation algorithms for infinite horizon dynamic programming problems with discounted cost. The focus is on discrete time dynamic systems with a large number of states. We discuss methods for policy evaluation that use temporal diffrences and function approximations. The methods update parameters of the function approximation on-line incrementally based on observations of system states from an infinite trajectory.

■ SC55

S-Ravenna (Lev. 3)

Methods of Airline Network Analysis

Sponsor: Aviation Applications
Sponsored Session

Chair: Laurie Garrow, Assistant Professor, Georgia Institute of Technology, School of Civil & Envr Engineering, 790 Atlantic Drive, Atlanta, GA, 30332-0355, United States, laurie.garrow@ce.gatech.edu

1 - Methods of Measuring Airline Network Value
Roger A Parker, Chief of Technology, Marketing Commercial Airplanes, The Boeing Companu, P.O. Box 3707 MC 21-33, Seatte, WA, 98124-2207, United States, roger.a.parker@boeing.com, Fred Ervin, Richard Lonsdale

Several measures of the effectiveness and value of the world's airline network are described. These include measure of consumer surplus (the Network Value Index), measures of market share structure, including q-derivatives, the Herfindahl index, and entropy notions, and measures of hub and spoke concentration, such as spoke density. These measures will be compared and contrasted, and evaluated as vehicles for in-depth studies of the world's airline network. Computing algorithms are outlined.

2 - The Evolution of the World's Airline Network
Kemp Harker, Boeing Commercial Airplanes, kemp.d.harker@boeing.com, Roger A Parker

Using some of the measures discussed in the previous presentation, the evolution of the world's airline network over the last 25 years is analyzed. The rates of recovery from system shock (e. g. SARS outbreak or terrorist attack) are characterized with time series methods. The emergence of hub and spoke network structure is portrayed, leading to the proliferation of point-to-point service. The demand structures and network response underlying the network's evolutionary pattern are examined.

3 - Generating Artificial Airline Schedules with a Genetic Algorithm Approach
Zhengjie Zhang, Boeing Commercial Airplanes, zhengjie.zhang@boeing.com, Roger A Parker

Using the measures discussed previously, and the computing systems built by BCA for network analysis, the creation of artificial airline schedules using genetic algorithm techniques is presented. The aim is to produce airline schedules that mimic the evolution of the airline network so that its future structure can be studied. Airline schedule generation both with and without the presence of competition are offered. The effects of various fitness measures on the results are described.

■ SC56

S-Wallingford (Lev. 3)

Valuation Uncertainty and Revenue Monotonicity

Cluster: Auctions
Invited Session

Chair: Kevin Leyton-Brown, University of British Columbia, 201-2366 Main Mall, Vancouver, BC, V6T1Z4, Canada, kevinlb@cs.ubc.ca

1 - Reducing Costly Information Acquisition in Auctions
Kate Larson, University of Waterloo, 200 University Ave W, Waterloo, ON, N2L 3G1, Canada, klarson@cs.uwaterloo.ca

Most auction research assumes that potential bidders have private information about their willingness to pay for an item. In reality, bidders often have to go through a costly information-gathering process in order to learn their valuations. We will discuss ways of alleviating the strategic-burden placed on bidders faced with this information-gathering.

2 - Valuation Uncertainty and Imperfect Introspection in Sealed-Bid Auctions

David Thompson, University of British Columbia, 201-2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, daveth@cs.ubc.ca, Kevin Leyton-Brown

In auctions, agents might not know their exact valuations because of transaction costs or bounded rationality. We show settings where if agents don't coordinate value discovery, it can affect efficiency and revenue. For sealed-bid auctions, we show revenue and value-of-information bounds and where revenue equivalence applies.

3 - Revenue Monotonicity in Combinatorial Auctions

Baharak Rastegari, University of British Columbia, 201-2366 Main Mall, Vancouver, BC, V6T1Z4, Canada, baharak@cs.ubc.ca, Kevin Leyton-Brown, Anne Condon

Intuitively, one might expect that an auction's revenue weakly increases as the number of bidders grows, as this increases competition. However, it is known that for combinatorial auctions that use the VCG mechanism, a seller can sometimes increase revenue by dropping bidders. We show that such failures of revenue monotonicity can occur under a broad class of dominant-strategy mechanisms that includes affine maximizers and mechanisms that always select strongly Pareto efficient allocations.

■ SC57

S-Columbia (Lev. 4)

Joint Session TELECOM /ICS: Optimization Models for Routing in Telecommunication Networks

Sponsor: INFORMS Telecommunications Section, INFORMS Computing Society
Sponsored Session

Chair: Eli Olinick, Associate Professor, EMIS Department, SMU, P.O. Box 750123, Dallas, TX, 75275, United States, olinick@engr.smu.edu

1 - Traffic Engineering over Hop-constrained Node Survivable Networks

Luis Gouveia, CIO and DEIO-FCUL, Edificio C6, Campo Grande, Lisbon, Lx, Portugal, legouveia@fc.ul.pt, Pedro Patrício, Amaro de Sousa

We address a traffic engineering problem of routing a new demand matrix R over a dimensioned network, complying with the installed bandwidth on each edge and guaranteeing D node disjoint hop-constrained paths for every commodity. An optimal routing is the one that minimizes i) the average number of hops or ii) the largest number of hops of all paths supporting every commodity.

2 - Internet Routing Under Active Congestion Control

Stanko Dimitrov, University of Michigan - Ann Arbor, 2812 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, sdimitro@umich.edu, Marina A. Epelman, Dushyant Sharma

We present a mathematical model of Internet routing that incorporates congestion control techniques such as random early detection (RED). We show that several model instances are NP-hard and present numerical results comparing current routing policies to the routing policies corresponding to the optimal solution of our model.

3 - Minimizing Maximum Link Utilization in OSPF Network

Anusha Madhavan, Student, Southern Methodist University, 6425 Ownby Drive, Room 356, Dallas, TX, 75205, United States, amadhava@engr.smu.edu, Jeffery Kennington

Open Shortest Path First (OSPF) is a popular internet routing protocol. One of the main challenges in routing data is to minimize the maximum link utilization in order to limit the congestion in a network. In this investigation, we present an arc-path column generation procedure and a modified arc-path optimization model with an objective of minimizing link congestion. An empirical analysis and comparison of the node-arc version and our arc-path procedure is also presented.

4 - IP-based Heuristics for Incremental Demand Rerouting

Eli Olinick, Associate Professor, EMIS Department, SMU, P.O. Box 750123, Dallas, TX, 75275, United States, olinick@engr.smu.edu

Network managers are reluctant to make wholesale changes to an established routing assignment; complete modification to obtain an optimal assignment is viewed as highly risky. Therefore, we consider the problem of making incremental changes to a given routing assignment to maximize throughput metric based on residual capacity. We present IP-based heuristics for this problem and empirical results showing that the incremental approach finds near-optimal results within a reasonable CPU time limit.

■ SC58

S-Pike (Lev. 4)

Learning, Innovation and Entrepreneurship

Sponsor: Organization Science
Sponsored Session

Chair: Suresh Kotha, University of Washington, UW Business School, Management and Organization Department, Seattle, WA, 98195, United States, skotha@u.washington.edu

1 - External Venturing for Strategic Renewal: Towards Understanding Who Makes Corporate Venture Capital Investments and Why

Sandip Basu, University of Washington, sb4@u.washington.edu, Corey Phelps, Suresh Kotha

This study examines the conditions under which firms participate in corporate venture capital (CVC), an important mode of exploration and strategic renewal. Based on extant literature and our field research, we conceptualize CVC investments as growth options. We integrate insights from real options research with an inducements and opportunities perspective of interfirm relationship formation to explain CVC participation. We use longitudinal data on 477 firms from the 1990 Fortune 500 list for the period 1990-2000 to investigate this question. We find that firms in industries with rapid technological change, high competitive intensity and weak appropriability engage in greater CVC activity. We also find that weak appropriability has a more pronounced effect on CVC activity when competitive intensity is high. Regarding firm characteristics, we show that firms that possess strong technological and marketing capabilities and resources developed from prior venturing experience engage in greater CVC activity. Finally, we find the combination of both strong technological and marketing capabilities reduces subsequent CVC activity. Our findings suggest that the exploration of new competences involves the exploitation of established resources and capabilities. We discuss the implications of these results for research into corporate entrepreneurship, VC syndication networks and real options.

2 - Pre-entry Knowledge and the Survival of New Firms

Sonali K. Shah, University of Illinois Urbana-Champaign, sonali@uiuc.edu, John C. Dencker, March Gruber

New firms are endowed with knowledge and experience at birth – through the human capital of their founder(s). Existing empirical research suggests that this pre-entry knowledge and experience will influence the firm's chances of survival; however the mechanisms underlying this relationship have yet to be investigated. We seek to better understand and unpack this relationship. Specifically, we study the extent to which a founder's pre-entry knowledge of the business activity and pre-entry management experience influence the effectiveness of two subsequent learning activities, namely early-stage business planning and product line change. We find that pre-entry knowledge and management experience jointly increase firm survival through moderating the effects of these subsequent learning activities. We also find that learning activities are not always beneficial; in our sample, early-stage business planning decreased firm survival and product line change increased firm survival. We examine these patterns using survey data collected from 436 individuals in the Munich region who founded their own firms as an alternative to continued unemployment.

3 - Learning from What Others Have Learned from You: The Effects of Knowledge Spillovers on Originating Firms

Kevin Steensma, University of Washington, steensma@u.washington.edu, Hongyan Yang, Corey Phelps

When an originating firm's spillovers are recombined with complementary knowledge by recipient firms, a knowledge pool is formed that is inherently related to the originating firm's knowledge base. This relevant knowledge pool contains valuable opportunities for the originator to vicariously learn from recipients' recombinatorial activities. In a longitudinal study of 87 telecommunications equipment manufacturers, we find that firms with larger relevant knowledge pools that are similar to the firm's existing knowledge base are more innovative.

4 - The Role of Absorptive Capacity and Industry Context in the Search for New Competencies

Arvin Sahaym, University of Washington, arvin@u.washington.edu, Jeff Barden, Kevin Steensma

Research and development (R&D) and corporate venture capital (CVC) are two fundamental modes by which capabilities are developed within industries. However, there is some debate regarding how resources are allocated between these two modes of capability development, and the conditions under which internal R&D influences CVC. On the one hand, these modes of investment may be substitutes for each other. The choice between developing capabilities in house and accessing them in the venture capital marketplace represents a classic make or buy decision. On the other hand, these modes of investments may be complementary. Internally-developed knowledge can increase the ability to recognize and assimilate valuable technologies in potential venture targets. In this study, we examine the relationship between R&D investments and industry CVC deals. We find that R&D investments increase the number of CVC deals in an industry. Moreover, we find that industry growth combined with rapid technological change enhances the complementary relationship between R&D and CVC.

■ SC59

S-Seneca (Lev. 4)

Joint Session TM/Health: Hospital Process Change and Improvement

Sponsor: Technology Management, Health Applications Section
Sponsored Session

Chair: David Moore, PhD, KLICNET.ORG, The Knowledge, Learning and Intellectual Capital Network, 3788 Davidson Place, Boulder, CO, 80305, United States, dmoore@klicnet.org

1 - The Impact of New Technology on Hospital Supply Chains
Mike Magazine, Professor, University of Cincinnati, Dept. of QAOM, Univ. of Cincinnati, Cincinnati, OH, 45221, United States, mike.magazine@uc.edu

I will describe a proof of concept of implementing a new technology in a hospital setting. Specifically, Pyxis machines were tested in a pilot study to see if we could get the right products to the right place in a hospital setting at the right cost. Metrics will be described in the study before and after a pilot project. in addition, I will discuss some of the current issues, both managerial and technical, faced by the hospital.

2 - The Verdict is in: Toyota-based Process Improvements Work in Health Care
Naida Grunden, Medical Communications Consultant, 1910 Ponderosa Drive, Bellingham, WA, 98229, naidag@comcast.net

For 6 years all around Pittsburgh, the nonprofit Pittsburgh Regional Health Initiative (PRHI) conducted pilot projects in various hospitals using a health-oriented form of TPS. PRHI has even developed its own curriculum and teaches Toyota-based process improvements to healthcare workers across the nation. Naida Grunden, former PRHI Communications Director now residing in Bellingham, details numerous examples in her talk.

3 - Process Management, Patient Outcomes and Hospital Efficencies: A Model Joint Replacement Program
Mary Ziemba-Davis, Research Director, St. Vincent Center for Joint Replacement, 2001 W. 86th Street - Entrance #8, Indianapolis, IN, 46260, United States, mxziemba@stvincent.org, Lisa Brandt, Jeffery Pierson

Our success relies on preoperative patient assessment, education, and team-based planning; streamlined patient registration; dedicated aftercare planning; postoperative team rounding; standardized medical protocols; evidence-based procedures; board-certified surgeons; and empirical research to streamline processes, reduce cost and resource use and enhance patient care. We show impact on patient satisfaction; length of stay; complications; case delays, volume and duration; and process variances.

4 - Engineering Improvements in Efficiency, Patient Flow and Care in a Hospital Surgical Suite
David Moore, PhD, KLICNET.ORG, The Knowledge, Learning and Intellectual Capital Network, 3788 Davidson Place, Boulder, CO, 80305, United States, dmoore@klicnet.org

This hospital case study follows process improvements from conception through implementation, identifies engineering and analytical techniques leveraged and describes obstacles faced and successful change management tactics applied. The ongoing improvement effort combines interviews, archival data and hundreds of hours of direct observation with process mapping, statistical and Pareto analysis, simulation, optimization and heuristics to improve metrics of efficiency, patient flow, and care.

■ SC60

S-University (Lev. 4)

Knowledge, Learning, Intellectual Capital-I: Knowledge Systems

Sponsor: Technology Management
Sponsored Session

Chair: Charles Weber, Assistant Professor of Engineering and Technology Management, Portland State University, P.O. Box 751, Portland, OR, 97207, United States, webercm@gmail.com

1 - Real-time Learning in Semiconductor Manufacturing
Asser Fayed, Senior Staff Engineer, Cypress Semiconductor, yed@cypress.com, Charles Weber

The complexity of semiconductor manufacturing systems forces semiconductor manufacturers to manage product mix, cycle-time and throughput in near real time. Profitability depends upon accurate simulation of the cycle-time/throughput curve.

2 - Scale, Scope and Learning in Technological Development
Jeffrey Macher, Assistant Professor, Georgetown University, G-04 Old North, Washington, DC, 20057, United States, jtm4@georgetown.edu

This paper examines how knowledge resulting from firm experience and scale and scope economies affect performance in technological development. Knowledge that results from greater experience within a particular technological area, when combined with knowledge spillovers from greater scope in other technological areas, significantly improves development performance. The results suggest that experience shapes and facilitates firms' abilities to absorb knowledge spillovers.

3 - The Fragile Foundations of Regional Scientific Advantage?
Jeffrey L. Furman, Boston University, 595 Commonwealth Ave - 653a, Boston, MA, 02215, United States, furman@bu.edu, Fiona Murray, Scott Stern

This paper evaluates the impact of restrictions on the use of embryonic stem cell lines in US Federally funded scientific research on the geography of scientific discovery. It exploits an exogenous shock to the process of step-by-step scientific discovery to assess the sensitivity of regional scientific agglomeration to a temporary revision in the knowledge production process.

4 - Coordinating Search in Modular Systems: The Value of Temporary Integration
Oliver Baumann, Research associate and PhD Candidate, Institute for Information, Organization and Management, LMU Munich, Ludwigstr. 28, Munich, Germany, baumann@lmu.de

As complex systems are at best near-decomposable, decentralized search in modular structures requires coordination. Yet how much should efforts to provide for system-level fit constrain the independence of the module-level units, and what role do the specifics of the decomposition play? Using agent-based simulation, I suggest that intensive coordination is beneficial in the short-run, while module-level independence and punctuated system-level integration yield the highest long-run performance.

Sunday, 4:30pm - 6:00pm

■ SD01

C-Room 602

Supply Chain Management IV

Contributed Session

Chair: Jayant Rajgopal, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States, rajgopal@pitt.edu

1 - Optimal and Approximate Policies for Inventory Systems with Multiple Supply Options
Mahesh Srinivasan, The Pennsylvania State University, 463A Business Bldg., Dept.. of Supply Chain and Info. Systems, University Park, PA, 16802, United States, maheshs@psu.edu, Dougals Thomas

We consider a single item periodic-review system with lost sales having iid demand and lead times. There is an option to use either a slower source of supply which is more economical or an expedited source, which is more expensive. We use dynamic programming based optimization and simulation to investigate optimal and near-optimal inventory policies and supply choices. We also provide insights to the cost threshold limit δ below which the fast supply option is preferred.

2 - Challenges of Humanitarian Logistics on Supply Chain Management: Perspectives from Southern Africa
Ozias Ncube, Lecturer - Operations Research, University of South Africa, Department of Decision Sciences, P O Box 392 Unisa, Pretoria, 0003, South Africa, ncubeo@unisa.ac.za, Sarma Yadavalli, Jacomine Grobler

Relief organisations face challenges in effective planning and delivery of aid to persons affected by emergencies, ranging from coordination of efforts, human resources requirement and technical know-how. This coordination can be studied using the supply chain management paradigm. In this paper, we show the challenges faced by relief organisations in Southern Africa, and use the ideas of commercial SCM to address these challenges.

3 - Supply Chain Dynamics Under Extended Warranty Sales
Seb Heese, Indiana University, 1309 E 10th St, Bloomington, IN, 47405, United States, hheese@indiana.edu

Consider two competing manufacturers selling their products through the same retailer. If this retailer derives profits from extended warranty sales, the manufacturers face a dilemma: While they have incentive to increase their warranties to make their products attractive to consumers, the retailer might prefer selling lower-warranty products to enhance sales of extended warranties. We develop a stylized model to determine and analyze optimal manufacturer and retailer strategies in this setting.

4 - Imposing Minimum Cycle Times on Single Server Queues
Diederik Claerhout, K.U.Leuven Campus Kortrijk, E. Sabbelaan 53, Kortrijk, 8500, Belgium, Diederik.Claerhout@kuleuven-kortrijk.be, Nico Vandaele

In order to evaluate time phased release mechanisms in stochastic manufacturing systems we study the impact of imposing minimum cycle times on single server queues without blocking servers in open queueing networks. A conditional probability analysis provides the probability density function, distribution function and SCV of the modified M/M/1 interdeparture times. We report on our search for approximating numerical results for the SCV of the modified G/G/1 interdeparture times.

5 - Maximizing Read Accuracy of RFID Readers in Supply Chain Applications
Jayant Rajgopal, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States, rajgopal@pitt.edu, Bryan Norman, Lin Wang

There has been a sharp growth in interest in the use of RFID tags for tracking the movement of goods within the supply chain. While tag costs have been steadily declining, a major inhibitor to their adoption that remains is their relatively low read accuracy. In this presentation we formulate and analyze a model to study read-accuracy at a typical portal used in a warehouse or a store, and to optimize the number and locations of interrogator antennas at the portal.

■ SD02

C-Room 603

Contracts in Multi-tier Supply Chains with Information Asymmetry

Cluster: Supply Chain
Invited Session

Chair: Feryal Erhun, Assistant Professor, Stanford University, MS&E, Stanford, CA, 94305, United States, ferhun@stanford.edu

1 - Outsourcing Structures, Commitment and Contracts in a Three-tier Supply Chain
Pengfei Guo, Assistant Professor, The Department of Logistics, Hong Kong Polytechnic Univeristy, Hung Hum, Kowloon, Hong Kong - ROC, pengfei.guo@polyu.edu.hk, Jeannette Song, Yulan Wang

We consider a three-tier supply chain consisting of an original equipment manufacturer (OEM), a contract manufacturer (CM) and a component supplier. We analyze and compare two outsourcing structures currently implemented by top-tier OEMs: consignment and turnkey. We study the two-period bargaining games with one-sided information and one-sided offer among the three parties. We show that the gain of turnkey depends on cost priors and parties' commitment power.

2 - The Role of Distributors as an Information Intermediary in Distribution Systems
Ying-Ju Chen, Assistant Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, United States, ychen0@stern.nyu.edu, Mingcherng Deng, Ke-Wei Huang

We consider the capacity allocation problem in a decentralized distribution system with retailers, distributors, and a supplier. Retailers privately observe local demands, distributors own information technology that generates segment data of the retailers' demands, and the supplier builds capacity. We study this informational effect on the supply chain structure as well as the optimal contract design.

3 - Towards a Unified Theory of Procurement Contract Design: Production Flexibility, Spot Market Trading and the Structure of Sales and Options Contracts
Pamela Pen-Erh Pei, PhD Candidate, MIT, 30A Mount Auburn Street, Cambridge, MA, 02138, United States, ppei@mit.edu

We examine pricing of capacity options with post-contract production and information asymmetry under spot trading. We derive the optimal price scheme for capacity contracts and show that it is governed by three main pricing regimes. We identify the regions under which each regime is preferred by a supplier. We also explore the effects of spot market characteristics on contract design.

4 - Delegation vs. Control of Component Procurement
Enis Kayis, PhD Candidate, Stanford University, Management Science and Engineering, Stanford, CA, United States, ekayis@stanford.edu, Feryal Erhun, Erica Plambeck

Should manufacturers delegate component procurement to their tier-1 suppliers, or control component procurement by contracting with both tier-1 and tier-2 suppliers? We consider a model in which suppliers have asymmetric cost information and manufacturers have alternative sources of supply with cost known only to them. We study how the complexity of contracts, the manufacturers' beliefs about the suppliers' costs as well as the underlying supply chain structure influences the optimal decision.

■ SD03

C-Room 604

Issues in Supply Chain Management

Cluster: Supply Chain
Invited Session

Chair: Greys Sosic, Marshall School of Business, University of Southern California, Los Angeles, CA, United States, sosic@marshall.usc.edu

1 - Modeling Consumer Returns Policies in Retail Operations
Xuanming Su, University of California, Haas School of Business, Berkeley, 94720, United States, xuanming@haas.berkeley.edu

For many products, consumers are unable to assess their value until after purchase. Returns policies help to stimulate demand by insuring consumers against potential product misfit. However, this increases the chances that firms will be left with excess stock when unwanted items are returned. We develop an integrated model to address consumers' purchase and keep-or-return decisions, as well as firms' operational decisions.

2 - Capacity Investment and Pricing Strategy Under Technology Evolution
Xiao Huang, PhD Candidate, University of Southern California, Los Angeles, CA, 90089, United States, Xiao.Huang.2009@marshall.usc.edu, Greys Sosic

Consider a market with two products, in which the new technology is on some attributes inferior to the old one. Our model consists of an entrant who can use only the new technology, and an incumbent who can use both. A segment of the customers is loyal to the old technology, while the rest can purchase either product. We study how the firms strategically determine their capacities and prices under technology evolution, and determine equilibria under different assumptions about the capacity cost.

3 - Implementing High-powered Contracts to Motivate Intertemporal Effort Supply
Leon Chu, Marshall School of Business, University of Southern California, Bridge Hall 401, Los Angeles, CA, 90089, United States, leonyzhu@usc.edu, David Sappington

We characterize the optimal contract when the wealth-constrained agent acquires information over time. The optimal contract is more steeply-sloped for the largest output levels than that in either the standard moral hazard setting or the standard adverse selection setting. This reflects an important intertemporal effort externality: inducing higher levels of effort after the agent acquires more information also motivates the agent during the earlier periods when the agent has little information.

4 - Solution to an Infinite-Horizon Principal-Agent Problem by Direct Construction
Hao Zhang, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, 90089, United States, zhanghao@marshall.usc.edu

A principal delegates the control of a Markovian system to an agent. She offers a long-term contract to the agent in order to maximize her expected profit, but the system states can only be observed by the agent. Through a two-state example, we demonstrate that the optimal contract may be directly constructed from certain pivotal points. It is more efficient than backward induction and helps uncover the structure of the optimal contract.

■ SD04

C-Room 606

Tutorial: A Tutorial on Safe Scheduling

Cluster: Tutorials
Invited Session

1 - A Tutorial on Safe Scheduling
Kenneth Baker, Tuck School, Dartmouth College, Hanover, NH, 03755, Kenneth.R.Baker@Dartmouth.EDU, Dan Trietsch

Safe scheduling augments the traditional approach to sequencing and scheduling models by recognizing safety times explicitly. In this paper, we give a brief review of the basic results in scheduling theory, describe how these results have been extended to stochastic cases, and demonstrate how safe scheduling models sharpen our ability to formulate stochastic problems. Although scheduling theory has historically been driven by optimization methods, we demonstrate how stochastic scheduling problems can be approached with a powerful spreadsheet-based heuristic procedure.

■ SD05

C-Room 607

Nicholson Student Paper Prize Competition, II

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Chung-Piaw Teo, Professor, Department of Decision Sciences, National University of Singapore, Singapore, bizteocp@nus.edu.sg

1- Submodular Set Function Maximization Revisited
Pranava Goundan, Consultant, Analytics Operations Engineering, 111 Devonshire Street, 8th Floor, Boston MA 02109, United States of America, pranava@alum.mit.edu

Abstract not available at this time.

2- Sequential-Merge Facets for High-Dimensional Infinite Group Problems
Santanu Dey, Purdue University, 105 East Oak Street, West Lafayette IN, United States of America, sdey@purdue.edu

Although numerical and theoretical studies suggest that group cuts like Gomory Mixed Integer Cuts can be significantly improved by considering higher-dimensional groups, the discovery of facet-defining inequalities for high-dimensional infinite group problems has remained an open problem for 35 years. In this paper, we present the sequential-merge operator that creates a very large family of facet-defining inequalities for high-dimensional infinite group problem.

3- Robust Management of Motion Uncertainty in Radiation Therapy Treatments
Timothy Chan, MIT, 77 Massachusetts Ave., E40-130, Cambridge MA, United States, tcychan@MIT.EDU, Thomas Bortfeld, Alexei Trofimov, John Tsitsiklis

In the context of patient care for life-threatening illnesses, the presence of uncertainty may compromise the quality of a treatment. In this talk, we present a robust framework to optimize radiation therapy treatments (subject to realistic uncertainties) for cancer patients. We illustrate our results on a clinical case where the uncertainty is due to organ motion during treatment.

■ SD06

C-Room 608

Advances in Call-center Research

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

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

1 - Modeling Call Centers with Delay Information
Zeynep Aksin, Koc University, Rumeli Feneri Yolu, Istanbul, Is, Turkey, zaksin@ku.edu.tr, Oualid Jouini, Yves Dallery

We consider call center models with impatient customers and study how informing customers about their anticipated delays affects performance. A method for modeling the customer reaction with regard to delay information is developed. We propose and analyze a method of delay announcement labeled as announcement by increments.

2 - Asymmetric Information and Economies of Scale in Service Contracting
Baris Ata, Associate Professor, Northwestern University, Evanston, IL, b-ata@kellogg.northwestern.edu, Mustafa Akan, Martin Lariviere

We consider the implications of economies of scale for service outsourcing when one party is better informed about demand. Economies of scale reverses standard results. While asymmetric information generally leads to distorted actions for an unfavorable type, here actions are distorted for favorable, high-volume customers.

3 - Service-Time Heterogeneity in an Inbound Call Center
Noah Gans, OPIM Dept. - Wharton - Penn, 3730 Walnut St, Suite 500, Philadelphia, PA, 19104, United States, gans@wharton.upenn.edu, Haipeng Shen

Service times in call centers are highly variable. Still, a number of factors – e.g. which agent it is, the current level of system congestion – are associated with systematic changes in handle times. We investigate the sources of variation, as well as the potential effect on the agent staffing.

4 - Fair Dynamic Routing Policies in Large-scale Service Systems with Heterogeneous Servers
Mor Armony, Associate Professor, NYU, 44 West 4th Street, New York, NY, 10012, United States, marmony@stern.nyu.edu, Amy Ward

Modern call centers typically have many agents answering calls with different skill levels. It has been shown that routing customers to the fastest agent first asymptotically minimizes steady-state customer waiting times. Unfortunately, this policy penalizes the faster agents by keeping them busy at all times, and only allowing the slower agents to idle. We address the question of how to optimize system performance subject to fairness with respect to server utilization.

■ SD07

C-Room 609

Competitive Models in Operations Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Terry Taylor, Associate Professor, UC Berkeley, Haas School of Business, 545 Student Services #1900, Berkeley, CA, 94720, United States, taylor@haas.berkeley.edu

1 - Quality Competition Under Yield Uncertainty
Awi Federgruen, Professor, Columbia University, 419 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, af7@columbia.edu, Nan Yang

We characterize the equilibrium behavior in an industry with N potential suppliers with uncertain yields, competing for the business of M buyers, in a single sales season. Suppliers can select (i) the yield reliability, as measured by an appropriately chosen decreasing function of the coefficient of variation of the yield factor, (ii) a yield target, i.e. the mean of the yield distribution, or (iii) both. We discuss mechanisms by which suppliers can be induced to adopt higher quality standards.

2 - Incentive Compensation and the Choice of Inventory Buffer in Production Systems
Serguei Netessine, Associate Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu, Stanley Baiman, Richard Saouma

The inventory buffer (kanban) is an essential part of Toyota production system. We model a two-stage (tandem) production system in which the principal needs to motivate two workers. We show that the size of kanban is an effective mechanism by which the principal can motivate the downstream worker to work harder as well as to motivate the upstream worker to help the downstream worker.

3 - Competition in Large Scale Service Systems: Do Waiting Time Standards Matter?
Gad Allon, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu, Itai Gurvich

We study the equilibrium behavior in a market with both small- and large-scale service providers that compete on both price and service level attributes. Applying the epsilon-Nash equilibrium framework to a sequence of markets with growing aggregate demand allows us to identify key properties of these markets. When restricting the demand models under consideration, we show that competition forces the firms to operate in the Quality and Efficiency Driven (QED) operational regime.

4 - Regulating Through Rivalry
Terry Taylor, Associate Professor, UC Berkeley, Haas School of Business, 545 Student Services #1900, Berkeley, CA, 94720, United States, taylor@haas.berkeley.edu, Erica Plambeck

Under new product-based environmental regulations in the electronics industry, firms have incentive to test their competitors' products and reveal violations to a regulator so as to block competing products from the market. Paradoxically, we show that relying on competitive testing is only effective in uncompetitive markets. We characterize more broadly when regulating through rivalry is effective.

■ SD08

C-Room 611

Flexibility and Disruptions Reduction in Supply Chains

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Kathryn Stecke, Professor, The University of Texas at Dallas, School of Management, Richardson, TX, 75083, United States, kstecke@utdallas.edu

1 - On Measuring Supply Chain Resilience

Nitin Bakshi, Doctoral Student, Univ. of Pennsylvania, 3730 Walnut Street, Ste 500, Philadelphia, PA, 19104, United States, nbakshi@wharton.upenn.edu, Paul Kleindorfer, Howard Kunreuther

We study how characteristics of supply chains and markets in which a firm operates determine the impact of a major natural disaster. These characteristics include disaster preparedness, supplier-switching costs, interconnectedness, competition in the market for the final product, financial health of the firm, and historical trends in sales and profitability.

2 - Engineering Changes and Quality Spills in Long Supply Chains

Daniel Reaume, Staff Researcher, General Motors Operations Research, M/C 480-106-155, 30500 Mound Road, Warren, MI, 48090, United States, daniel.reaume@gm.com, Bob Bordley

Long supply chains tend to make engineering changes and quality spills more difficult to manage because disruptions lead to long pipelines of unusable parts. We present an analytic model of such disruptions, taking into account production rates, supplier capacity, pipeline length, premium freight and part repairability.

3 - IS-enabled Reduction of Disruptions in Supply Chains

Pamela Rogers, Teaching Fellow, University of North Texas, Department of Management, PO Box 305429, Denton, TX, 76203, United States, RogersP@unt.edu, Arun Madapusi

A tightly integrated supply chain is crucial to the sustainability of a firm's competitive advantage. However, failure to integrate the objectives of all the supply chain members results in sub-optimal supply chain performance. This study examines the use of information systems (IS) as a solution to reduce supply chain disruptions.

■ SD09

C-Room 612

Aviation Security Applications

Cluster: Homeland Security
Invited Session

Chair: Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W Main Street, Richmond, VA, 23284, United States, lamclay@vcu.edu

1 - Air Marshals Scheduling Problem

Xiaofeng Nie, University at Buffalo (SUNY), 438 Bell Hall, Buffalo, NY, 14260, United States, xnie2@buffalo.edu, Rajan Batta, Colin Drury, Li Lin

We propose a two-level formulation where flights are classified into several risk levels. The first level relates to TSA who will decide which flights from each risk level to be covered and construct the air marshals pairings such that the expected exposure is minimized. The second level relates to a threat source who will decide the probability of attaching one flight from each risk level with two objectives: maximizing the expected exposure and minimizing probability of apprehension.

2 - Designing Aviation Security Systems Using a Sequential Decision Process

Alexander Nikolaev, Dept. of Computer Science, Univ of Illinois, 201 N Goodwin Ave, Siebel Center, Room 1218-4, Urbana, IL, 61801-2302, anikolae@uiuc.edu, Laura McLay, Sheldon H. Jacobson

This paper introduces the sequential stochastic security design problem (SSSDP) for aviation security screening operations. SSSDP is formulated as a two-stage model, where in the first stage security devices are purchased, and in the second stage a policy determines how passengers are screened, with the objective to maximize the total security of all passenger-screening decisions.

3 - A Problem to Sequentially Screen Passengers for Aviation Security

Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W Main Street, Richmond, VA, 23284, United States, lamclay@vcu.edu, Sheldon H. Jacobson, John Kobza, Adrian Lee

Passenger screening systems have become an important component in the design and operation of aviation security systems. This presentation introduces the Sequential Stochastic Multilevel Passenger Screening Problem (SSMPSP), which allows passengers to be optimally assigned (in real-time) to aviation security resources. SSMPSP is formulated as a Markov Decision Process, and an optimal policy is found using dynamic programming. The model is illustrated with computational results.

■ SD10

C-Room 613

Inventory Inaccuracy and Value of Information

Cluster: Inventory
Invited Session

Chair: Kevin Shang, Fuqua School of Busines, Duke University, Durham, NC, United States, khshang@duke.edu

1 - Firm Competition Under Supply Uncertainty

Fuqiang Zhang, Assistant Professor, University of California, Irvine, CA, United States, fzhang@uci.edu, Shaoxuan Liu, Rick So

We use a game-theoretical framework to study the impact of supply uncertainty on the joint marketing and inventory decisions between two competing retailers. We derive some analytical results that provide managerial insights on the equilibrium behavior of these joint decisions and the corresponding profitability of the two retailers

2 - A Break-even Analysis for RFID Technology for Inventory Sensitive to Shrinkage

Karel van Donselaar, Eindhoven University of Technology, P.O. Box 513, Eindhoven, NB, 5611 PT, Netherlands, K.H.v.Donselaar@tm.tue.nl, Ton de Kok, Tom van Woensel

With RFID tags retailers try to control for shrinkage. Current inventory control systems do not take into account the inventory data inaccuracy resulting from shrinkage. Therefore costly audits are performed in which actual inventory is counted. The research in this paper adapts the inventory policy by including the impact of both shrinkage and RFID technology. An exact analytical expression as well as a simple rough-cut approximation is derived for the break-even prices of an RFID tag.

3 - Evaluation of Supply Chains with Cycle-count Policies and Its Implication on IT Investments

Kevin Shang, Fuqua School of Busines, Duke University, Durham, NC, United States, khshang@duke.edu, Gurhan Kok

This paper examines the impact of cycle count policies on multi-location supply chains with inventory record inaccuracy. We examine the impact of RFID technology on system performance and reveal insights on selecting choke points in supply chains.

4 - Information-sensitive Inventory Management When Records Are Inaccurate

Adam Mersereau, Assistant Professor, Kenan-Flagler Business School, University of North Carolina, Campus Box 3490, McColl Bldg., Chapel Hill, NC, 27599-3490, United States, amersere@chicagogsb.edu

We consider replenishment policies in a lost sales inventory system with imperfect inventory records, where the decision-maker maintains a Bayesian record of her inventory position. We formulate the replenishment problem as a partially observed Markov decision process, and we compare single-period to forward-looking policies. We show the impact of data uncertainty on optimal replenishment. We also develop approximations for making near-optimal replenishment decisions.

■ SD11

C-Room 614

Pricing in Competitive Environment

Cluster: Manufacturing
Invited Session

Chair: Shu Zhou, Assistant Professor, San Jose State University, San Jose, CA, 95192, United States, zhou_s@cob.sjsu.edu

1 - Slotting and Pricing Decisions in a Durable Product Supply Chain

Xiuli He, UT-Dallas, School of Management, SM 30, Dallas, TX, 75080, United States, xiulihe@gmail.com, Suresh Sethi

Consider a supply chain in which a manufacturer sells an innovative durable product to a retailer. The product demand follows a Bass-type diffusion process and is determined by the market influences, retail price, and shelf-space allocated to it. We consider the myopic and far-sighted retailer profit strategies. We characterize the optimal dynamic shelf space allocation and optimal pricing policies. Surprisingly, the manufacturer, and even the retailer, may be better off with a myopic strategy.

2 - Capacity and Price Competition Under Imperfect Information
Bing Jing, Assistant Professor of Marketing, Cheung Kong Graduate School of Business, Oriental Plaza, 3F, Tower E3, 1 East Chang An Avenue, Beijing, 100738, China, bjing@stern.nyu.edu, Yuxin Chen

We examine capacity-then-price competition in a duopoly where some (the remaining) consumers are uninformed (informed) about prices. The central result is the following. Even in the absence of capacity costs, in the sub-game perfect equilibria each firm in general chooses a capacity below its maximum demand and thus has to undertake rationing when it prices below its competitor. The price equilibrium in the first stage is of independent interest.

3 - Bundling and Pricing in a Duopoly Environment
Shu Zhou, Assistant Professor, San Jose State University, San Jose, CA, 95192, United States, zhou_s@cob.sjsu.edu, Srinagesh Gavirneni

In a duopoly with two products, when the companies are allowed to use the mixed bundling strategies, the leader no longer dominates the follower in terms of gaining a competitive edge. This is in complete contrast to the setting in which only pure bundling strategies are allowed. We explore the main reasons for this behavior and also evaluate the impact of randomness on these results.

4- Competitive Pricing and Due-Date Quotation with No Tardiness
Ling Wang, Assistant Professor, University of Miami, liwang@exchange.sba.miami.edu

We consider a competitive model in which two make-to-order firms quote non-static prices and lead-times to incoming customers. No tardiness is allowed. We identify and explain a seemingly counter-intuitive behavior - "lose-for-now" - in which the firm with smaller backlog chooses to lose the current customers to the rival.

■ SD12

C-Room 615

Contemporary Scheduling

Cluster: Scheduling
Invited Session

Chair: Joseph Y.-T. Leung, Distinguished Professor, New Jersey Institute of Technology, University Heights, Newark, NJ, 07102, United States, leung@cis.njit.edu

1 - The Coordination of Pricing and Scheduling Decisions
Nicholas G. Hall, Professor, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States, hall_33@cob.osu.edu, Zhi-Long Chen

We consider the coordination of pricing and scheduling decisions to maximize revenue less scheduling cost. We develop an optimal algorithm and an FPTAS for solving three related problems. Our computational results estimate the value of coordination. This work is apparently the first study of pricing and job level scheduling coordination.

2 - Parallel Machine Scheduling with S-precedence Constraints
Marc Posner, Professor, Ohio State University, Integrated Systems Engineering, Columbus, OH, 43210, United States, posner.1@osu.edu, Eun-Seok Kim

For s-precedence constraints, a job cannot start processing until all preceding jobs have started. While not discussed in the scheduling literature, S-precedence constraints have wide applicability in real world settings such as FIFO processing systems. We study an identical parallel machine problem where the objective is to minimize the makespan.

3 - Machine Scheduling with Deliveries to Multiple Customers to Minimize Total Number of Tardy Jobs
Guohua Wan, Professor, University of Macau, Faculty of Business Administration, Taipa, Macau, gh_wan@china.com

We consider several scheduling problems with order deliveries to multiple customers. Each customer has a due date for his/her order. The order completion time is the time when a customer receives his/her order. The objective of the problems is to minimize the number of tardy orders. We study the complexity issues and provide polynomial time algorithms or heuristic algorithms to solve the problems.

4 - Better Online Buffer Management
Jay Sethuraman, Associate Professor, Columbia University, Dept.. of IEOR, New York, NY, 10012, United States, js1353@columbia.edu, Cliff Stein, Fei Li

We design effective buffer management policies for network switches supporting Quality of Service (QoS) guarantees. Specifically, we consider a model in which each packet has a deadline by which it must be sent, and a value reflecting the payoff for sending it on-time. The goal is to maximize the value of the packets sent. In this talk, we shall discuss several online algorithms for this problem and some well-studied variants.

■ SD13

C-Room 616

Development and Application of Mixed Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Bo Zeng, Purdue University, Arnold Drive, 223-3, West Lafayette, IN, 47906, United States, bzeng@ecn.purdue.edu

1 - A Computational Study of the Maximum Co-2-plex Problem
Benjamin McClosky, Rice University, 6100 Main St. - MS 134, Houston, TX, 77030, United States, bjm4@rice.edu, Balabhaskar Balasundaram, Illya Hicks

2-plexes are cohesive subgraphs which were introduced to relax the structure of cliques. A co-2-plex is the complement of 2-plex and is therefore similar to a stable set. We present an exact algorithm for solving the maximum co-2-plex problem.

2 - A Framework for Implementing Parallel Tree Search Algorithms
Yan Xu, Optimization Developer, SAS Institute Inc, yax2@lehigh.edu, Matthew Saltzman, Ted Ralphs, Laszlo Ladanyi

COPS is a framework for implementing and parallelizing tree search algorithms. It employs a number of features to improve scalability and support the implementation of data intensive algorithms. Implementing such algorithms in a scalable manner is challenging. We describe the design of COPS and how the design addresses these challenges. We present several applications built with COPS and some computational results of solving integer programs.

3 - Solving Set Covering Problems with Symmetry
James Ostrowski, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States, jao204@lehigh.edu, Jeff Linderoth

In this talk we discuss methods that could be used to potentially solve hard set covering problems. Our particular focus will be on Steiner triple systems and covering design problems. We generate collections of non-isomorphic feasible partial solutions with specific properties. By considering the symmetry of the constraints, we can use these partial solutions to break the original problem into several smaller subproblems. These subproblems are much easier to solve and can be done in parallel.

4 - Optimization Models and Applications in United Airlines Irregular Operations: Now and Future
Jianhong Qiao, Senior Analyst, United Airlines, 1200 E Algonquin Rd, Elk Grove Village, IL, 60007, United States, jianhong.qiao@united.com, Shravanth Gongireddy, Zhifeng Chen, David Newton, Qiang Gong, Joseph Mathews

Real time irregular operations in airline industry lack sophisticated optimization models and integrated implementation due to prohibitively large problem size, system complexity, and running time limitation. Good solutions against unexpected events, e.g. weather, should efficiently and effectively rebook passengers, reassign pilots and flight attendants, and balance aircrafts. A future system integrates optimization models and pursues globally optimal solutions with reasonable solving time.

■ SD14

C-Room 617

Large-scale Optimization

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Michael Saunders, Stanford University, Dept. of Management Science & Engineering, 380 Panama Way, Stanford, CA, 94305-4026, United States, saunders@stanford.edu

1 - Iterative Methods for Generalized Saddle-point Problems
Philip Gill, Professor, University of California, San Diego, 9500 Gilman Drive, # 0112, La Jolla, CA, United States, pgill@ucsd.edu, Joshua Griffin, Anders Forsgren

We consider iterative methods for generalized saddle-point problems that arise in interior methods for general nonlinear optimization. We focus on the application of the preconditioned conjugate-gradient method to a certain "doubly-augmented system" that is positive definite with respect to both the primal and the dual variables.

2 - An Augmentation Preconditioner for Linear Systems Arising from Interior Point Methods
Chen Greif, University of British Columbia, 2366 Main Mall, Vancouver, BC, V6T 1Z4, Canada, greif@cs.ubc.ca

We introduce a preconditioning technique for saddle point linear systems arising from primal-dual interior point algorithms in linear and quadratic programming. The preconditioner has the attractive property of improved eigenvalue clustering with increased ill-conditioning of the (1,1) block of the matrix. We analyze spectral characteristics and demonstrate performance on problems from the NETLIB and CUTEr test suites. The numerical experiments include results based on inexact inner iterations.

3 - A Unified Theorem on SDP Rank Reduction
Yinyu Ye, Professor, Stanford University, Dept. of Management Science & Engineering, Stanford, CA, 94305-4026, United States, yinyu-ye@stanford.edu

We consider the problem of finding a low—rank approximate solution to a system of linear equations in symmetric, positive semidefinite matrices, where the approximation quality of a solution is measured by its maximum relative deviation, both above and below, from the prescribed quantities. We present a randomized polynomial time algorithm to compute such a solution with provable bounds, and show such bounds are tight.

4 - Improving Parameter Optimization Performance
Mark Abramson, Associate Professor, Air Force Institute of Technology, AFIT/ENC, Building 641, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, Mark.Abramson@afit.edu, Thomas Asaki, John Dennis, Jr., Raymond Magallanez, David Bethea

We study the numerical solution of optimization problems, in which the time required to compute a function value may vary greatly within the domain. Our approach applies a surrogate-based mesh adaptive direct search algorithm, in which surrogates are based on previously stored CPU times, rather than objective function values. Examples come from industrial problems, including one that requires a hydrodynamic simulation and an image registration process for each function evaluation.

■ SD15

C-Room 618

Linear Programming and Linear Complementarity Problems

Sponsor: Optimization/ Linear Programming and Complementarity
Sponsored Session

1 - A New Class of Polynomial Interior-point Algorithms for P*(\kappa)- linear Complementary Problems
Goran Lesaja, Associate Professor, Georgia Southern University, Department of Mathematical Sciences, P.O. Box 8093, Statesboro, GA, 30458, United States, goran@GeorgiaSouthern.edu, Kees Roos, Yanqin Bai

We present a new class of short- and long-step polynomial interior-point algorithms for P*(\kappa)- Linear Complementarity Problems based on a new class of parametric kernel functions. This class is fairly general and includes the classical logarithmic function, the prototype self-regular function, and non-self-regular kernel functions as special cases. The iteration bounds obtained in this paper are very favorable and they match the best known existing iteration bounds.

2 - Strong Duality and a Dual Method for Nonconvex Spectrum Optimization of Multicarrier Systems
Tamas Terlaky, McMaster University, Department of Computing and Software, Hamilton, ON, Canada, terlaky@mcmaster.ca, Jiaping Zhu

Yu and Liu's strong duality theorem under the time-sharing property requires the Slater condition to hold for the considered general nonconvex problem, what is satisfied for the specific application. We further extend the scope of the theorem under Ky Fan convexity which is slightly weaker than Yu&Lui's time-sharing property.

3 - On the Global Solution of Linear Programs with Linear Complementarity Constraints
John E. Mitchell, Professor, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, 110 Eighth St. AE325, Troy, NY, 12180, United States, mitchj@rpi.edu, Jong-Shi Pang, Kristin P. Bennett, Gautam Kunapuli, Jing Hu

This talk presents a parameter-free integer-programming based algorithm for the global resolution of a linear program with linear complementarity constraints (LPEC). The cornerstone of the algorithm is a minimax integer program formulation that characterizes and provides certificates for the three outcomes—-infeasibility, unboundedness, or solvability—-of an LPEC. Computational results demonstrate that the algorithm can handle infeasible, unbounded, and solvable LPECs effectively.

4 - The Colourful Feasibility Problem
Tamon Stephen, Simon Fraser University, 14th Floor Central City Tower, 250-13450 102nd Ave., Surrey, BC, V3T0A3, Canada, tamon@sfu.ca, Sui Huang, Tamas Terlaky, Antoine Deza

A colourful version of the linear programming feasibility problem is to find a feasible basis that respects a given colouring (partition) of the vertices. This problem was presented by Barany and Onn in 1997, it is still not known if a polynomial time algorithm exists. We compare their methods with new methods. We show that some algorithms can lead to cycling or slow convergence, but we provide extensive numerical experiments which show that others perform much better than predicted.

■ SD16

C-Room 619

Meta-control Applications to Optimization

Cluster: Optimization (Invited)
Invited Session

Chair: Wolf Kohn, CTO and Founder, Clearsight Systems, 12828 Northup Way, Suite 310, Bellevue, WA, 98005, United States, wolf.kohn@clearsightsystems.com

1 - Continualized Approximation Method for Binary Integer Programming
Kathrine von Haartman, PhD Student and Systems Analyst, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98195, United States, meggie.vonhaartman@clearsightsystems.com, Wolf Kohn, Zelda Zabinsky

This paper uses continualization techniques to find approximate solutions to binary integer programming problems. The algorithm emphasizes the construction of sequential approximations to a solution using a meta-control approach that has low polynomic time complexity. This algorithm will be illustrated with an example.

2 - Advanced Demand Forecasting Algorithm
Yanfang Shen, Chief OR Analyst, Clearsight Systems, 12828 Northup Way, Suite 310, Bellevue, WA, 98005, United States, yanfang.shen@clearsightsystems.com, Vladimir Brayman, Wolf Kohn

This paper proposes a distributed algorithm for the real-time estimation of product demand as a function of sensory data (RFID, Bar code readers). The algorithm includes building a sub-process that learns the parameters of the model, and scheduling their incorporation as a function of observed behavior quality of the forecast. We will describe the algorithm and theoretical aspects of the technology. We will illustrate the technology with an example.

3 - Rule-based Supply Chain Forecasting and Control
Hongrui Liu, PhD Student, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98195, United States, hrliu@u.washington.edu, Zelda Zabinsky, Wolf Kohn

We develop a rule-based method to formulate a stochastic supply chain flow problems that includes forecasting and control. We explore the use of quantum logic to transform the IF-THEN-ELSE type rules to quantum states and perform inferences with a quantum operator. This has the potential to drastically reduce computation, so we hope for a real-time efficient methodology for supply chain management.

4 - Quantum Dynamic Programming Using Hybrid Automata
Wolf Kohn, CTO and Founder, Clearsight Systems, 12828 Northup Way, Suite 310, Bellevue, WA, 98005, United States, wolf.kohn@clearsightsystems.com, Zelda Zabinsky

We describe early results about implementing dynamic decision processes using quantum reasoning techniques. The processes are represented by hybrid automata. The reasoning techniques use quantum observables as inference operators. These operators are the edges of an automaton whose states are quantum states of the decision process. We provide several examples, such as inventory, replenishment management, resource scheduling and dispatch, using this paradigm.

■ SD17

C-Room 620

Information Systems Economics

Sponsor: Information Systems Society
Sponsored Session

Chair: Vidyanand Choudhary, University of California, Irvine, SB 313, Irvine, CA, 92697, United States, veecee@uci.edu

1 - Impact of Competition from Open Source Software on Proprietary Software Quality and Social Welfare
Zach Zhou, The Paul Merage School of Business, UC Irvine, Irvine, CA, 92697, United States, zzhou01@gsm.uci.edu, Vidyanand Choudhary

We analyze the impact of competition from open source on the quality of proprietary software. Whereas prior research showed that competition from open source causes proprietary software quality to increase, we find that proprietary software quality can be higher or lower than the quality of a proprietary monopoly. We also find that competition from open source can reduce social welfare even in the absence of network effects.

2 - Does Online Information Substitute or Complement Traditional Quality Signals?
Siva Viswanathan, Assistant Professor, University of Maryland, 4313 Van Munching Hall, RH Smith School of Business, College Park, MD, 20742, United States, sviswana@rhsmith.umd.edu, Vandana Ramachandran

We analyze an extensive dataset of consumers who obtained vehicle and transaction information from online sources in their used-car purchase process, to examine the impact of online information on the choice of certification, and price paid. We compare outcomes involving certified purchases, with outcomes where there was no certification. Our findings highlight interesting relationships between different information categories and the likelihood of a certified purchase, as well as price paid.

3 - Digitization of Music: An Empirical Study of Dis-intermediation and the Long-tail Phenomenon
Ramnath Chellappa, ram@bus.emory.edu, Shivendu Shivendu, Vallabhajosyula Sambamurthy, Benn Konsynski

Digitization of content has led to significant changes in the structure of the music industry. Theoretical research argues that record-labels are being increasingly displaced and consumers' music purchasing behavior has been fundamentally altered. Our work investigates the impact of content digitization through an empirical examination of the role of traditional players in this entertainment industry.

■ SD18

C-Room 201

Real-time Integer Programming

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Jeff Linderoth, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706-1572, United States, jtl3@lehigh.edu

1 - Parallel Local Search Methods for Mixed Integer Programs
Andrew Miller, University of Wisconsin-Madison, 3156 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, United States, amiller@engr.wisc.edu, Mahdi Namazifar

We discuss frameworks that use ideas from MIP heuristics such as local branching and RINS to search for feasible solutions simultaneously on many different processors on a grid or high performance computing architecture. Our frameworks are designed to ensure that the work done on different processors does not significantly overlap. Computational evidence suggests that such frameworks can obtain good solutions for many problems faster than commercial solvers.

2 - Approximating the Stability Region of Binary Variables with Linear Objectives
Martin Savelsbergh, Professor, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Tech, 765 Ferst Dr, Atlanta, GA, 30332-0205, United States, mwps@isye.gatech.edu, Shabbir Ahmed, Fatma Kilinc Karzan, George Nemhauser, Alejandro Toriello

We study sensitivity and stability analysis for NP-hard optimization problems. We focus an optimal solution's sensitivity to changes in the cost coefficients of binary variables. We establish inner- and outer approximations of the region in the cost-vector space for which the optimal solution remains optimal. Furthermore, we investigate techniques to quickly re-optimize when the current solution is no longer optimal.

3 - Warm Starting for Mixed Integer Linear Programs (MILPs)
Menal Guzelsoy, Lehigh University, 200 West Packer Ave, Room 362, Bethlehem, PA, 18015, United States, megb@lehigh.edu, Ted Ralphs

Warm starting is a technique used to start the solution procedure of a modified MILP from an advanced state using data generated from execution of a previous solution procedure. Methods for warm starting are useful in cases where solution of a family of related MILPs is required. In this talk, we will consider various warm starting approaches appropriate for MILP families parameterized over different parts of the input data.

4 - Multi-stage Process Models and Grid Computation
Michael Ferris, Professor, University of Wisconsin-Madison, Department of Computer Sciences, 1210 West Dayton Street, Madison, WI, 53706, United States, ferris@cs.wisc.edu

We consider the solution of a time critical application using grid computation. A hierarchical model involving batching, assignment and scheduling for an chemical process application will be described and new tools for its solution will be outlined. In particular, the use of the GAMS/grid interface, the condor resource manager, and a variety of mixed integer programming solvers, coupled with domain expertise will be demonstrated.

■ SD19

C-Room 203

Joint Session ICS/INFORMS-ED: Recommendations of the INFORMS Computing Society Education Committee

Sponsor: INFORMS Computing Society, INFORM-ED
Sponsored Session

Chair: Jill Hardin, Virginia Commonwealth University, 1001 W. Main St., P.O. Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu

1 - Panel Discussion: Recommendations of the INFORMS Computing Society Education Committee
Moderator: Jill Hardin, Virginia Commonwealth University, 1001 W. Main St., P.O. Box 843083, Richmond, VA, 23284-3083, United States, jrhardin@vcu.edu, Panelist: David Rader, Cesar Rego, Kevin Furman, Allen Holder

At its January 2007 business meeting, the INFORMS Computing Society proposed forming an Education Committee. This committee has been charged with recommending a model undergraduate curriculum which would produce graduates who are well prepared for work at the OR/CS interface. The draft report detailing the committee's recommendations and rationale will be presented, followed by a panel discussion with the members of the committee.

■ SD20

C-Room 204

DA Practice Award Finalists

Sponsor: Decision Analysis
Sponsored Session

Chair: Karen Jenni, Insight Decisions LLC, 2200 Quitman Street, Denver, CO, 80212-1116, kjenni@insightdecisions.com

1 - DAS Practice Award Finalists
Karen Jenni, Insight Decisions LLC, 2200 Quitman Street, Denver, CO, 80212-1116, kjenni@insightdecisions.com

The DAS Practice Award was established to recognize, promote, and publicize outstanding decision analysis practice. Finalist for the award will present their work during this session, and the winner will be announced at the DAS Awards session.

■ SD21

C-Room 205

Behavioral Aspects of Decision Making Under Uncertainty

Sponsor: Decision Analysis
Sponsored Session

Chair: Bob Bordley, General Motors Operations Research, M/C 480-106-256, 30500 Mound Road, Warren, MI, 48090, United States, robert.bordley@gm.com

1 - High Stakes Risk Preference Experiment With Actual Payout
Sam Bodily, John Tyler Professor, Darden- Univ. of Virginia, 100 Darden Boulevard, Charlottesville, VA, 22903, United States, bodilys@virginia.edu, Phil Pfeifer

We report an experiment where 319 MBA students gave certainty equivalents (CEs) for a real 50/50 lottery involving identical briefcases containing $17,500 and $0. Students gave binding statements of the least they would accept for their briefcase from a banker offering cash. We expected that the CEs from actual payouts would be systematically lower than students' earlier CEs elicited using a hypothetical lottery. In fact, there is a complex story to be told.

2 - Using a Combination of Forecasts Approach to Resolve Partition-dependence Bias

Bob Bordley, General Motors Operations Research, M/C 480-106-256, 30500 Mound Road, Warren, MI, 48090, United States, robert.bordley@gm.com

Elicited probabilities vary with partition. This paper treats each partition's elicited probability as an estimate of the individual's true underlying subjective probability. Assuming forecast error has a Dirichlet distribution (which reproduces some of known biases toward the uniform prior) leads to a combined estimate of the subjective probability. This is applied to a real problem in missing survey data. This Bayesian solution has some Shaferian-aspects.

3 - Decision Making Under Uncertainty: Representational and Psychometric Measures

John Aloysius, University of Arkansas, 204 WCOB, Fayetteville, AR, 72701, United States, JAloysius@walton.uark.edu, Srinivasan Venkatraman, Fred Davis

Decision analysis has normative foundations, but understanding linkages with descriptive information processing is key to develop prescriptive recommendations. Our experiment varies the number of plays and parameters of binary gambles. We analyze the relationships between abstract properties (e.g., expected value), psychological perceptions (riskiness and ambiguity) of these multiple prospects, decision behavior (e.g., certainty equivalents) and individual differences (e.g., risk attitude).

■ SD22

C-Room 206

JFIG Paper Competition Finalists II

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Sunil Kumar, Standford University, skumar@stanford.edu

1 - JFIG Paper Competition Finalists

In these two sessions the finalists of the 2007 JFIG paper competition will present their research. The paper competition is organized by the Junior Faculty Interest Group (JFIG) forum in INFORMS. JFIG was created in 2001 to promote the career development of tenure-track faculty in INFORMS. The goals of the paper competition are to encourage research among junior faculty and to increase the visibility of research conducted by junior faculty within the fields of operations research and management science. Six finalists are selected by the award committee and their papers are presented in these two sessions. The papers submitted for the competition are evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. Winners are announced at the JFIG lunch on Sunday at the INFORMS Annual Meeting.

■ SD23

C-Room 208

Behavioral Queuing

Sponsor: Behavioral Process Management (BPM)
Sponsored Session

Chair: Ken Schultz, Associate Professor, University of Alberta, 340-G Business School, Edmonton, Ab, T6G 2R6, Canada, klschult@ualberta.ca

1 - Willingness to Pay and the Waiting Experience

Diane Bischak, Associate Professor, University of Calgary, Haskayne School of Business, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, diane.bischak@haskayne.ucalgary.ca, Robert Oxoby

We present results from a simple willingness-to-pay (WTP) experiment in which individuals' preferences for a good of known value were elicited. Three time treatments were used to assess the effects of an occupied or unoccupied wait prior to the elicitation of WTP values. Our results indicate that an unoccupied wait has a significant effect on WTP, with implications for the cost of customer waiting time in service operations.

2 - Perceived Wait Time, Satisfaction and the Effect of Wait Time Fillers

Kelly McGuire, Cornell University, 105 Cobb St, Ithaca, NY, 14850, United States, kam63@cornell.edu, Sheryl Kimes, Mellie Pullman, Mike Lynn

Previous research into the impact of waiting time fillers on perceived wait time and satisfaction has failed to establish a consistent effect. A series of computer-based, laboratory experiments were conducted to first establish the processes that contribute to the relationship between perceived wait time and satisfaction, and then to test the impact of different types of time filling activities on these processes.

■ SD24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - ATEJI - Object-Oriented Modeling and Integration with OptimJ

Patrick Viry, ATEJI, 14 Rue Soleillet, Paris, 75020, France, patrick.viry@ateji.com

The OptimJ object-oriented modeling language provides a radical new approach to integrating optimization techniques in general IT environments. See how easy it is to integrate your models in web-based database-enabled applications. Discover OptimJ bulk processing operators for data feeding and cleaning. Understand how OptimJ can significantly improve collaboration between software developers and OR experts.

2 - Responsive Learning Technologies, Inc. - Online Games for Operations Courses

Sam Wood, Responsive Learning Technologies, Inc., 10181 Parlett Place, Cupertino, CA 95014, wood@responsive.net

See a demonstration of online games that are used in operations management courses and supply chain management courses in more than 100 undergraduate and MBA-level programs to teach topics like capacity management, lead time management, inventory control, and supply chain design and logistics.

■ SD25

C-Room 210

Service Planning, Modeling and Assessment

Sponsor: Service Science
Sponsored Session

Chair: Kwang-Jae Kim, Professor, Pohang Univ of Science and Technology, Industrial and Management Engineering, Pohang, KY, 790-784, Korea, Republic of, kjk@postech.ac.kr

1 - An Extended QFD Planning Model for Goal Attainment Considering Longitudinal Effect

Dae-Kee Min, Pohang Univ of Science and Technology, Industrial and Management Engineering, Pohang, Ky, Korea, Republic of, pupamin@postech.ac.kr, Kwang-Jae Kim

This paper proposes an extended QFD planning model for goal attainment that considers longitudinal effect. In the longitudinal effect case, the level of goal is determined by a series of effects over a certain period of time rather than by the effect at a specific point of time. In the proposed model, the longitudinal effect is incorporated by introducing a time dimension into the existing house of quality structure. The proposed model is illustrated using a case in high-speed internet service.

2 - Computation of Prices in Competitive, Dynamic Service Networks

Terry Friesz, Harold and Inge Marcus Chaired Professor, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States, tlf13@psu.edu, Changhyun Kwon, Matthew Rigdon

In this presentation we review a family of dynamic, game-theoretic models for pricing, resource allocation and demand management related to the provision of competitive services offered over networks. An algorithm based on gap functions is proposed and numerically tested.

3 - A Baldrige Model Based Assessment Strategy for Management Systems of Telecommunication Industries

Wan-Seon Shin, SungKyunKwan University, Dept.. of Systems Management Engineering, Suwon-city, Korea, Republic of, wsshin@yurim.skku.ac.kr, Taeho Kim

This paper proposes a management system assessment strategy for telecommunication industries using the Baldrige criteria. It first introduces how the criteria have been used as an organization wide assessment tool in KT, Korea. A number of key issues such as the assessment schema, checklists, web based self-assessment aids, and reporting templates are explained with illustrations. A step-wise assessment procedure is then proposed.

4 - A Model of Rapid New Service Development Process: Rapid-NSD

Kwang-Jae Kim, Professor, Pohang Univ of Science and Technology, Industrial and Management Engineering, Pohang, KY, 790-784, Korea, Republic of, kjk@postech.ac.kr, Kwangsoo Kim, Byung-In Kim, Deok-Hwan Kim

The new service development (NSD) process defines the what and the how of a new service. This paper proposes a systematic model for NSD process. The proposed model consists of three phases, namely, service concept development, service process design, and service performance verification. A special focus is placed on improving the rapidity of the NSD process.

■ SD26

C-Room 211

Joint Session DM/ Computational Methods for Data Mining: Recent Advances in Data Mining and Machine Learning

Sponsor: Data Mining (Sponsored), Computational Methods for Data Mining
Sponsored Session

Chair: Zhiguang Qian, Assistant Professor, University of Wisconsin at Madison, zhiguang@stat.wisc.edu

1 - Active Learning via Sequential Design with Applications to Anti-money Laundering
Xinwei Deng, PhD Student, Georgia Institute of Technology, xdeng@isye.gatech.edu, Roshan Vengazhiyil, Agus Sudjianto, C. F. Jeff Wu

Anti-money laundering is an important responsibility. There are millions of transactions happening each day. Investigating each transaction and classifying an account to be suspicious or not is time-consuming. In this article, we propose an active learning method using Bayesian sequential designs to detect money-laundering. The sequential nature helps to identify suspicious accounts with minimal effort. An application to real banking data is used to demonstrate the performance of the method.

2 - A Bayesian Approach for the Registration of High-resolution NMR
Seoung Bum Kim, Assistant Professor, University of Texas at Arlington, 420K Woolf Hall, Arlington, TX, 76001, United States, sbkim@uta.edu

We propose a new registration method for high-resolution NMR spectra within the Bayesian modeling framework. The proposed method allows us to estimate the amplitude and phase shifts simultaneously and to obtain robust in the existence of noise.

3 - Evidence Contrary to the Statistical View of Boosting
David Mease, Assistant Professor, San Jose State University, mease_d@cob.sjsu.edu, Abraham Wyner

The statistical perspective on boosting focuses on optimization, drawing parallels with logistic regression. We present empirical evidence that raises questions about this view. Although the statistical perspective provides a theoretical framework within which it is possible to derive theorems and create new algorithms for general contexts, we show that there remain many unanswered important questions.

4 - GIS-based Data Mining On Performance of ATM Transaction: An Empirical Study
Ming Xie, IBM China Research Laboratory, Diamond Building, ZGC Software Park #19, Dong Beiwang Road, Shang Di, Beijing, 100094, China, xieming@cn.ibm.com, Jia Chen, Wenjun Yin, Jin Dong

In banking industry, ATM is quite important for commercial banks to extend their business. This paper presents a case study of one of the biggest Chinese banks. Firstly the performance of ATM is analyzed from transaction flow by statistical analysis. Then the market potential around ATM is evaluated in terms of the Geographical Information System. Finally a comparative study provides insights on the relationship between ATM transaction characteristics and its environmental factors.

■ SD27

C-Room 212

Business Data Mining Applications

Cluster: Data Mining (Invited)
Invited Session

Chair: Wolfgang Jank, Assistant Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, wjank@rhsmith.umd.edu

Co-Chair: Galit Shmueli, University of Maryland, Robert H Smith School of Business, College Park, MD, United States, gshmueli@rhsmith.umd.edu

1 - Using Virtual Stock Exchanges to Forecast Box-Office Revenue via Functional Shape Analysis
Wolfgang Jank, Assistant Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, wjank@rhsmith.umd.edu, Natasha Foutz

We propose a novel model for forecasting box office revenue success based on virtual stock markets. Our forecasting model uses novel statistical methodology from the area of functional data analysis. It uses the entire trading path rater than only its final value and it employs trading dynamics and it teases out differences between different trading paths using functional shape analysis. Our results show that the model has strong predictive power and improves over competitors.

2 - A Family of Growth Models for Representing Price Evolution in Online Auctions
Galit Shmueli, University of Maryland, Robert H Smith School of Business, College Park, MD, United States, gshmueli@rhsmith.umd.edu, Wolfgang Jank, Valerie Hyde

Bids in online auctions arrive at discrete timepoints. We represent the continuous price-process as a functional object. Typical nonparametric smoothing (e.g., p-splines or monotone splines) used to estimate price curves from observed discrete bid data has several limitations. We present a parametric family of growth models that overcomes these limitations. It is parsimonious, insightful, and useful. A measure of fit and automated fitting algorithm are provided. eBay data used for illustration.

3 - Active Information Acquisition for Clustering and Classification
Maytal Saar-Tsechansky, Assistant Professor, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States, Maytal.Saar-Tsechansky@mccombs.utexas.edu

The role of data-driven intelligence is becoming critical for supporting business decisions. Often the underlying data available for induction can be enhanced by acquiring unknown values. I will discuss and present experimental results of policies that aim to improve induction by acquiring new information cost-effectively. The policies employ estimations to enable effective ranking of potential acquisitions in settings where relatively little information is available about the underlying domain.

4 - Challenges in Large Scale Detection of Accounting Irregularities
Krishna Kumaraswamy, krishna.kumaraswamy@us.pwc.com, Stephen Bay, Markus Anderle, David Steier

In this talk we present a system, Sherlock, that uses machine learning techniques for detecting accounting fraud and error in a company's general ledger data. In developing Sherlock, we addressed challenges in creating efficient processes for using data from heterogeneous sources, learning classification models with few known cases of fraud and in evaluating the effectiveness of our methods. We also show how anomaly detection complements the classification approach when using unlabeled data.

■ SD28

C-Room 213

Metaheuristics for Location Problems

Cluster: Joint Cluster Metaheuristics/ ICS: Metaheuristics
Invited Session

Chair: Mauricio G. C. Resende, Lead Member of Technical Staff, AT&T Labs Research, 180 Park Avenue, Room C241, Florham Park, NJ, 07932, United States, mgcr@research.att.com

1 - Meta-heuristics for Strategic and Tactical Facility Location
Michael Bucci, Doctoral Candidate, North Carolina State University, CB # 7906, Daniels Hall, Raleigh, NC, 27695, United States, mbucci@nc.rr.com, Michael Kay, Jeffrey Joines, Don Warsing

We develop and compare several meta-heuristic methods for solving facility location-allocation problems that include costs related to both strategic and tactical level decisions. Problem parameters cover inventory and transportation economies of scale, uncertainty in supply and demand, and multiple product classifications. Various empirical tests are used to measure heuristic performance by comparing solution cost, solution time, and solution complexity.

2 - A Fast Swap-based Local Search Procedure for Location Problems
Renato Werneck, Researcher, Microsoft Research Silicon Valley, 1065 La Avenida, Mountain View, CA, 94043, United States, renatow@microsoft.com, Mauricio G. C. Resende

We present a new implementation of a widely used swap-based local search procedure for the P-median problem, proposed in 1968 by Teitz and Bart. It produces the same output as the best alternatives described in the literature and, even though its worst-case complexity is similar, it can be significantly faster in practice: speedups of up to 3 orders of magnitude were observed. We also show that our method can be easily adapted to implement path-relinking and tabu search.

3 - A Hybrid Heuristic for the P-median Problem
Mauricio G. C. Resende, Lead Member of Technical Staff, AT&T Labs Research, 180 Park Avenue, Room C241, Florham Park, NJ, 07932, United States, mgcr@research.att.com, Renato Werneck

We present a multistart hybrid heuristic that combines elements of several traditional metaheuristics to find near-optimal solutions to the P-median problem. Empirical results on instances from the literature attest the robustness of the algorithm, which performs at least as well as other methods, and often better in terms of both running time and solution quality. In all cases the solutions obtained by our method were within 0.1 percent of the best known upper bounds.

4 - A Hybrid Multistart Heuristic for the Uncapacitated Facility Location Problem

Renato Werneck, Researcher, Microsoft Research Silicon Valley, 1065 La Avenida, Mountain View, CA, 94043, United States, renatow@microsoft.com, Mauricio G. C. Resende

We present a multistart heuristic for the uncapacitated facility location problem, based on a method we originally developed for the P-median problem. Empirical evidence shows the effectiveness of our algorithm in practice. For most instances in the literature, we obtain solutions that are either optimal or a fraction of a percentage point away from it. For instances created with the sole purpose of being hard to tackle, our algorithm can get very close to optimality if given enough time.

■ SD29

C-Room 214

Optimization Services and Third Party Software

Sponsor: INFORMS Computing Society/ICS/COIN-OR
Sponsored Session

Chair: Kipp Martin, Professor, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States, kipp.martin@chicagogsb.edu

1 - C++ Algorithmic Differentiation by Operator Overloading

Brad Bell, Mathematician, Applied Physica Laboratory, University of Washington, 1013 NE 40th Street, Seattle, WA, 98105-6698, United States, bradbell@washington.edu

Reverse mode algorithmic differentiation calculates a gradient using a small multiple of the number of operations required to compute an objective. This requires storing the operations and values corresponding to the objective. As memory gets larger, reverse mode can be efficiently applied in more cases. We present a C++ templated objective and use it with float, double, and the AD types defined by ADOLC, CppAD, and FADBAD. The gradient computation time using these AD packages is compared.

2 - Setting Up and Hosting Your Solver as Web Services via Optimization Services (OS)

Jun Ma, Northwestern University, Dept. of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, maj@northwestern.edu, Robert Fourer, Kipp Martin

Optimization Services (OS) is a unified framework for new generation distributed optimization systems. We provide the open source OS library which is based on a set of Optimization Services Protocols (OSP). The library supports the solution of a wide variety of optimization problem types in a loosely coupled distributed environment. We also provide OS server software for users to host their own Optimization Services. In particular, we demo the OS integration in Apache's Tomcat Web server.

3 - Hooking Optimization Services to Modeling Languages and Solvers

Robert Fourer, Professor, Northwestern University, Dept. of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu, Kipp Martin, Jun Ma

The OS framework is designed to avoid duplication of effort by means of a new standard for representing optimization problem instances. Once adopted, this standard will require only one interface to be written for each modeling system and each solver. At the heart of our proposal are OsiL, an XML-based representation for optimization problem instances, and OSInstance, a corresponding in-memory representation, together with an object-oriented library of methods for working with these forms.

4 - Optimization Services and Nonlinear Optimization

Kipp Martin, Professor, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States, kipp.martin@chicagogsb.edu

We describe how to use Optimization Services (OS) with third party nonlinear solvers. The OS library contains an OS instance class that provides a flexible API for solvers. The OSInstance class has a method to generate instance representations in postfix format. This is illustrated with the LINDO solver. There are also calculate methods that use the CppAD package to provide gradient and Hessian values using algorithmic differentiation. This is illustrated with Knitro and Ipopt.

■ SD30

C-Room 2A

System Reliability Modeling and Optimization II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qianmei (May) Feng, Assistant Professor, University of Houston, Houston, TX, United States, qmfeng@uh.edu

Co-Chair: Yong Chen, University of Iowa, Iowa City, IA, United States, yongchen@engineering.uiowa.edu

1 - MoPriGA: A Multiple Objective Prioritized Genetic Algorithm

Heidi Taboada, Assistant Professor, The University of Texas at El Paso, 500 W. University Av., El Paso, TX, 79902, United States, hataboada@utep.edu, David Coit

A newly developed multiple objective evolutionary algorithm is presented. MoPriGA, a multiple objective prioritized genetic algorithm, incorporates the knowledge of the decision-maker objective function preferences directly within the evolutionary algorithm. The idea behind this algorithm is to more intensely focus on the region of the Pareto set of interest to the decision-maker.

2 - Evaluation of Linear Sensor System Reliability Using Monte Carlo Methods

Yong Chen, University of Iowa, Iowa City, IA, United States, yongchen@engineering.uiowa.edu, Qingyu Yang

Linear sensor systems have broad applications in manufacturing fault diagnosis, array signal processing, and wireless sensor networks. Evaluating the reliability of linear sensor systems is an NP hard problem. In this paper, Monte Carlo methods are applied to evaluate/approximate the linear sensor system reliability and their performances are compared.

3 - Robust System Reliability Design

Jose Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Jose.Ramirez-Marquez@stevens.edu

Recently developed bounding strategies that improve confidence interval estimation for system reliability are used to provide a new reliability allocation perspective with the goal of developing a robust system reliability design. Research efforts have been focused : developing models for general series-parallel robust reliability analysis and, based on these models, generating heuristic methods for obtaining quasi optimal solutions to the best system design.

4 - The Decision Model for the Optimal Time Points to Repair Aging Multistate Systems

Yung-Wen Liu, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Road, Dearborn, MI, 48128, United States, ywliu@umich.edu

Customers may consider repairing the system when they are dissatisfied with how it works even before it reaches the failure. However, repairing costs and other factors may make customers hesitate to repair it. The nonstationary stochastic processes are used to model the deterioration and repairing processes for aging multistate systems, and customers' disutility functions, costs and other factors are used to build the optimization model for customers to decide when a system should be repaired.

■ SD31

C-Room 2B

Joint Session QSR/HAS/Service: Quality and Statistical Decision-making in Healthcare Applications II

Sponsor: Quality, Statistics and Reliability, Health Applications Section, Service Science
Sponsored Session

Chair: Jing Li, Arizona State University, Tempe, AZ, United States, jinglz@umich.edu

Co-Chair: Julie Simmons Ivy, University of Michigan, jsimmons@bus.umich.edu

1 - Including Culture in Resource Allocation Models of HIV/AIDS Prevention Methods

Rupa Valdez, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States, rsvaldez@wisc.edu

Models of resource allocation of HIV/AIDS prevention methods have not explicitly included cultural factors. Evidence of the impact of culture on these decisions may be found in the literature. A pilot study conducted at the University of Wisconsin-Madison offers guidance as to dimensions of culture that should be included.

2 - Coordinating Anesthesia Appointments and Scheduling Milestones Using Enterprise-Wide Scheduling

Franklin Dexter, Professor, University of Iowa, Dept.. of Anesthesia, 6JCP, Iowa City, IA, 52242, United States, franklin-dexter@uiowa.edu

We implemented scheduling of anesthetics outside of operating rooms by clerks and nurses from other departments using the hospital's enterprise-wide scheduling system. Experimental studies investigated how tabular and graphical displays affected the scheduling of milestones (e.g., NPO times) and appointments before anesthetics. Results apply to other problems of patients arriving just in time (e.g., for non-OR anesthesia, surgery, or regional block placement at facilities with limited space).

3 - Analysis of the Consistency of a MIP-based Multigroup Constrained Discriminant Model

Paul Brooks, VCU, Dept.. of Stat. Sci. and O.R., P.O. Box 843083, Richmond, VA, 23284, United States, JPBrooks@vcu.edu, Eva K. Lee

A Bayes optimal classifier minimizes the probability of misclassification. Even if a Bayes optimal classifier can be obtained, the inter-group misclassification rates may be higher than desirable. Constrained discrimination models are classification models that allow for the non-classification of observations until more information is collected. We analyze the consistency of a mixed-integer programming formulation of a constrained discrimination model.

4 - Designing a Decision-making System for Medical Disaster Mutual Aid

Jeffrey W. Herrmann, Associate Professor, University of Maryland, Dept.. of Mechanical Engineering, College Park, MD, United States, jwh2@umd.edu

A medical disaster requires effective decision-making to coordinate the response. For designing a decision-making system for this type of exceptional event, we present a systematic, scenario-based methodology that is based on the operational procedure methodology, which has been used to develop avionics systems. We apply this approach to the case of medical disaster mutual aid, in which multiple hospitals must coordinate activities to respond to a mass casualty incident.

■ SD32

C-Room 302

Airport Benchmarking and Air Transport Logistics

Cluster: Shipping, Maritime, and Supply Chain Logistics
Invited Session

Chair: John Liu, Lgtjliu@polyu.edu.hk,

Co-Chair: Tae Oum, Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6P4P8, Canada, Tae.Oum@sauder.ubc.ca

1 - Competition and Social Welfare: Effects of Airport Concession Revenue Sharing

Xiaowen Fu, Assistant Professor, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, lgtxfu@polyu.edu.hk

This paper studies the competitive and welfare implications when an airport offers the option of sharing its concession revenue with airlines. It is found that such revenue sharing allows airlines and airports to internalize positive demand externality, which could lead to substantial welfare gains. However, such practice may cause negative effects to airline competition. In addition, while sharing concession revenue with airlines an airport may still prefer to increase airport charge.

2 - Are the Low Cost Carriers More Efficient than the Full Service Airlines: Evidences from the US Airline Market

Jia Yan, Assistant Professor, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China, lgtjiay@inet.polyu.edu.hk

Airlines provide differentiated services. For example, the services from the full service airlines (FSA) are different with the ones from the low cost carriers (LCC). The nature of product differentiation is ignored in the airline efficiency studies. This paper measures the airline efficiency by estimating a stochastic cost frontier model, which incorporates the multiple and differentiated outputs of the airlines.

3 - How Airlines Compete

Bill Swan, Chief Economist, Seabury Airline Planning Group, 2232 157th PL SE, Bellevue, WA, 98008, United States, bill.swan@cyberswans.com

Each airline in the market plans a schedule of departure times and offers a series of fares. The fundamentals of airlines competing are this: customers choose based on price and time, and those customers who find both airlines equal choose based on secondary characteristics we call quality. This simple model of the demand side leads to some compelling consequences on the supply side. The preferred airline strongly dominates in fare in the peaks and in load in the off peaks.

4 - Competitive Revenue Management with Customer Choice Behavior

Michael Li, Associate Professor, Nanyang Technological University, Nanyang Avenue, 639798, Singapore, ZFLI@ntu.edu.sg

This paper studies the dynamic pricing models for two substitutable and perishable products with customer choice behavior under monopoly and duopoly respectively. We characterize the structural properties of the value function and the optimal control policy under monopoly. We examine the optimal pricing policy with discrete price set and study the equilibrium in duopoly with finite strategy spaces.

5 - Travelers Prefer Airline Frequent Flier Programs Over Hotel Frequent Guest Programs

Rex Toh, Professor, Director of the Marketing Program, Seattle University, 901 12th Avenue, P.O. Box 222000, Seattle, WA, 98122, United States, rextoh@seattleu.edu, Frederick DeKay

Based on a survey of 304 hotel guests, 81% belong to frequent flier programs, while only 62% belong to hotel frequent guest programs. And of those who belong to frequent guest programs, 90% belong to airline frequent fli er programs while only 69% of airline frequent fliers who stay in hotels belong to hotel frequent guest programs. Why have hotels lagged the airlines in attracting hotel guests to their loyalty programs?

■ SD33

C-Room 303

Urban Transportation Planning Models IV: Pricing and Tolls

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States, yafeng@ce.ufl.edu

1 - Converting HOV to HOT: Efficiency, Profit, and Equity

Yueyue Fan, Assistant Professor, University of California, Department of CEE, Davis, CA, 95616, United States, yyfan@ucdavis.edu, Hemant Bhargava, N.P. Raghavender

We present an optimization model for evaluating the merits of converting HOV to HOT lanes. The important issue of income inequity is addressed at the planning stage by imposing limits on the benefits/ costs of each group. Preliminary results on the trade-offs between equity and multiple objectives are presented.

2 - Toll Policies for Mitigating Hazardous Materials Transport Risk

Anne Mercier, CRT, Université de Montréal, C.P. 6128, Succursale Centre-ville, Montréal, Canada, anne.mercier@gerad.ca, Patrice Marcotte, Gilles Savard, Vedat Verter

We propose toll setting as an alternative policy tool to regulate the use of roads for dangerous goods shipments. We propose a bilevel programming formulation as well as a solution method. Based on a comparative analysis, we show that toll policies can be more effective than network design policies that identify road segments to be closed. We present a summary of computational experiments on a problem instance from Western Ontario, Canada.

3 - Loops and the Existence of Traffic Tolls

Jane Hagstrom, Professor, University of Illinois at Chicago, Dept. of Information & Decision Sciences, 601 S. Morgan, (MC 294), Chicago, IL, 60607, United States, hagstrom@uic.edu, Robert Abrams

Given desired feasible flows in a multi-commodity traffic network, we provide a characterization in terms of loops of the conditions under which commodity-independent tolls exist to enforce those flows. Such tolls exist if and only if the flow contains no removable single- or multiple-commodity loop in the sense of Gallager (1977).

4 - Profit-Maximizing and Socially Optimal Pricing of Advanced Traveler Information Services

Lei Zhang, Assistant Professor, Oregon State University, School of Civil & Construction Eng., 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

This paper theorizes users' willingness to pay for advanced traveler information services (ATIS). For each user, information provided by ATIS is valuable if its price is lower than the subjective gain from the information, and lower than the perceived cost of other information-acquisition means. The profit-maximizing and socially optimal prices of ATIS, which correspond to different levels of ATIS market penetration, are analyzed and computed for a real-world transportation system.

■ SD34

C-Room 304

Dynamic and Stochastic Models in Transportation and Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Sumit Kunnumkal, Cornell University, 292 Rhodes Hall, Ithaca, NY, United States, smk68@cornell.edu

1 - Solving Single-round, Fully Enumerated Combinatorial Truckload Procurement Auctions to Optimality

Richard Chen, PhD Student, University of Michigan, Ann Arbor, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, richchen@umich.edu, Damian Beil, Amitabh Sinha, Amy Cohn, Shervin AhmadBeygi

We apply an implicit bidding mechanism to optimally solve in a single round, a fully enumerated combinatorial truckload procurement auction. We present tractable network models for solving winner determination, with extensions for operational considerations. We demonstrate tractability via computational results for random instances of varying sizes, networks, and operational considerations.

2 - Computing Bid-prices in Revenue Management via Stochastic Approximation

Huseyin Topaloglu, Cornell University, Rhodes Hall, Ithaca, NY, United States, ht88@cornell.edu

We present a stochastic approximation method to compute bid prices in network revenue management problems. The idea is to visualize the total expected revenue as a function of the bid prices and to use sample path-based derivatives to search for a good set of bid prices. Computational experiments demonstrate that our method is especially advantageous when the bid prices are not recomputed frequently.

3 - An Alternative to Clark and Scarf's Balance Assumption for Inventory Distribution Systems

Sumit Kunnumkal, Cornell University, 292 Rhodes Hall, Ithaca, NY, United States, smk68@cornell.edu, Huseyin Topaloglu

We present a new method to make the inventory replenishment decisions in a distribution system consisting of multiple retailers and a single warehouse. Our method is based on relaxing the constraints that ensure the nonnegativity of the shipments to the retailers by associating Lagrange multipliers with them. Numerical studies show that our method can provide significant improvements over traditional methods when the balance assumption of Clark and Scarf (1960) is not satisfactory.

4 - Optimal Pricing and Consolidation Cycle for a Shipper

M. Ali Ulku, PhD Candidate, University of Waterloo, Dept.. of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, maulku@engmail.uwaterloo.ca, James H. Bookbinder

Consider a shipper whose customers are sensitive to both price and delivery guarantee. For various pricing schemes and a for-hire carrier, we maximize the shipper's profit per unit time through optimal choice of consolidation cycle. We find that charging according to an order's time of arrival is not necessarily the best pricing scheme.

■ SD35

C-Room 305

Facility Logistics II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Sunderesh Heragu, Professor and Duthie Chair in Engineering Logistics, University of Louisville, Room 309, JB Speed Building, Department of Industrial Engineering, Louisville, KY, 40292, United States, s.heragu@louisville.edu

1 - Integration of Operational Policies into the Design Phase of a Material Handling Network

Ardavan Asef-Vaziri, Assistant Professor, California State University, 18111 Nordhoff Street, Northridge, CA, 91330—824, United States, aa2035@csun.edu

We develop exact formulations for the concurrent design of a material handling network and station locations. A primary interest of our work is to illustrate the superiority of the deterministic shortest-trip-distance-first over the stochastic first-come-first-served when integrated into the design phase. The take-away of this talk is to design the loop and stations under shortest-trip-distance-first, and operate the fleet of the vehicles under first-encountered-first-served dispatching.

2 - A Model and an LP-based Rounding Heuristic for the Facility Layout Problem

Zeynep Kirkizoglu, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, zkirkizo@uark.edu, Haldun Sural

We propose a mixed integer programming model for the facility layout problem. It uses the sequence-pair representation for department overlap prevention constraints and epsilon-accurate representation of the department areas. We analyze the LP relaxation of the model and propose an LP-based rounding heuristic for solving the problem. Computational results are provided.

3 - Hybrid Predictive Control for the Dynamic Vehicle Routing Problem Based on EMO

Cristian Cortes, Assistant Professor, Universidad de Chile, Blanco Encalada 2002, Santiago, SA, Chile, ccortes@ing.uchile.cl, Doris Saez, Alfredo Nuñez, Marcela Riquelme

A new hybrid adaptive predictive control (HAPC) approach for the dynamic pickup and delivery problem (DPDP) is presented. The approach is solved through an Evolutionary Multiobjetive Optimization (EMO) algorithm, considering the opposite interests of users and operators, both included in the dynamic dispatch objective function. EMO is utilized to find the dynamic Pareto Front, and take the real dispatch decision based on different optimization criteria. Promissory simulation results are reported.

4 - Constraint Programming and B&P for a Joint Depot Location, Fleet Design and Routing Problem

Jaime Miranda, Universidad Diego Portales, Ejercito Libertador 441, Santiago, Chile, jaime.miranda@udp.cl, Cristian Cortes, Sebastian Souyris, Pablo Rey, Jose Robles

In this paper we propose a Branch and Price scheme to solve a joint depot location, fleet design and routing problem, required for the application of the standarized evaluation exam SIMCE over all schools located in Santiago-Chile. This exam is conducted every year by the Ministry of Education. The master problem is an extension of a standard VRP, while the resulting subproblem is solved with Constraint Programming. Promisory preliminary results have been obtained so far.

■ SD36

C-Room 306

Evacuation Planning

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: April Kuo, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, United States, aprilkuo@umd.edu

1 - Evacuation Planning Based on Lane Reversal and Crossing Elimination

Mark Turnquist, Cornell University, mat14@cornell.edu, Chi Xie

We describe a bi-level program for network evacuation that includes both lane reversal and elimination of traffic stream crossings at intersections. Traffic assignment is done using stochastic user equilibrium on the congested network. Provision for inbound access by emergency vehicles is also included. Solutions are illustrated for a case study in an area surrounding a nuclear power plant.

2 - An Optimization-Simulation Approach to Model the Routing of Public Transit Systems for No-notice Mass

Fatemeh Sayyady, Research Assistant, Mississippi State University, 350 McCain Engineering Building, Department of Industrial and Systems Eng, Mississippi State, MS, 39762, United States, fs131@msstate.edu, Sandra Duni Eksioglu

This study investigates how the public transit system can be used in no-notice mass evacuation using an optimization-simulation approach. In optimization stage, a mixed integer linear programming formulation is used to model the routing of the public transit system. A heuristic tabu search algorithm finds the near-optimal solution shortly. In simulation stage, a dynamic traffic network analysis and evaluation tool, DYNASMART-P, is used to evaluate the effectiveness of the developed routing plan.

3 - Transit Vehicle Routing for Evacuation of the Carless

Mark Hickman, Associate Professor, University of Arizona, P.O. Box 210072, Tucson, AZ, 85721-0072, United States, mhickman@engr.arizona.edu

There is a role for public transit vehicles in evacuating low-mobility persons during an emergency. We explore the problem of how buses might be routed dynamically to evacuate the carless. In this on-line problem context, various vehicle routing heuristics are proposed and compared.

4 - Large-scale Modeling and Analysis for Contraflow and Phased Evacuation Operations in Central Texas

Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. 2nd St., Tucson, AZ, United States, chiu@email.arizona.edu, Hong Zheng, Russell Henk, Walter Peacock

We discuss the modeling process and results for planning for evacuating several millions of evacuees out of Galveston and Houston, Texas inland to other major Texas cities through the central Texas highway network. Model formulation and computational analysis are conducted for both contraflow and phased evacuation operational strategies. DYNASMART-P was modified enhanced as the computational platform for this research.

■ SD37

C-Room 307

Defense Supply Chain Analysis

Sponsor: Military Applications
Sponsored Session

Chair: Alan Johnson, Associate Prof of Logistics, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, W-P AFB, OH, 45433-7765, United States, alan.johnson@afit.edu

1 - Developing An Entire Public Health Campaign Modeling Suite

James Burke, Systems Scientist, Argonne National Laboratory, 9700 S. Cass Ave, Building 900, Argonne, IL, 60439, United States, jay@anl.gov, Charles Van Groningen

Public Health Preparedness Models rarely bring focus to an entire Mass Prophylaxis Campaign. Public Health needs models to consider all of the supply, behavioral and disease issues across an entire jurisdiction for a total campaign closure analysis. Our modeling method and Chicago test scenario will be presented.

2 - Multiobjective Simulation Optimization: A Comparison of Methods

Hugh Medal, Department of Industrial Engineering, University of Arkansas, Fayetteville, AR, United States, hmedal@uark.edu, Ed Pohl

Large-scale complex systems are characterized by complex input-output relationships and often have multiple performance measures. The many decision variables and system complexity render simulation and classic optimization techniques inadequate if used alone for optimization. We give a multi-objective genetic algorithm for simulation-based optimization, and compare the performance of this algorithm versus OptQuest commercial software when optimizing a military aircraft transportation model.

3 - Modeling Chem-Bio Effects at Airports and Seaports

Phil Collins, Sr. Scientist, BBN, 1337 Park Plaza #3, O'Fallon, IL, 62269, United States, pcollins@bbn.com

U.S. Transportation Command's Airport and Seaport Simulation Tools (AST/SST) have been modified to provide detailed APOD and SPOD modeling of chemical and biological effects and the resulting impacts on installation capabilities. This is accomplished as part of the Joint Operation Effects Federation (JOEF) which includes agent dispersion, deposition, exposure, and human effects models.

4 - High-Level Model of the DoD Supply Chain: The MIDAS Multi-Echelon Sustainment Simulation

Soraya Stevens, Division Engineer, BBN Technologies, 10 Moulton Street MS 6/3A, Cambridge, MA, 02138, United States, sstevens@bbn.com, Carroll Keyfauver, Jeffrey Tustin, Daniel Hazen

MIDAS is a composite simulation of linked sub-simulations that together model global deployments of large-scale scenarios over multiple theaters. We will present MIDAS' sustainment capabilities for tracking and delivering multi-echelon resupply using opportunistic mode selection to satisfy demands at all nodes within complex supply chains. This includes discussion of setup, tracking consumption and safety stockage demands, capacity-constrained planning, and discussion of future directions.

5 - USSOUTHCOM Channel Airlift Commercialization

Carmen Oeltjen, Operations Research Analyst, Northrop Grumman, Joint Distribution Process Analysis Ctr, US Transportation Command, Scott AFB, IL, 62225, United States, Carmen.Oeltjen.ctr@ustranscom.mil

USTRANSCOM's JDPAC analysis team was asked to evaluate distribution options for USSOUTHCOM requirements currently moved by Channel air. The requirement is small making reliable frequent service more challenging and costly as efficiencies normally attributed to volume may not be realized. Cargo was examined to determine its eligibility for commercial movement, recognizing some items must remain on MILAIR. The analysis resulted in an overall strategy customized for regional considerations.

■ SD38

C-Room 308

To the Memory of Frank Bass

Cluster: To The Memory of Frank Bass
Invited Session

Chair: Peter Popkowski-Leszcyc, Associate Professor of Marketing, University of Alberta, 4-20 F School of Business, Edmonton, AB, T6G 2R6, Canada, ppopkows@ualberta.ca

1 - Frank's M. Bass' Key Contributions to Choice Modeling and Stochastic Behavior

Peter Popkowski-Leszcyc, Associate Professor of Marketing, University of Alberta, 4-20 F School of Business, Edmonton, AB, T6G 2R6, Canada, ppopkows@ualberta.ca

This talk will provide a brief overview of some of Frank M. Bass's major achievements, and will focus on his key contributions in the area of choice modeling and stochastic behavior. An Introduction to this session will be provided by key members of the INFORMS and Marketing community.

2 - The Bass Model: A Timeless Classic

Demetrios Vakratsas, Associate Professor, McGill University, 1001 Sherbrooke W, Montreal, QC, H3A 1G5, Canada, demetrios.vakratsas@mcgill.ca, Trichy Krishnan

This paper takes a historical perspective on the Bass Model (BM) of diffusion of innovations and discusses its contribution to multiple disciplines, its applications and extensions. It also explores possibilities for future research including new application domains and estimation-related issues.

3 - Research Contributions of Dr. Frank Bass in Marketing Econometrics

Shuba Srinivasan, Associate Professor and University Scholar, University of California, Riverside, A. Gary Anderson School of Management, Riverside, CA, 92521-0203, United States, shuba.srinivasan@ucr.edu

Dr. Frank M. Bass was one of the first marketing scholars to apply econometric methods in developing statistical estimates of the effects of advertising, promotions, and prices upon sales. His research in marketing econometrics and that of his intellectual descendants include seminal works in the field. This talk will highlight his key contributions to this area of research in marketing.

4 - Frank Bass and Future Dissertation Topics

Mark Parry, Professor, University of Missouri-Kansas City, 321 Bloch School, 5110 Cherry Street, Kansas City, MO, 64110, United States, parryma@umkc.edu, John Norton

Frank Bass is well known for his work in diffusion modeling, stochastic processes, and applications of the scientific method to business data, with an emphasis on econometric testing and modeling. However, one can make a strong case that his most singular pursuit was the development of doctoral students. In this session we discuss possible extensions of his research that might serve as disseration topics for future doctoral students.

■ SD39

C-Room 309

Health Care Systems Optimization

Sponsor: Health Applications Section
Sponsored Session

Chair: Gorkem Saka, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, gos2@pitt.edu

1 - Using Artificial Neural Networks to Predict the Risk of Breast Cancer

Turgay Ayer, University of Wisconsin-Madison, 1513 University Ave. Mechanical Eng., Building, ISyE Department, Madison, WI, 53706, United States, tayer@wisc.edu, Charles E. Kahn, Oguzhan Alagoz, Elizabeth Burnside, Jagpreet Chhatwal

Although breast cancer is the most common cancer affecting women in the US, current methods in practice for diagnosis have low positive predictive values. We developed an artificial neural network (ANN) to predict breast cancer risk from standardized mammographic findings and demographic risk factors.

2 - Optimal Design of Regions for Liver Transplantation: Balancing Allocation Effciency and Equity
Mehmet C Demirci, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, demirci@ie.pitt.edu, Edwin Romeijn, Andrew Schaefer

Currently the in the U.S., a harvested liver is offered hierarchically to patients, first within the local OPO, then regionally and finally nationwide. By using a multi-objective optimization approach, we aim to balance the efficiency of the system and geographic equity throughout the nation. We use two integer programming models, one of which aims to maximize the efficiency of the allocation mechanism, while the other tries to maximize the equity measure across all OPOs.

3 - Analysis of Patient Triage in Urban Pediatric Emergency Departments
Michael DeGuzman, Children's HealthCare of Atlanta, Michael.DeGuzman@choa.org, Eva K. Lee

In this talk, we describe the challenges of pediatric patient triage to correct level of acuity in the emergency departments. Two approaches: conventional 4-tier triage versus the 5-tier emergency severity index (ESI) will be described and contrasted. Preliminary work using OR approaches to improve proper patient categorization will be described.

4 - In Which OPOs Should an End-stage Liver Disease Patient List?
Gorkem Saka, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, gos2@pitt.edu, Andrew Schaefer, Mark Roberts, Oguzhan Alagoz, Lisa Maillart

Multiple listing refers to the practice where patients may join waiting lists in multiple OPOs. The important research question is where should a patient multiple list? By multiple listing, the patient in essence chooses a liver arrival matrix. We model this problem as a continuous-time MDP. We propose a modified branch-and-bound algorithm to optimally solve this decision problem where the problem to be solved at every iteration of the algorithm is an MDP.

■ SD40

C-Room 310

Stochastic Models in Health Care

Sponsor: Health Applications Section
Sponsored Session

Chair: Burhaneddin Sandikci, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15217, United States, bus2@pitt.edu

1 - An Analytical Framework for Managing Community-based Care Delivery Processes for Chronic Diseases
Beste Kucukyazici, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A 1G5, Canada, bkucuk@po-box.mcgill.ca, Vedat Verter, Nancy Mayo

In this study, we develop a Markov modeling framework to represent the community-based care delivery process of chronic diseases. This approach enables us to represent the patient flow information in a compact form and to analyze the care delivery process in terms of the flow patterns and to assess the impact of the flow patterns on health outcomes. The model constitutes a tool for clinicians and system planners in developing an understanding of the disease-specific community care process.

2 - Timing of Testing and Treatment of Hepatitis C and Other Diseases
Daniel Faissol, PhD Student, Georgia Institute of Technology, 755 Ferst Drive, Room 425F, Atlanta, GA, 30332-0205, United States, dfaissol@isye.gatech.edu, Paul Griffin, H. Eser Kirkizlar, Julie Swann

We develop a Markov Decision Process (MDP) model for diseases where our goal is to determine the best timing for testing (and treatment) decisions when the presence of the disease is not known in advance. We focus on minimizing the cost from a societal perspective, and additionally produce an efficient frontier of timing decisions with respect to the cost per quality adjusted life year (QALY) measure. We apply the model to Hepatitis C, and we discuss the insights for healthcare practice.

3 - Optimal Liver Acceptance Policies for Risk-sensitive Patients
Atul Bhandari, Post-Doctoral Associate, University of Pittsburgh, 1178c Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States, abhandari79@gmail.com, Andrew Schaefer, Mark Roberts

For liver transplantation, patients join UNOS,Äôs waiting list. When a liver is offered, the patient decides between transplanting and waiting. We formulate the decision problem as a risk-sensitive finite-horizon MDP. We model risk preferences and maximize the total expected utility for any v.N-M utility function. We use age-dependent transition probabilities and rewards and establish structural properties. We extend the model to infinite-horizon for patients with exponential utility function.

4 - Estimating the Patient's Price of Privacy in Liver Transplantation
Burhaneddin Sandikci, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15217, United States, bus2@pitt.edu, Oguzhan Alagoz, Lisa Maillart, Andrew Schaefer, Mark Roberts

In the United States, ESLD patients join a waiting list for cadaveric liver transplantation. The details of the composition of this list are not publicly available. We consider the benefits associated with creating a more transparent list by studying the organ accept/reject decision as a Markov decision process. We define the concept of the patient's price of privacy to measure the cost of keeping the list private. We also present the results of numerical experiments based on clinical data.

■ SD41

C-Room 3A

Strategies for Pandemic Response

Sponsor: Optimization/ Optimization and Computing in Medicine and Life Sciences
Sponsored Session

Chair: Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Optimizing the Dose of Pre-pandemic Influenza Vaccines to Reduce the Infection Attack Rate
Joesph Wu, The University of Hong Kong, 21 Sassoon Road, Pokfulam, Hong Kong - ROC, joewu@hku.hk

For many countries, the principal constraint for human pre-pandemic vaccine stockpiles will be the total mass of antigen maintained. We hypothesize that lower individual doses may provide extra community-level benefits because they permit wider coverage for a given size of antigen stockpile. We use a mathematical model to predict infection attack rates under different policies. We find that substantial reductions in the attack rate are likely if vaccines are given to more people at lower doses.

2 - Simulation to Assess Quarantine Station Continuity of Operations in Response to Pandemic Influenza
Robert Brigantic, Pacific Northwest National Laboratory, 902 Battelle Blvd., P.O. Box 999, Richland, WA, 99352, United States, robert.brigantic@pnl.gov, John Malone, James Campbell

This presentation summarizes efforts conducted for DHS to simulate the flow of aircraft and passengers arriving from international destinations under an assumed Pandemic Influenza Federal Government Response Stage 2 which activates domestic quarantine stations. Starting with the CDC Quarantine Station Seattle, this research assesses current capabilities and examines the requirements for effective quarantine and isolation of people potentially infected with a pandemic strain of influenza.

3 - Multi-modality Mass Dispensing Strategies for Biodefense and Infectious Disease
Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Ferdinand Pietz, Bernard Benecke, Yang Zhang

In this talk, we will describe our experience with the Centers for Disease Control and Prevention, and with state and county public health and emergency response administrators on large-scale dispensing of prophyllaxic medication in response to biological and infectious disease outbreaks. Locations of dispensing facilities, optimal facility staffing and resource allocation, routing of the population, and various dispensing modalities will be discussed and analyzed.

4 - A Simulation-Based Optimization Model for Dynamic Resource Utilization at Federal and Local Levels During Cross-Regional Pandemic Outbreaks
Alex Savachkin, Assistant Professor, University of South Florida, Dep. of IMSE, Tampa, FL, 33620, United States, savachki@eng.usf.edu, Andres Uribe, Tapas K. Das, Diana Prieto

Optimal dynamic allocation of limited resources at the federal and local levels during emergence of a multi-city pandemic outbreak is an open research challenge. We develop a simulation based two-tier optimization strategy for allocation of vaccines, antiviral drugs, medical personnel, and hospital beds, to minimize the total cost of the pandemic.

■ SD42

C-Room 3B

Operations Research in Health Care

Cluster: Operations Research in Medicine and Health Care
Invited Session

Chair: Yifan Liu, 4400 University Dr., MS 4A6, Fairfax, VA, 22030, United States, yliu9@gmu.edu

1 - Vaccine Inventory Design for a Break out of Epidemic Disease
Yifan Liu, 4400 University Dr., MS 4A6, Fairfax, VA, 22030, United States, yliu9@gmu.edu

We aim at deriving the necessary stockpile levels for vaccine, in order to meet the urgent need, due to a natural breakout of an epidemic disease, or due to a bio-terror attack. We produce the relation between the optimal inventory levels and the decisive properties of vaccine production and the infectious disease, including the usual production and shipment rate, and the population dynamics of the infectious disease in the potential regions of vaccine shortage, etc.

2 - Improving the Behavioral Health of Youth in the Juvenile Justice System
Michael Foster, Professor of Maternal and Child Health; and Health Policy, University of North Carolina, School of Public Health, Rosenau Hall, Chapel Hill, NC, 27599, United States, emfoster@email.unc.edu, Nomesh Bolia, Serhan Ziya

In this article, we examine the impact of mental health services on the functioning of the juvenile justice system and on crime in a community. The authors have developed a complex, dynamic model of crime and delinquency in a hypothetical community and of the impact of adding a rehabilitative service to the juvenile justice system. The authors have populated the key parameters of the model using data from the Fast Track, a large, longitudinal study of youth in four communities.

3 - The Effects of Electronic Health Record (EHR) Implementation on Health Care Delivery Processes
Sharon Johnson, Associate Professor, WPI, Department of Management, Worcester, MA, 01566, United States, sharon@wpi.edu, Diane Strong, Isa Bar-On, Lori Pelletier

This pilot project at a multi-specialty, multi-site clinic examines process and productivity changes and their implications on service quality and physician/staff and patient satisfaction at several clinic locations, resulting from the implementation of the EpicCare EHR in examination rooms. In this presentation, results from a grounded theory analysis of interview data is combined with process analysis to explore baseline expectations and short-term implementation effects.

■ SD43

S-Grand Ball. A (Lev. 2)

Things That Go Bump in the Project: Risk Management in Software and Systems Development

Cluster: O.R. Practice
Invited Session

Chair: Clay Williams, IBM Watson Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States, clayw@us.ibm.com

1 - Measuring and Monetizing Development Risk
Murray Cantor, Distinguished Engineer, IBM, 209 Burgess Ave, Westwood, MA, 02090, United States, mcantor@us.ibm.com

Standard risk management practices take a qualitative approach; having staff score the likelihood of occurrence and impact, prioritizing high occurrence/impact risks for mitigation. The practice is rarely followed as it is not central to the project focus on delivery. I introduce a quantitative approach for measuring development risk that is a basis for measuring development project health and for monetization supporting informed go/no-go decisions for undertaking and continuing risky projects.

2 - Active Risk Management for Value-creation Optimization in Software and Systems Development
Michel Benaroch, Professor of IS, Whitman School of Management, 721 University Avenue, Syracuse University, Syracuse, NY, 13224, United States, mbenaroc@syr.edu, James Goldstein

We develop an economic optimization model for managing IT investment risk, building on two research streams. One offers solid ways to control granular cost risks in software development, devoid from this activity's value-creation aspect. Another uses real options theory to model risk and flexibility in relation to value creation throughout the IT investment lifecycle, devoid from software development details. Our model unifies micro- and macro-level risk management practices in both streams.

3 - Adding Project Value by Creating Information That Reduces Risk
Tyson Browning, Assistant Prof. of Enterprise Operations, Dept.. of Information Systems and Supply Chain Management, Neeley School of Business, Texas Christian University, Fort Worth, TX, 76129, United States, T.Browning@tcu.edu

The goal of project management is to enable activities whose results will decrease the risk of the project failing to meet stakeholder expectations. We will present a method for project planning and control, the Risk Value Method, that enables managers to connect activity costs and durations with the benefits they provide towards this goal.

4 - A Value-driven Perspective to Architectural Stability and Evolution
Rami Bahsoon, Dr, School of Engineering and Applied Sc, Aston University in Birmingham, Aston Triangle, Birmingham, UK, United Kingdom, r.bahsoon@aston.ac.uk, Wolfgang Emmerich

We describe ArchOptions, a model that uses real options theory to value the flexibility of an architecture in face of likely changes. We highlight the model use on two cases: (i) informing the selection of middleware-induced software architecture guided by the value added in supporting likely changes in load and (ii) valuing the cost-effectiveness of investing in a refactoring exercise. We reflect on our experience in using a value-driven approach to architecture evolution decision making.

5 - Six Sigma & Monte Carlo Simulation to Improve Service Delivery while Optimizing Profits
Tayfun (Ty) Avni, IBM Global Business Services, SCM Operations Analytics, tavni@us.ibm.com

IBM is engaged in providing Information Technology Outsourcing Services at global corporations. Level of service delivered not only impacts client satisfaction, but IBM's bottom line through contract obligations. Six Sigma tools are combined with Monte Carlo simulation analysis to not only improve IT Service Level Availability through variation reduction, but also quantify and mitigate risk of contract defaults to optimize profits.

■ SD44

S-Grand Ball. B (Lev. 2)

Classroom Games from INFORMS Transactions on Education

Sponsor: INFORM-ED
Sponsored Session

Chair: Paul Griffin, Georgia Institute of Technology, School of Industrial and Systems Engineering, Atlanta, GA, 30332, United States, paul.griffin@isye.gatech.edu

1 - The Stock Portfolio Classroom Game
J Rene Villalobos, Associate Professor, Arizona State University, Department of Industrial Engineering, Arizona State University, Tempe, AZ, 85281, United States, rene.villalobos@asu.edu

The objective of the game is to introduce undergraduate engineering students to the application of optimization techniques for stock portfolio selection. The game is played in four rounds within an hour-long session. The teams are provided with an initial virtual investment fund, which they have to allocate or reallocate based on the information presented. The results of the game are used in the last part of the session to put the investment game in the perspective of an optimization problem.

2 - Inventory Control at Spiegel Grove
Matt Drake, Assistant Professor, Duquesne University, School of Business, Pittsburgh, PA, United States, drake987@duq.edu, John Mawhinney

In this presentation we detail a classroom game designed to show students the impact of uncertainty related to transportation lead time and product quality on inventory control strategies in a serial supply chain.

3 - The Inventory Routing Game
Christos Alexopoulos, Associate Professor, H. Milton Stewart School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, christos@isye.gatech.edu, Martin Savelsbergh, David Goldsman, Ralph Mueller

The inventory routing problem is concerned with the distribution of products from various facilities to a set of customers. Customers consume products and can maintain inventories. The game provides an environment in which users can simulate various strategies on different problem instances. Players compose delivery routes and determine the delivery quantities at these customer sites. A player can make routing decisions online. At the end of the game, a detailed performance report is generated.

4 - What Makes a Good Game?
Joel Sokol, Associate Professor, School of ISyE, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu

Creating educational games is hard. Creating good educational games is even harder. In this talk, we suggest some guidelines for making good games (including a definition of what good is), and illustrate using examples of our own games (including several bad ones).

■ SD45

S-Capitol Hill (Lev. 3)

Performance Evaluation and Risk Management

Sponsor: Financial Services
Sponsored Session

Chair: Bruce Weber, Professor of Information Management, London Business School, Regents Park, London, NW1 4SA, United Kingdom, bweber@london.edu

1 - Data Envelopment Analysis in Mutual Fund Evaluation: A Critical Review
Tarja Joro, Adjunct Assistant Professor, University of Alberta, School of Business, Canada, tarja.joro@ualberta.ca, Paul Na

Recently, there has been interest in using Data Envelopment Analysis (DEA) in the evaluation of Mutual Funds. This paper discusses the benefits and pitfalls of using DEA in this context and reviews the ways in which DEA can be used to extend the evaluation of Mutual Funds beyond the traditional mean-variance framework.

2 - Applications of Genetic Algorithms to Risk Management and Client Segmentation in Financial Services
Russell Walker, President, Walker Bernardo, LLC, 1617 W Grace Street, Richmond, VA, 23220, United States, russell@walkerbernardo.com

New data mining techniques enable managers in financial services to exploit large amounts of data. We demonstrate how our new proprietary, genetic algorithm-based approach, increases the predictive value of models for credit risk management, and in resolving the general customer segmentation dilemma. Applications of such models need not tax the analytical team and can process large amounts of data and consider and identify numerous interaction and non-linear realities in the underlying data.

3 - Valuation Impacts of IT Weaknesses in SOX Reports
Bruce Weber, Professor of Information Management, London Business School, Regents Park, London, NW1 4SA, United Kingdom, bweber@london.edu

Effective financial control systems ensure the integrity of financial reporting. SOX disclosures of ineffective internal control over financial reporting from 47 U.S. companies show abnormal returns of –1.52% over a (0,+1) window around the FY2005 10K filing date. The 2005-06 return on an equally weighted portfolio of the firms reporting ineffective control due to IT problems is –2.6%, a 32% underperformance relative to the CRSP EW index.

■ SD46

S-Ballard (Lev. 3)

Risk Management in the Energy Sector

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

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

1 - Hydroelectric Scheduling: Empirical Evidence
Stein-Erik Fleten, Norwegian U of Science and Technology, Alfred Getz v. 3, Trondheim, Norway, stein-erik.fleten@iot.ntnu.no, Jussi Keppo

Electricity companies owning storage hydroelectric plants have a complex task of scheduling the release of water from reservoirs, under uncertainty of prices and inflows. Optimization problems are solved every week to support this activity. Using weekly data from 13 Norwegian power plants in the period 2000-2006, we investigate the factors that drive the production schedules and how scheduling is performed.

2 - How to Proceed with the Thorium Reactor Technology: A Real Options Analysis
Afzal Siddiqui, University College London, Gower Street, London, United Kingdom, afzal@stats.ucl.ac.uk, Stein-Erik Fleten

The advantage of a thorium nuclear reactor is that it is easier to stop or control the process, and it produces less long-lived nuclear waste than existing reactors. However, there are a number of technical challenges that need to be overcome, and the current costs of building a thorium reactor would be very high. We analyse how a government may proceed with a staged development of meeting the need for electricity as fossil fuel sources are being phased out.

3 - A Comparison of Regime-switching Models for Electricity Spot Price
Dipeng Chen, PhD Candidate, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, dipengchen.phd2004@london.edu, Derek Bunn

Through analysing the complex relationship between British spot price dynamics and fundamental/strategic factors under Markov regime-switching and logistic smooth transition modelling frameworks, we gain a better understanding of the market. In addition to including conventional fundamentals, this work also studies the influence from high-frequency market structure variables as well as the carbon emission trading on spot price. Two models' forecasting performances are also compared.

4 - Impact of the Unavailability of a Power Unit on Its Forward Contracting
Antonio J. Conejo, Professor, Universidad de Castilla - La Mancha, Electrical Engineering, Campus Universitario s/n, Ciudad Real, 13071, Spain, Antonio.Conejo@uclm.es, Salvador Pineda

As a complement of selling in the pool, a power unit engages in forward contracting to hedge against the risk of profit variability due to pool price volatility. Unavailability of the unit due to its force outage rate results in the need of buying in the pool the contracted energy that cannot be supplied by self-production, which in turn might result in a significant loss and profit variability. This presentation explores how forward contracting is influenced by unit unavailability.

■ SD47

S-Admiral (Lev. 3)

Forestry IV: Wildfire Management

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Jeremy Fried, USDA Forest Service Pacific Northwest Research Station, P.O. Box 3890, Portland, OR, 97208, United States, jsfried@fs.fed.us

1 - Considering the Economics of Performance Metrics in Fire Management Planning
Doug Rideout, Dept.. of Forest, Rangeland, and Watershed Stewardship, Colorado State University, Fort Collins, CO, 80523, United States, doug.rideout@colostate.edu

The shift to ecosystem management has important implications for fire policy and how the performance of fire systems are perceived and analyzed. While economists have improved the measurement theory and technology for non-market valuation, development of theory and techniques for performance metrics has lagged. This paper addresses the need for sound performance metrics in fire management planning. Key principles applicable to economically sound performance metrics are addressed.

2 - Contract Crew Forecasting Models and Potential Agency Cost Savings
Geoffrey Donovan, USDA Forest Service Pacific Northwest Research Station, 620 SW Main St. Suite 400, Portland, OR, 97205, United States, gdonovan@fs.fed.us

Suppressing wildfires requires significant funds for inputs in advance of uncertain fire seasons. The benefits of improved information about the severity of an upcoming season can be quantified using ex post analyses. We report the potential gains to the U.S. Forest Service of using a new forecasting method that exploits historical information about cost-minimizing input choices for type II hand crews. Our analysis documents that potential gains far outweigh their research and development costs.

3 - A Simulation and Stochastic Programming Approach to Resource Deployment for Wildfire Containment
Lewis Ntaimo, Assistant Professor, Industrial and Systems Engineering, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, ntaimo@tamu.edu, Ewelina Zwierzykowski

We present a simulation and stochastic programming approach to wildfire suppression resource deployment under uncertainty. Simulation is used to generate scenarios of daily fire occurrence and growth. These are input to a two-stage stochastic mixed-integer programming model to determine the mix of resources to deploy to bases in the first stage, and resources from each base to dispatch to a reported fire in the second stage. The objective is to minimize expected cost plus net value change.

4 - Strategic Budgeting for Initial Response and Fuel Management in Wildfire Management

Tarun Kumar, IBM TJ Watson Research Center, Room 32-238, Yorktown Heights, NY, 10598, United States, ktarun@us.ibm.com, Steven Carty, Andy Kirsch, Yan Liu, Gyana Parija

We present a new multi-criteria budget allocation model for assigning national budgets across multiple Fire Planning Units. Causal relationships between the various effectiveness measures and underlining historical funding allocation decisions are learned from detailed FPU-level analyses. These causal relationship functions are posted as constraints in the Goal Program framework to optimally allocate budgets nationally.

5 - Linked Models Predict Climate Change Effects on Wildfire Containment as Subtle but Consequential

Jeremy Fried, USDA Forest Service Pacific Northwest Research Station, P.O. Box 3890, Portland, OR, 97208, United States, jsfried@fs.fed.us

Using stochastic and deterministic modeling and bridging the coarse scale output of general circulation models of climate and fine-scale models of initial attack, effects of climate change on wildfire severity and outcomes in California were modeled for a base case and multiple greenhouse gas scenarios. Subtle shifts in fire behavior that might be induced by the climate changes are of sufficient magnitude to generate an appreciable increase in the number of fires that escape initial attack.

■ SD48

S-Fremont (Lev. 3)

Advances in Simulation Output Analysis

Sponsor: Simulation
Sponsored Session

Chair: Preston White, Professor, University of Virginia, P.O. Box 400747, 151 Engineers' Way, Charlottesville, VA, 23901, United States, kpwhite@virginia.edu

Co-Chair: Roy Creasey, Assistant Professor, Longwood University, 201 High Street, Farmville, VA, 23901, United States, creaseyrr@longwood.edu

1 - Verifying Limit Standards Based on Binary Outcomes Derived from Monte Carlo Simulation

Preston White, Professor, University of Virginia, P.O. Box 400747, 151 Engineers' Way, Charlottesville, VA, 23901, United States, kpwhite@virginia.edu, Roy Creasey

We illustrate the use of acceptance sampling by attributes (ASA) to probabilistic requirements verification using Monte Carlo simulation. Given the required probability of attaining a specified limit and the required confidence that this probability is achieved, ASA can determine a family of appropriate (n,c) sampling plans. We illustrate how this approach to statistical inference can be implemented with an example from aerospace engineering.

2 - Agent-based Simulation Output Analysis

Charles Macal, Argonne National Laboratory, 9700 S. Cass Ave., Bldg 900-DIS, Argonne, IL, 60439, United States, macal@anl.gov

Agent-based simulations (ABS) produce results similar to conventional simulations, but the agent focus adds some new dimensions not addressed in discrete event simulation output analysis. A goal of agent-based simulation is to better understand how system behavior at the macro-level results from the agents' behavioral rules at the micro-level. Another challenge is to recognize and characterize emergent behavior. This presentation identifies unique aspects of ABS output analysis.

3 - A Bayesian Approach to Output Analysis of Limit Standards

Roy Creasey, Assistant Professor, Longwood University, 201 High Street, Farmville, VA, 23901, United States, creaseyrr@longwood.edu, Preston White

Limit standards have been defined as probabilistic requirements that specify confidence on the maximum proportion of simulation runs yielding values of an output variable above or below a desired threshold. Typical analysis methods utilize the binomial distribution. This research investigates the relationship between the binomial and beta distributions, and develops a Bayesian sequential approach to analysis of limit standards.

4 - Classification of Discrete Event Simulation Models and Output: Creating a Sufficient Model Set

Kathryn Hoad, Research Fellow, Warwick Business School, The University of Warwick, Coventry, CV4 7AL, United Kingdom, kathryn.hoad@wbs.ac.uk, Ruth Davies, Stewart Robinson

This presentation describes the creation of a representative and sufficient set of models/output data that can be used by discrete event simulation researchers to test their research ideas. The identification of certain DES model/output characteristics is described, as is the creation of a classification system for each general type of model/output encountered in 'real life' DES modelling. The process of setting up this classification system is explained and the classification tables outlined.

■ SD49

S-Greenwood (Lev. 3)

Applications in Airline Alliances

Sponsor: Revenue Management & Pricing- Invited/Sponsored Sponsored Session

Chair: Lori Houghtalen, Babson College, Math/Science Division, Babson Hall 316, Babson Park, MA, 02457, United States, lhoughtalen@babson.edu

1 - Fairness Considerations in Allocation Mechanisms for Carrier Alliances

Lori Houghtalen, Babson College, Math/Science Division, Babson Hall 316, Babson Park, MA, 02457, United States, lhoughtalen@babson.edu, Joel Sokol, Ozlem Ergun

In an alliance among cargo carriers, a key issue to resolve is the allocation of alliance benefit among participating members. The notion of fairness in allocation will be explored beyond traditional cooperative game theoretic ideas; a methodology for adapting an allocation mechanism to include fairness considerations will be discussed, and several measures for quantifying fairness will be proposed and evaluated.

2 - Dynamic Revenue Management in Airline Alliances

Christopher Wright, PhD Candidate, William E. Simon Graduate School of Business Administration, Carol Simon Hall 4-341, University Of Rochester, Rochester, NY, 14627, United States, wrightc1@simon.rochester.edu, Harry Groenevelt, Robert Shumsky

Currently, most airline alliances use static contracts for revenue-sharing. We propose and analyze several dynamic contracts that adjust sharing proportions based on the changing state of the system. Framing a two-airline alliance as a finite-horizon Markov game, we find the equilibrium policies for each contract. We compare revenues under these policies with those under static proration contracts and with those of a centralized controller, providing insight into when each performs well.

3 - Contracting Mechanisms for Airline Code Share Alliances

Achal Bassamboo, Northwestern University, a-bassamboo@northwestern.edu, Sunil Chopra, Sandeep Juneja, Milind Sohoni

We study revenue-sharing contracts for airline alliances. An airline privately observes local demand on a single leg and reveals information about remaining capacity, which is used to accept passengers with 2-flight itineraries (thru-passengers.) We show conditions under which the max-allocation contract, for thru-passengers, is an optimal truth-telling contract. We develop conditions when the min-allocation contract achieves optimality. We extend the results for larger alliances.

4 - Options, Spot Prices, and Buyer Learning

Jinpyo Lee, School of Industrial and Systems Engineering Georgia Institute of Technology, jplee@isye.gatech.edu, Anton J. Kleywegt

A seller sells options, and later also sells on the spot at a price chosen by the seller. The spot price may depend on the number of options sold, as well as some random demand data that was observed after the options were sold but before the spot price was determined. In the first stage buyers decide how many options to buy, not knowing what the spot price will be, and not knowing the seller's spot pricing policy. In the second stage buyers decide how many options to exercise and how much to buy on the spot. Buyers use past observations of spot prices to estimate a spot price distribution. Spot prices depend on previous decisions, and thus the sequence of spot prices is neither independent nor identically distributed. We study the convergence of decisions and distribution estimates, and compare the limits with the Nash equilibrium.

■ SD50

S-Issaquah A & B (Lev. 3)

Data-driven and Learning-based Methods in Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Itir Karaesmen, University of Maryland, College Park, MD, United States, ikaraes@rhsmith.umd.edu

1 - Optimal Timing of Price-Quote Revisions
Miguel Sousa Lobo, Duke University, Fuqua School of Business, 1 Towerview Dr, Durham, NC, 27708, United States, mlobo@duke.edu

While most work in optimal pricing has focused on posted-price transactions, in many if not most transactions in the economy the seller may offer individualized discounts. In our model buyers contact the seller for a price quote, while simultaneously searching for alternatives. A seller can significantly increase revenue by correctly managing the timing of subsequent individual discounts offered to each buyer as an incentive to complete the transaction. We also discuss estimation procedures.

2 - Sequential Pricing and Demand Learning
Rene Caldentey, Prof., New York University Stern School of Business, 44 West 4th St., New York, NY, 10012, United States, rcaldent@stern.nyu.edu, Victor Araman

A seller is endowed with a finite amount of inventory that can sell in market with stochastic and price-sensitive demand. The probability distribution of this demand is partially known. We characterize dynamic pricing strategies that simultaneously balance market exploitation (revenue maximization) and market exploration (demand learning).

3 - Revenue Management for Products with Unknown Quality and Observable Price and Sales History
Laurens Debo, Tepper School of Business, Carnegie Mellon Universitry, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu, Nicola Secomandi

This paper studies pricing strategies of a monopolist when customers are strategic and infer the product quality from historical sales and price paths. The monopolist can sell a finite amount of inventory during a finite horizon. Its pricing policy controls the inventory as well as the customer learning. We derive the structure of the optimal pricing strategy and discuss the implications of strategic customer behavior.

4 - A Provably Near-optimal Sampling-based Algorithm for the Capacity Allocation Problem
Thiam Lee, IEOR Department, Columbia University, 500 West 120th St, Mudd 323, New York, NY, United States, thl2102@columbia.edu, Woonghee Tim Huh, Retsef Levi

We consider yield management capacity allocation with monotonic fare classes and independent demands, but with unknown demand distributions. Instead, we assume access to a black box that generates uncensored samples from the true distributions. We give an algorithm to compute from samples a nested protection level policy, and prove an upper bound for the number of samples needed to guarantee that that policy is epsilon-optimal with probability 1-delta for any epsilon>0 and delta>0.

■ SD51

S-Kirkland (Lev. 3)

Pricing, Revenue Management and Applications

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Juan-Carlos Ferrer, Assistant Professor, P. Universidad Catolica de Chile, Casilla 306 Correo 22, Santiago, 00, Chile, jferrer@ing.puc.cl

1 - Non-cooperative Competition Among Revenue Maximizing Service Providers with Demand Learning
Changhyun Kwon, PhD Candidate, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, chkwon@psu.edu, Terry Friesz, Baichun Feng, Reetabrata Mookherjee, Tao Yao

This research recognizes that, in many decision environments in which revenue optimization is attempted, an actual demand curve is generally unobservable. We describe the dynamics of demand as an evolutionary differential equation. The resulting model takes the form of a differential variational inequality (DVI). We then observe realized sales data to obtain estimates of parameters that govern the evolution of demand. We present an algorithm for solving the DVI based on a gap function.

2 - Optimal Pricing for Services Bundles with Down-payments: Monopoly vs. Duopoly
Juan-Carlos Ferrer, Assistant Professor, P. Universidad Catolica de Chile, Casilla 306 Correo 22, Santiago, Chile, jferrer@ing.puc.cl, Hugo Mora, Gabriel Bitran

We examine the pricing decision of a provider that offers a bundle that includes a physical product with a high setup cost, and its associated services by means of a subscription. A two-part tariff scheme is used which consists on a down-payment (a fraction of the setup cost) and a periodic fee. We examine the monopoly and duopoly market scenarios, finding near optimal fixed-price policies, and that duopoly firms use the down-payment to protect themselves from the effect of customers switching.

3 - Risk Averse Selective Newsvendor with All-or-nothing Orders
Kiran Chahar, PhD Candidate, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, kchahar@clemson.edu, Kevin Taaffe

Consider a firm offering its product for a single selling season to various unconfirmed demand sources each with unique forecasted demand and revenue. The order may either come in at a predefined level or not come in at all (all-or-nothing), and the firm can choose to pursue the order or not. We propose an order selection approach minimizing the risk of incurring losses below some threshold value. We employ multiple optimization models, including a Conditional Value-at-Risk (CVaR) approach.

■ SD52

S-Leschi (Lev. 3)

Rails to the Sea - Continuation

Sponsor: Railway Applications
Sponsored Session

Chair: Steven Harrod, Assistant Professor, University of Dayton, School of Business Administration, 300 College Park, Dayton, OH, 45469, United States, a2soft@aol.com

1 - Panel Discussion: Rails to the Sea - Continuation
Moderator: Steven Harrod, Assistant Professor, University of Dayton, School of Business Administration, 300 College Park, Dayton, OH, 45469, United States, a2soft@aol.com

Steven Harrod will introduce an exciting panel discussion of current issues in marine-rail intermodal service and port management.

■ SD53

S-Medina (Lev. 3)

Economic Location Models

Sponsor: Location Analysis
Sponsored Session

Chair: Tammy Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States, tdrezner@fullerton.edu

1 - Revenue-driven Elastic Demand and Congestion Location Model
Dmitry Krass, Professor, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, krass@rotman.utoronto.ca, Dehui Tong, Oded Berman

A revenue-maximizing firm must select price, service capacity and facility locations. Customer demand is affected by prices and service levels. A closed-form solution is given for one-facility case. Multi-facility problem is formulated as system optimization model and as user optimization models. System optimization assumes customers cooperate with a central authority to achieve the best performance of the system; in user optimization model customers act individually in making their decisions.

2 - Subsidy Strategies in a Location Model
H.A. Eiselt, Professor, University of New Brunswick, P.O. Box 4400, Fredericton, NB, Canada, HAeiselt@unb.ca, Joy Bhadury, Steve Peng

The paper considers a location model with three levels of decision makers: customers who purchase products, firms that locate, and a regional planner who awards subsidies. Customers buy at the cheapest source, firms maximize profits from sales plus subsidies and planners maximize social benefit. The resulting location patterns are examined.

3 - Capacitated Facility Location for Disbursement of Supplies in a Large-scale Emergency
Fernando Ordonez, University of Southern California, 3715 McClintock Avenue, GER-240, Los Angeles, CA, 90089, United States, fordon@usc.edu, Pavankumar Murali, Maged Dessouky

We propose a model for the facility location problem with capacity constraints, with the objective being to minimize unmet demand. We then extend this problem to the scenario with stochastic demands, for which we propose a chance-constrained model. The performance of the locate-allocate heuristic combined with LP-rounding procedures is evaluated for both these problems for the case of locating emergency medical supplies in Los Angeles.

4 - Gradual Coverage in Location Set Covering Problem (LSCP)
Vladimir Marianov, Professor, Department of electrical Engineering, Pontificia Universidad Catòlica de Chile, Santiago, RM, Chile, marianov@ing.puc.cl, H.A. Eiselt

We review and propose different forms to soften the coverage function in the LSCP. The formulations either penalize excessive customer – facility distances, or require some proportion of customers to receive service within a specified distance, while the remaining customers receive at least a secondary level of service, or maximize the minimum level of service. We also analyze the case in which there is congestion. The approaches are compared with respect to their practicability.

■ SD54

S-Queen Anne (Lev. 3)

Joint Session AP/ICS: Approximate Dynamic Programming II

Sponsor: Applied Probability, INFORMS Computing Society
Sponsored Session

Chair: Sandjai Bhulai, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, sbhulai@few.vu.nl

1 - Robust Dynamic Programming for Markov Decision Processes with Uncertain Transition Matrices
Baohua Li, Research Associate, Arizona State University, Department of Electrical Engineering, Tempe, AZ, 85287, United States, Baohua.Li@asu.edu, Jennie Si

Markov decision processes with uncertain stationary transition matrices are discussed. These matrices are classified into independent and correlated cases. A new criterion of quadratic total value function is proposed to formulate robust dynamic programming solutions. Approximate robust policy iterations are developed to obtain stationary near-optimal policies surely or in the probability sense. Under some assumptions, such solutions are near-optimal in the deterministic policy space.

2 - Dynamic Programming for Bayesian Reinforcement Learning
Pascal Poupart, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, ppoupart@cs.uwaterloo.ca, Nikos Vlassis

Dynamic programming can be used to optimize the policy of Bayesian reinforcement learning problems. However, since the form of the value function is unknown, existing techniques tend to avoid dynamic programming. We derive an analytic solution, revealing that the optimal value function is the upper envelope of a set of linear combinations of Dirichlets. We also propose an effective approximate dynamic programming algorithm, called Beetle, which takes advantage of this analytical form.

3 - A Linear Programming Based Reinforcement Learning Algorithm
Vivek Borkar, Professor, School of Technology and Computer Science, Tata Institute of Fundamental Research, Homi Bhabha Road, Mumbai, Ma, 400005, India, borkar@tifr.res.in, Jervis Pinto, Tarun Prabhu

A new reinforcement learning algorithm for Markov decision processes is proposed, based on the dual linear program associated with it. A linear function architecture is used to approximate this linear program and the saddle point of the associated Lagrangian is learnt using a stochastic approximation version of a primal-dual scheme operating on two time scales. Convergence with probability one is established.

■ SD55

S-Ravenna (Lev. 3)

Research Challenges in Aviation

Sponsor: Aviation Applications
Sponsored Session

Chair: Stefan Karisch, VP Operations Research, Jeppesen Systems AB, 1800 McGill College Avenue, Suite 1930, Montreal, QC, H3A 3J6, Canada, stefan.karisch@jeppesen.com

1 - Panel Discussion: Research Challenges in Aviation
Moderator: Stefan Karisch, VP Operations Research, Jeppesen Systems AB, 1800 McGill College Avenue, Suite 1930, Montreal, QC, H3A 3J6, Canada, stefan.karisch@jeppesen.com, Panelist: Barry Smith, Amy Cohn, Michael Ball, Timothy L. Jacobs

The panel discussion will address current research challenges in aviation. Representatives from industry, regulators, suppliers, and academia will present current and future challenges for the research community, and engage the audience in a discussion.

■ SD56

S-Wallingford (Lev. 3)

Auction Design - Efficiency and Optimality

Cluster: Auctions
Invited Session

Chair: Wedad Elmaghraby, UMD, Van Munching Hall, College Park, MD, United States, Wedad_Elmaghraby@rhsmith.umd.edu

1 - Auctions in Which Losers Set the Price
Ilia Tsetlin, Assistant Professor of Decision Sciences, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, ilia.tsetlin@insead.edu, Claudio Mezzetti

We study auctions of a single asset among symmetric bidders with affiliated values. We show that the second-price auction minimizes revenue among all efficient auction mechanisms in which only the winner pays, and the price only depends on the losers' bids. We compute bidding functions and revenue of the k-th price auction for an illustrative example much used in the experimental literature to study first-price, second-price and English auctions.

2 - Utilization of Uniform Price Auctions in Supply Chain Coordination with Forecast Investment
Tunay Tunca, Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States, tunca_tunay@gsb.stanford.edu, Hyoduk Shin

We study supply chain coordination with investment in demand forecasting. We show that, when competing downstream retailers invest in private forecasts, common contracting schemes fail to coordinate the supply chain and cause overinvestment, as well as large supply chain inefficiencies. We analyze uniform price supply auctions as a remedy. We study the optimal design and characteristics of such auctions, and demonstrate that their utilization can achieve supply chain efficiency.

3 - Does it Make Sense to Favor Incumbent Suppliers in an Auction?
Wedad Elmaghraby, UMD, Van Munching Hall, College Park, MD, United States, Wedad_Elmaghraby@rhsmith.umd.edu, Se-Kyoung Oh, J. Daniel Aromi

We consider a game in which a buyer must repeatedly procure an input from a set of firms. In our model, the buyer is able to sign long term contracts that establish the likelihood with which the next period contract is awarded to an entrant or the incumbent. We find that the buyer finds it optimal to favor the incumbent, this generates more intense competition between suppliers. In a two period model we are able to completely characterize the optimal mechanism.

4 - Optimal Procurement Auctions under Product Differentiation
Vladimir Mares, Washington University, Olin School of Business, St. Louis MO, United States, mares@wustl.edu, Jeroen Swinkels

The paper derives the optimal procurement mechanism in the presence of heterogeneous preferences over alternative goods. Implementation can be achieved with simple auction mechanisms subject to properly choosing bidding credits. The paper also analyzes variants of the request for bid mechanisms, looking at sleeve auctions which combine comptetitive price allocation with the unfettered product choice by the buyer.

■ SD57

S-Columbia (Lev. 4)

Joint Session TELECOM /ICS: Network Design

Sponsor: INFORMS Telecommunications Section, INFORMS Computing Society
Sponsored Session

Chair: Raghu Raghavan, raghavan.umd@gmail.com

1 - The Generalized Regenerator Location Problem
S. Raghavan, University of Maryland, 4345 Van Munching Hall, College Park, MD, 20742-1815, United States, raghavan@umd.edu, Ivana Ljubic, Si Chen

In the generalized regenerator location problem (in optical networks) we are given a set of terminal nodes T that need to communicate. It is necessary to install regenerators if the distance between a pair of nodes in T is greater than L. Regenerators can only be installed at a subset of nodes in the network. We wish to minimize the number of regenerator (or a weighted combination). We describe heuristics for the problem, and an MIP model, and our computational experiences with both.

2 - Dual-ascent for the Connected Facility Location Problem
Gisela Bardossy, University of Maryland, Van Munching Hall, College Park, MD, 20742-1815, United States, mgbardossy@yahoo.com, S. Raghavan

We consider four well known problems in the network design literature. The Steiner-Star Tree problem, the Generalized Steiner-Star Tree Problem, the Connected Facility Location Problem, and the Rent or Buy Problem. We show how the latter three problems can be modeled as Steiner-Star Tree problems. Based on this observation and a transformation of the Steiner-Star Tree problem to a degree constrained Steiner Tree problem we discuss experiments with a dual-ascent procedure for the four problems.

3 - Modelling the Hop-constrained Minimum Spanning Tree Problem Over a Layered Graph
Luis Gouveia, CIO and DEIO-FCUL, Edificio C6, Campo Grande, Lisbon, Lx, Portugal, legouveia@fc.ul.pt, Eduardo Uchoa, Luidi Simonetti

In this talk we show that the Hop-constrained Minimum Spanning Tree Problem (HMSTP) that can be viewed as Steiner Tree Problem (STP) in a layered graph. We present formulations that correspond to well known formulations for the STP and here adapted for the layered graph and compare the linear programming relaxation of the new models with the linear programming relaxation of best models presented so far. The so called Diameter Constrained Minimum Spanning Tree will also be mentioned.

4 - A Solution Procedure for Broadband Convergence Access Network Design Problem
Youngho Lee, Professor, Korea University, Division of Information Management Eng., SungBuk Ku Anam Dong, Seoul, Korea, Republic of, itmsl@dreamwiz.com, Youngjin Kim, Junghee Han, Kyunam Chang, Hyunjung Yun, Youngwook Kim, Bongju Kwon, Kyungsoo Kong

We present a physical network design problem of broadband convergence access network. We formulate the problem as a three-level capacitated facility location-allocation model that minimizes the total cost, while satisfying nonlinear QoS constraints. The proposed branch and bound procedure finds the optimal solution within ten minutes for real problem instances.

■ SD58

S-Pike (Lev. 4)

Innovation: Entry, Learning and Change

Sponsor: Organization Science
Sponsored Session

Chair: Andy King, Dartmouth University, Andrew.A.King@tuck.dartmouth.edu

Co-Chair: Miguel Campo-Rambado, Dartmouth University, miguel.a.campo-rembado@dartmouth.edu

1 - Causes and Consequences of Entrepreneurial Entry in Bail Bonds
A.M. Knott, Washington University in St. Louis, knott@wustl.edu

Entrepreneurial entry is one of the boldest moves in the economy and we don't really understand it very well. Even Bresnahan and Reiss's, Entry and Competition in Concentrated Markets isn't really about entry per se, it's about the equilibrium number of firms. While there is prior work examining when we obtain excess entry and whether that entry is beneficial to the economy, that work was in an industry (banking) where entry restrictions are so severe (11 million dollars, prior executive experience, a business plan and demonstrated market void) that firm turnover rates are an order of magnitude lower than in the broader economy. This study examines a complementary setting (Bail Bonds) where entry is quite liberal (rates are twice the economy average). This allows us to examine 1) how cross-market variance in regulations affect the rate of entry and 2) how that entry affects innovation (improvement in economic outcomes: incarceration rates, failure to appear rates and fugitive rates).

2 - Bringing Context to the Explore-Exploit Trade-Off: Considering the Impact of Selection and Turbulent Environments
H. Posen, University of Michigan, hposen@bus.umich.edu, Daniel Leventhal

Strategy and organization scholars have argued that firms should pursue strategies that balance exploitation and exploration. Since March's seminal paper, research has focused significant attention on the mechanisms by which firms might pursue balance (e.g. ambidexterity). In this paper, we direct attention to an equally important question that has garnered much less attention in the literature: what factors affect the level of exploration? We employ a computational model based on the canonical n-armed bandit formulation. We examine the two basic rationales for exploration: static and dynamic. While the static rationale focuses on exploration as a mechanism for the identification of a good choice from the set of alternatives, the dynamic rationale focuses on exploration as enabling a firm to adjust in a turbulent world. Our counterintuitive result is that in the presence of environmental turbulence, the optimal balance requires less, not more, exploration (i.e. exploit in the face of turbulence).

3 - Innovation Differences Among Industries and Over the Technology Life-cycle
Scott Rockart, Duke University, srockhart@duke.edu, Michael Lenox, Arie Lewin

The nature and extent of firms' innovation efforts is extremely important to social welfare and known to vary across industries and over the technology life-cycle. In this paper, we use a computational model to replicate existing stylized facts and to develop novel predictions about how and why innovation efforts vary across industries and over time. Specifically, we argue that inter-industry differences in the interdependencies in products or production processes influence competitive intensity and firms' ability to innovate and imitate one another, thus conditioning firms' choices of innovation policies as well as their innovative success.

4 - Relative Technological Discontinuities: Insights from the Identification of Shifts in Innovation
Miguel Campo-Rambado, Dartmouth University, miguel.a.campo-rembado@dartmouth.edu, A.H. Taylor

In this paper, we conceptualize change in technological innovation as a continuous process where discontinuities are periods of greater change relative to other periods. Periods of high relative discontinuities are captured by identifying the unexpected, or residual, component in the trajectory of new innovative activity. Using our definition of relative discontinuities, we conduct cross-industry longitudinal analyses of technological innovation. Overall, we find that discontinuities are associated with tipping points in which the production of knowledge by organizations becomes self-reinforcing (e.g., new knowledge is produced that facilitates the production of more new knowledge). Firms accelerate their knowledge production during technological discontinuities and decelerate after. During discontinuities, firms use newer knowledge sources that, surprisingly, reinforce the existing knowledge trajectory. The results suggest that the accumulated effort of active innovators is what drives discontinuities.

■ SD59

S-Seneca (Lev. 4)

Hospital Process Improvement

Sponsor: Technology Management
Sponsored Session

Chair: Jose Zayas-Castro, Professor & Chair, University of South Florida, 4202 E Fowler Avenue, Industrial Engineering Department, Tampa, FL, 33620, United States, josezaya@eng.usf.edu

1 - Learning Orientation and Resident Physicians' Medical Treatment Errors
Eitan Naveh, Technion - Israel Institute of Technology, Faculty of Industrial Engin. & Manage., Haifa, 32000, Israel, naveh@ie.technion.ac.il, Tal Katz-Navon, Zvi Stern

Every organization is confronted with employee errors. In order to eliminate errors organizations emphasize a learning-orientation, which refers to the importance given within the organization to increasing each employee's knowledge and competence. This study explored the concepts of learning-orientation, employee autonomy, and employee voice (employee's perception that speaking up in the organization is wise), and the interactions among them as predictors of resident physicians' medical errors.

2 - Improving Operational Quality of Care in Healthcare Inpatient Processes
Abhik Bhattacharya, Graduate Student, University of South Florida, 4202 E Fowler Ave., ENB 118, Industrial Engineering, Tampa, FL, 33620, United States, abhattac@mail.usf.edu, Jose Zayas-Castro

Various departments within a hospital have to interact to treat an inpatient. Hospitals are facing rising demands that have led to increased waiting time for patient admission and other inpatient processes. A study at the VA Hospital in Tampa is being conducted with the aim of reducing the waiting time and process delays. Improved information and patient flows between departments would help to decrease the length of stay of patients.

■ SD60

S-University (Lev. 4)

Knowledge, Learning, Intellectual Capital-II: Human Learning

Sponsor: Technology Management
Sponsored Session

Chair: David Moore, PhD, KLICNET.ORG, The Knowledge, Learning and Intellectual Capital Network, 3788 Davidson Place, Boulder, CO, 80305, United States, dmoore@klicnet.org

1 - Workforce Knowledge Management and the Investment in New Technology

Cheryl Gaimon, Regents' Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, NW, Atlanta, GA, 30308-0520, United States, cheryl.gaimon@mgt.gatech.edu, Karen Napoleon, Gulru Ozkan

We demonstrate the importance of managing workforce knowledge when considering the purchase and implementation of a technology upgrade. We introduce a holistic treatment of how workforce knowledge changes over time including phenomena such as knowledge depreciation, forgetting and obsolescence. The manager invests in learning-before-doing to reduce the extent of workforce knowledge obsolescence that occurs at a technology upgrade.

2 - Learning and Technology Adoption: A Structural and Behavioral Analysis

Brent Zenobia, Doctoral Candidate, Portland State University, Engineering and Technology Managment, P.O. Box 751, Portland, OR, 97207, United States, bcapps@hevanet.com, Charles Weber

What is the relationship between learning and technology adoption? A case study of alternative transit mode choice suggests that adoption is one member of a family of learning processes which also includes choice framing and technology selection. Structural and behavioral analysis is applied to uncover the properties, dimensions, and behavioral primitives of these processes. Technology adoption and selection are cognitively distinct mental processes with different information requirements.

3 - Surgeon, Surgical Team and Surgery-recovery System Knowledge Generation and Learning in a Hospital

David Moore, PhD, KLICNET.ORG, The Knowledge, Learning and Intellectual Capital Network, 3788 Davidson Place, Boulder, CO, 80305, United States, dmoore@klicnet.org, Nile Hatch

Learning curves of surgeons, surgical teams and the surgery-recovery system of a hospital are analyzed using data collected over a five year period. We explore potential interactions between surgeons, surgical teams, and the surgery-recovery system learning processes. Interviews with surgeons, staff, unit managers and C-level administrators plus hundreds of hours of direct, protocol-guided observation provide foundations for designing empirical studies and interpreting empirical results.

4 - Cutting Your Teeth: Learning from Rare (One or More) Experiences

Chuck Eesley, MIT Sloan, 50 Memorial Dr. E52-557, Cambridge, 02139, United States, eesley@mit.edu, Edward Roberts

We explore whether learning occurs from one or more complex experiences. We examine organizational and entrepreneurial founder characteristics to test hypotheses related to learning from small sets of prior experiences. We use data from survey responses of 964 entrepreneurs to assess performance of startup firms as a measure of outcomes produced by knowledge acquired from prior founding experience. Results indicate substantial performance benefits from small sets of prior experience.

Monday, 8:00am - 9:30am

■ MA01

C-Room 602

Supply Chain Management V

Contributed Session

Chair: Renu Ramnarayanan, Global Focused Strategies, P.O.Box 5581, Parsippany, NJ, 07054, United States, renur@optonline.net

1 - Designing Supply Chain for Production and Distribution of Ethanol in a Cost Effective Way

Ambarish Acharya, Graduate Student, Mississippi State University, Dept. of Industrial & Systems Engineering, P. O. Box 9542, MS St Univ, Mississippi State, MS, 39762, United States, ama206@msstate.edu, Sandra Duni Eksioglu

The increase of gasoline demand together with the decline of oil reserves has increased USA's dependency on petroleum. This dependency jeopardizes USA's energy, economic and environmental security. Ethanol is one of the better alternatives to gasoline. However, the price of producing ethanol is high. One of the major contributors to its price is logistics related costs. The aim of this research is to design supply chains for supplying biomass to biorefineries and distribution of ethanol.

2 - Enabling a Process-centric Supply Chain Transformation Through Simulation and Analytics

Changrui Ren, PhD, IBM China Research Lab, Building 19 Zhongguancun Software Park, 8 Dongbeiwang WestRoad, Haidian District, Beijing, 100094, China, rencr@cn.ibm.com, Jin Dong, Wei Wang, Hongwei Ding

A solution from IBM Research, which aims at providing methodology and tool for process-centric supply chain transformation through simulation and analytics techniques, will be presented. The methodology and technologies behind will be illustrated by some selected reference cases from both IBM internal and external supply chain transformation projects.

3 - Lot Size Balancing Mechanism in a Single-manufacturer-multiple-retailer Supply Chain

Taebok Kim, Professor, University of Incheon, Miraeguan 2F Songdo-dong, Yeonsu-gu, Incheon, Korea, Republic of, tbkim@incheon.ac.kr, Sang Hwa Song, Seockjin Hong

In a single-manufacturer-multiple-retailer supply chain, we can observe two extreme cases according to the balance of supply and demands. Both a single manufacturer and multiple retailers need suitable coordination mechanism when the balance between supply capacity and demand is broken. In this paper, to determine the lot size between the manufacturer and retailers, we investigate the mechanism to coordinate the transactions among supply chain partners to optimally operate the supply chain.

4 - Supply Chain Alliances Success: B2B Online Reverse Auctions Buyer Perspective

Loay Sehwail, Assistant Professor of Supply Chain and Operations Management, University of Wisconsin Oshkosh, 800 Algoma Blvd., Oshkosh, WI, 54901, United States, sehwail@hotmail.com

Supply chain alliances are increasingly impacted by the use of B2B online reverse auctions. The attributes related to the indicators of strategic alliance success are tested across the experience maturity in using reverse auctions. The paper reports the results of a survey-based study of buyers with different levels of experience in reverse auction events. The findings offer insights into how reverse auctions affected the critical antecedents associated with success of strategic alliances.

5 - Top Management Styles as Determinants of Supply Chain Design, Structure and Performance

Renu Ramnarayanan, Global Focused Strategies, P.O.Box 5581, Parsippany, NJ, 07054, United States, renur@optonline.net, Joan Coll

We study several supply chain designs, structures and hierarchy within an organization to investigate their relationship to top management leadership styles and incentive structures. We include both strategic and tactical elements associated with these supply chain processes and evaluate their impact on key long and short term performance measures.

■ MA02

C-Room 603

Supply Chain Incentive Contracts

Cluster: Supply Chain

Invited Session

Chair: Wenqiang Xiao, Assistant Professor, New York University, 3 Washington Square Village, #4B, New York, NY, 10012, United States, wxiao@stern.nyu.edu

1 - Wholesale Price Contracts Under Demand Information Update

Lingxiu Dong, Associate Professor, Washington University in St. Louis, Olin School of Business, Saint Louis, MO, United States, dong@wustl.edu, Kaijie Zhu

We investigate Pareto improvement opportunities associated with wholesale price contracts in an environment where the supplier offers two ordering opportunities to the retailer, where the second order can be placed when the retailer receives updated demand information. We show how the Pareto improvement opportunities are affected by the quality of information and the availability of the supplier's production mode.

2 - Impact of Friction and Membership Cost and Demand Shape on Coalition Stability in Assembly Models

Greys Sosic, Marshall School of Business, University of Southern California, Los Angeles, CA, United States, sosic@marshall.usc.edu, Mahesh Nagarajan

We study an assembly model in which n suppliers sell to a downstream assembler, who faces deterministic price sensitive demand. We look at three types of competition - Supplier Stackelberg, Vertical Nash, Assembler Stackelberg - and allow the suppliers to form coalitions. Using dynamic stability concepts, we predict stable outcomes under different scenarios (linear and nonlinear demand with no friction and membership cost, linear demand with positive friction and/or membership cost).

3 - Incentives for Retailer Forecasting: Rebates versus Returns

Wenqiang Xiao, Assistant Professor, New York University, 3 Washington Square Village, #4B, New York, NY, 10012, United States, wxiao@stern.nyu.edu, Terry Taylor

This paper studies a manufacturer that sells to a newsvendor retailer who can improve the quality of her demand information by exerting costly forecasting effort. We focus on two forms contracts: a rebates contract and a returns contract which are mirror images of one another. We show that the manufacturer is better off offering returns.

4 - Lead Time and Price Decisions with Heterogenous Customers

Xuying Zhao, Assistant Professor, University of Notre Dame, Notre Dame, South Bend, IN, United States, xuying.zhao@utdallas.edu, Ashutosh Prasad, Kathryn Stecke

Service providers need to decide whether to provide uniform service to all customers or provide differentiated services with different lead times and different prices for customers to choose. Customers are characterized by their valuations for lead time reduction, which draw from a general distribution. We study the optimal lead time and price strategy for a service provider, under profit maximization and also under social optimization.

■ MA03

C-Room 604

Risk Hedging and Management in Supply Chains

Cluster: Supply Chain

Invited Session

Chair: Frank Chen, Associate Professor, The Chinese Univ of Hong Kong, Dept. of Systems Engg & Engg Mgmt, MW Mong Engg Bldg, Shatin, N.T., Hong Kong - ROC, yhchen@se.cuhk.edu.hk

1 - Joint Optimal Ordering and Weather Hedging Contract Decisions: A Newsvendor Model

Fei Gao, PhD Candidate, The Chinese Univ of Hong Kong, M.W. Mong Engg Bldg, Shatin, N.T., Dept. of Systems Engg & Engg Mgmt, Hong Kong - ROC, fgao@se.cuhk.edu.hk, Frank Chen, Xiuli Chao

This paper considers the problem of hedging inventory risk using weather options for a seasonal product whose demand is sensitive to the seasonal weather, such as the average seasonal temperature. The newsvendor not only decides the order quantity, but also adopts a weather hedging strategy thru weather derivatives markets. We address the joint decision problem under conditional value at risk (CVaR) and Mean-CVaR framework.

2 - The Interaction of Technology Choice and Financial Risk Management

Onur Boyabatli, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, Singapore, onur.boyabatli@insead.edu, Beril Toktay

This paper analyzes the interaction between technology choice (flexible versus dedicated) and financial risk management decisions of a monopolistic firm in a single period. The firm is budget-constrained and the budget can be engineered by using forward contracts. Flexible technology has risk-pooling benefits but higher investment cost. We investigate the complementarity/substitutability between flexible technology and financial risk management as a part of integrated risk management portfolio.

3 - Maximizing Supply Chain Profits with Selective Channel Strategies

Ulrich Thonemann, Professor, Department of Supply Chain Management and Management Science, University of Cologne, Albertus-Magnus-Platz, Koeln, K, 50923, Germany, Ulrich.Thonemann@uni-koeln.de, Marcel Sieke, Ralf Seifert

Demand variability is an important challenges that companies are facing. Companies that poorly manage demand variability report high supply chain costs and low profit levels. In this paper we make a conscious decision about admitting demand variability to the supply chain. By observing the impact of demand patterns on the efficiency of the supply chain, we derive an optimal distribution channel strategy that trades off between market size and demand variability.

4 - Risk Measures for Breach of Contracts

Cagri Haksoz, Dr., Cass Business School, City University of London, Operations Management & Quantitative Met, London, United Kingdom, C.Haksoz@city.ac.uk, Ashay Kadam

We develop a risk measure, coined as Supply-at-Risk (SAR) for commodity buyers who procure via fixed-price long-term contracts in the presence of demand uncertainty. In case of breach of the contract by the commodity sellers, the buyers needs to know how large a risk they are exposed to in the spot procurement market.

5 - Inventory Models with Lead-time Choice and Supply Capacity Constraints

Haifeng Wang, Chinese University of Hong Kong, William M. W. Mong Engineering Bldg., Room 615, Shatin, N.T., Hong Kong - ROC, hfwang@se.cuhk.edu.hk, Houmin Yan

We consider a multi-period inventory model in which a supplier provides two alternative lead-time choices to customers: a short or a long-lead time. The supplier operates in a batch-production mode with a supply capacity constraint. Orders from long lead-time customers can be satisfied in the next production cycle; while orders from short lead-time customers have to be satisfied from the on-hand inventory. We characterize the optimal production-inventory policies.

■ MA04

C-Room 606

Tutorial: Approximation Algorithms for Stochastic Inventory Control Models

Cluster: Tutorials
Invited Session

1 - Approximation Algorithms for Stochastic Inventory Control Models

David Shmoys, Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States, shmoys@cs.cornell.edu

We consider stochastic inventory control models in which we wish to coordinate a sequence of orders for stochastic demand over a finite time horizon with minimum expected overall holding and backlogging costs. Recent results develop new algorithms, aiming to prove guarantees for their performance. We shall survey several recent papers in this area, presenting results of three separate flavors: algorithms that combine a new amortization approach with a cost balancing technique; the analysis of the sample average approximation; and new ways to build on traditional DP techniques.

■ MA05

C-Room 607

Korea's Sustainable Competitive Advantage in the East Asian Economy and Beyond

Sponsor: INFORMS Korea Chapter
Sponsored Session

Chair: Sang Hyung Ahn, College of Business Adm, Seoul National University, Seoul, KR, Korea, Republic of, cwlee@jinju.ac.kr

1 - LG Chemical's Globalization Strategy in China

Bowon Kim, KAIST, Seoul, KR, Korea, Republic of, bwkim@business.kaist.ac.kr, Sang Hyung Ahn, Chulsoon Park

LG Yong Xing (LGYX) is a Chinese subsidiary of LG Chemical (LGC). LGYX was established in October 1996, which was devoted to producing and selling ABS in the Chinese market. Over the past decade, LGYX increased its capacity tenfold, from 50,000 to almost 500,000 tons a year. In 2006, LGYX was the largest company in the Chinese ABS market, boasting 27% market share and sales of US$709 million. In this study, we examine the company's strategy to expand its production capacity.

2 - Technology Strategy Using Business Roadmapping Model

Sang Hyung Ahn, College of Business Adm., Seoul National University, Seoul, KR, Korea, Republic of, shahn@snu.ac.kr, Chang Won Lee, Sungmin Kang

This paper presents a technology strategy using business roadmapping model in terms of product, market, and technology. The roadmapping model is utilized for analyzing current technology in an industry. This study suggests that decision-makers be able to gain strategic advantages by an business raodmapping modeling process planning in an industry and other similar settings. Correspondence:CW Lee

3 - New Business Models in Information Economy: GDP and Case Studies in Korea

Hosun Rhim, Professor, Korea University Business School, Anam-dong Seongbuk-gu, Seoul, 136-701, Korea, Republic of, hrhim@korea.ac.kr, Min Choi, Kwangtae Park

This paper examines the structure of Korean information economy in 1990, 1995, and 2000 using M.U. Porat's research framework in 1967 as the foundation and assesses the growth experienced by different industries and sectors over the years. The study shows that the share of information economy in total GDP grew from 51.92% in 1990 to 59.03% in 2000 implying that the structural changes may accompany newly emerging business models in information economy.

4 - Business Innovation Case of Korea Aerospace Industries (KAI)

Chang Won Lee, Department of Venture Management, Jinju National University, Jinju, KN, 660-758, Korea, Republic of, cwlee@cjcc.jinju.ac.kr, CW Lee

KAI is a leading corporation ushering in a new future for Korea's aerospace industry through continuous technology innovation and stronger worldwide competitiveness. A case study is utilized for analyzing current business innovation performance in terms of financial and non-financial aspects. This study suggests that the management can achieve strategic gains by appropriate business innovation along with a significant competitiveness of technology and business.

5 - An Analysis of Supply Chain Using Vendor-managed Inventory in Emerging Markets

SugJe Sohn, Senior Supply Chain Modeling Engineer, Intel Corporation, 6505 W Chandler Blvd MS-CH11-111, Chandler, AZ, 85226, United States, sugje.sohn@intel.com, Matt McMillan

The characteristics of emerging markets include typically the greater demand, lower sales price, higher demand uncertainty and larger transportation variability. The research analyzes the vendor-managed inventory (VMI) when implemented in the supply chain of emerging markets. An analytic comparison is performed between the conventional retailer and VMI supply chain models in developed market and emerging market.

■ MA06

C-Room 608

Operations Economics

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Gad Allon, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu

Co-Chair: Gabriel Weintraub, Columbia Business School, gweintraub@columbia.edu

1 - Positive Externalities and Optimal Scale

Ramesh Johari, Stanford University, rjohari@stanford.edu, Sunil Kumar

We study a system where many identical customers use a single service. Each customer experiences both positive and negative externalities from other customers using the service. We study the ratio of Nash equilibrium welfare to socially optimal welfare, as well as the welfare of a single individual at the Nash equilibrium, as the number of customers in the system varies. Our main result is that both these quantities are simultaneously maximized at a positive optimal scale.

2 - Outsourcing Games
Gad Allon, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu, Eyal Beigman

In many industries firms consider the option of outsourcing the service provision or the production of the good they bring to the market. In most markets, these firms may choose among multiple competing suppliers, according to the terms of the contracts offered and the quality of the product. We consider an industry with several competing retailers and several competing suppliers, and study the equilibria that arise in the multistage game.

3 - Lumpy Capacity Investment Dynamics
Lauren Xiaoyuan Lu, Kenan-Flagler Business School, University of North Carolina at Chapel Hill, Chapel Hill, NC, 27599, United States, lauren_lu@unc.edu, Ulrich Doraszelski, Mark Satterthwaite, David Besanko

We propose a dynamic model of capacity expansion and withdrawal in a differentiated duopoly where capacity is lumpy. Strong product differentiation is associated with coordinated capacity expansion and withdrawal processes. By contrast, when product differentiation is weak, capacity-overbuilding preemption arises, but is only transitory. Firms can achieve a nearly coordinated industry capacity level by removing excess capacity voluntarily following a preemption race.

4 - Approximations for Markov Perfect Industry Dynamics
Gabriel Weintraub, Columbia Business School, gweintraub@columbia.edu, C Lanier Benkard, Benjamin Van Roy

Dynamic models of imperfect competition are used in applied economics to analyze diverse dynamic phenomena. A major shortcoming, however, is the computational complexity involved in solving for the equilibrium, which has severely limited their applicability. We introduce approximation methods based on new equilibrium concepts that dramatically reduce the computational complexity. Our methods greatly increase the set of dynamic models of imperfect competition that can be analyzed computationally.

■ MA07

C-Room 609

Topics in Inventory Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Hyun-Soo Ahn, Assistant Professor, University of Michigan, Stephen M. Ross School of Business, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109-1234, United States, hsahn@bus.umich.edu

1 - Effective Contracted Logistics Utilization
Engin Alper, University of California at Berkeley, 5816 San Diego St. Apt.3, El Cerrito, CA, 94530, United States, engin@ieor.berkeley.edu, Hyun-Soo Ahn, Phil Kaminsky

Third party logistics (3PL) providers have typically guaranteed a high level of flexibility to their customers. We demonstrate how customers can effectively utilize less flexible contracts, and argue that by offering less flexible contracts, 3PL providers can more effectively utilize their resources.

2 - Inventory Control with Satisfaction-dependent Future Demand
Justin Azadivar, University of California - Berkeley, University of California - Berkeley, Berkeley, CA, United States, jazad@berkeley.edu, George Shanthikumar, Max Shen

Inventory control decisions are made based on assumptions and estimates of demand levels. But those decisions also affect demand levels, and a complete inventory control model recognizes the use of control decisions to both meet current demand and modify future demand. In this paper, we look at a simple inventory control model with a demand that responds to satisfaction of previous demand and propose a simple framework to determine the value of these control decisions.

3 - Supply Chain and Logistics Planning of Platform Products: Value of Platform Demand Information
Evren Ozkaya, PhD Student, Georgia Institute of Technology, 251 10th Street NW A-702, Atlanta, GA, 30318, United States, evren@gatech.edu, Pinar Keskinocak, John Vande Vate, Michael Waithe

In this research, we investigate the value of demand information for platform products. In semiconductor industry, suppliers deliver multiple components to the OEMs at different times that are then assembled as a single platform by OEMs. We analyzed scenarios where we can use this component demand dependency to improve forecasting accuracy. We developed an integrated supply chain simulator to quantify the potential benefits of this information on Intel's global supply chain.

4 - Bargaining in the Supply Chain and Its Implication to Coordination of Competing Supply Chains
Opher Baron, University of Toronto, 105 Saint George Street, Toronto, ON, M5S3E6, Canada, Opher.baron@Rotman.utoronto.ca, Oded Berman, Desheng Wu

A significant part of the supply chain coordination literature focus on inducing the supply chain to act as a Vertically Integrated (VI) one rather than a Manufacturing Stackelberg (MS). We investigate an industry with two supply chains that Bargain on the Wholesale price and show that both the MS and the VI are special cases of this contract. We characterize the unique Nash Equilibrium for the strategies of both chains and, surprisingly, show that VI of both chains is never equilibrium.

■ MA08

C-Room 611

Supplier Selection for Mitigating Disruption in Supply Chains

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Lei Li, University of Washington, Industrial Engineering, University of Washington, Seattle, WA, 98195, United States, leili@u.washington.edu

1 - Addressing Risk in a Supplier Selection Problem
Lei Li, University of Washington, Industrial Engineering, University of Washington, Seattle, WA, 98195, United States, leili@u.washington.edu, Zelda Zabinsky

With implementation of JIT and trends to global outsouring, the risk presented in the strategic supplier selection decision process must be considered. Risk is captured in a two-stage stochastic programming model with recourse and a chance constrained programming model to determine a Pareto set of suppliers and optimal order quantities with consideration of business volume discounts.

2 - A Multicriteria Supplier Selection Model with Backup Suppliers
Ufuk Bilsel, PhD Student, Penn State University, 355 Leonhard Building, University Park, PA, 16802, United States, rub150@psu.edu

We present a multicriteria supplier selection model where a primary and a sequence of backup suppliers are assigned at each customer. A similar model has previously been proposed for a facility location problem without capacity constraints. The model developed in this study considers capacity restrictions and covers cost, quality, lead time and disruption risk as criteria. Several different multicriteria techniques have been applied to solve the model and the solutions have been compared.

3 - A Dual Supplier Inventory Model with Demand and Supply Uncertainty
Dogan Serel, Bilkent University, Faculty of Business Administration, Bilkent, Ankara, 06800, Turkey, serel@bilkent.edu.tr

We study an extension of the single-period stochastic demand inventory problem in a dual supplier setting. The suppliers have different unit costs and supply risks. The buyer's problem is to determine the amount to be ordered from each supplier so that his expected profit is maximized. We discuss properties of the optimal solution, and present numerical examples.

4 - Choice of a Mitigation Strategy for Supplier Default Risk: Subsidies, Inventory or Diversification
Luz Caudillo, University of Michigan, 660 Hidden Valley Dr. Apt 202, Ann Arbor, MI, 48104, United States, fuentesl@umich.edu

We analyze the tradeoffs of diversification, subsidies and inventory using a model where a manufacturer can rely on either inventory or financial subsidies to control exposure to supplier default risk. We consider a setting where current demand is known (deterministic), for different scenarios: a) having one or two suppliers, b)considering one or two periods, or c) having known (deterministic) or uncertain future demand. In general, the higher the granted subsidy, the less supplies are ordered.

■ MA09

C-Room 612

Decision Analysis for Homeland Security

Cluster: Homeland Security
Invited Session

Chair: Detlof von Winterfeldt, University of Southern California, Ronald Tutor Hall 316A, University Park, Los Angeles, CA, 90089, winterfe@sppd.usc.edu

1 - Constructing Objectives for Homeland Security
Ralph Keeney, Duke University, Fuqua School of Business, 101 Lombard Street Suite #704W, San Francisco, CA, 94111, United States, keeneyr@aol.com

This presentation discusses a procedure to identify the fundamental objectives of the Department of Homeland Security (DHS) and construct an objective function that combines them. This would provide a basis for developing consistent evaluation procedures for allocating DHS funds and for analyses of DHS alternatives.

2 - Decision Analysis by Proxy for the Rational Terrorist
Richard S. John, Professor, Center for Risk and Economic Analysis of Terrorism Events (CREATE), Department of Psychology, University of Southern California, Los Angeles, CA, 90089-1061, United States, richardj@usc.edu, Heather Rosoff

Anti-terror decisions should depend on the likelihood of terrorist actions. We develop a methodology to estimate the likelihood of alternative actions for the rational terrorist using a random utility model constructed from assessments of proxy rational terrorists. The random utility model includes assessments of uncertainty about terrorist attack outcomes and values, including terrorist attitudes toward risk and trade-offs among conflicting terrorist objectives.

3 - Robust Risk-based Resource Allocation for Counter Terrorism
Don Kleinmuntz, University of Southern California, c/o Strata Decision Technology, 2001 S. First St, Suite 200, Champaign, IL, 61820, United States, dnk@strata-decision.com

A method for allocating funds to counter terrorism measures under incomplete information is described. The method uses robust portfolio allocation methods that identify efficient portfolios when information on risk, benefits, and costs is limited. An example of allocation of funds to infrastructure protection measures is presented.

4 - Insights From Applying Decision Analysis to Homeland Security Problems
Detlof von Winterfeldt, University of Southern California, Ronald Tutor Hall 316A, University Park, Los Angeles, CA, 90089, winterfe@sppd.usc.edu

Three recent decision analyses applied to homeland security problems created new insights in the use of decision analysis in adversarial situations. This presentation will discuss some of these insights.

■ MA10

C-Room 613

Advances in Inventory Management

Cluster: Inventory
Invited Session

Chair: Edwin Romeijn, Professor, University of Florida, Department of Industrial and Systems Engineering, 302-B Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, romeijn@ise.ufl.edu

1 - Demand Management and Inventory Control for Substitutable Products
Zhengliang Xue, Duke University, 1 Towerview Drive, Fuqua School of Business, Durham, NC, 27708, United States, zhengliang.xue@duke.edu, Jeannette Song

We study dynamic inventory and pricing decisions for a set of substitutable products over a finite horizon. Demands are random and price sensitive. In each period, we decide the price and order quantity for each product. Unsatisfied demands are backlogged. There are linear purchasing, inventory-holding and backorder costs. We characterize the optimal policy that maximizes the total expected discounted profit and devise an algorithm to compute it.

2 - Inventory Control with Observable and Unobservable Demands
Mariana Olvera-Cravioto, Assistant Professor, Columbia University, 306 S. W. Mudd Building, New York, NY, 10027, United States, molvera@ieor.columbia.edu, Woonghee Tim Huh, Ozalp Ozer

We study a peridic-review inventory model where a portion of demand is not observable. We assume that both observable and unobservable demands are stochastic with known distributions. In each period, the manager makes inventory replenishment and count decisions.

3 - Order Policies for a Perishable Product with Age-Dependent Demand
Amar Sapra, University of Florida, Industrial and System Eng. Department, Weil Hall, Gainesville, FL, 32611, United States, sapra@ise.ufl.edu, Li-Ming Chen

Motivated by recent advances in bakery industry that have increased shelf-life, we consider a single stage periodic review inventory system for a perishable product whose demand depends on age. We characterize the form of the optimal ordering policy.

4 - Order-timing Strategies and Incentives in a Multi-retailer, Single-period Setting
Joseph Geunes, Associate Professor, University of Florida, Department of Industrial and Systems Eng, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu, Ismail Bakal

We consider order-timing preferences in a single-supplier, multi-retailer system facing a single period of uncertain demand. We characterize conditions under which the supplier and a given retailer prefer that the retailer order pre- or post demand realization. When the retailer prefers ordering after demand realization, we consider mechanisms the supplier can use to induce an early order, as well as the conditions under which it is in the supplier's best interest to apply these mechanisms.

■ MA11

C-Room 614

Managing Inventories in Two-stage Supply Chains with Multiple Suppliers and/or Multiple Retailers

Cluster: Manufacturing
Invited Session

Chair: Srinagesh Gavirneni, Assistant Professor, Cornell University, Johnson Graduate School of Management, Ithaca, NY, 14853, United States, sg337@johnson.cornell.edu

1 - Comparison of (s,S) and (R,T) Policies in Supply Chains with Fixed Costs and Information Sharing
Jin Kyung Kwak, PhD Student, Cornell University, 401 M Sage Hall, Ithaca, NY, 14853, United States, jkk37@cornell.edu, Srinagesh Gavirneni

We investigate how the retailer's inventory policy affects the total cost of a two-stage supply chain with a fixed cost at the retailer. When the retailer uses the locally optimal (s,S) policy, there is randomness in both order time and order quantity to the supplier. When the retailer uses the non-optimal (R,T) policy there is randomness only in order quantity. When the supplier has knowledge of the end-customer demand information, we hypothesize that the (R,T) policy is more cost effective.

2 - The Effects of Inventory Misplacement on Supply Chains
Almula Camdereli, Georgetown University, McDonough School of Business, Georgetown University, 37 & O Streets, Washington, DC, 20057, United States, zac2@georgetown.edu, Jayashankar Swaminathan

In this paper, we explore the effects of increasing the proportion of inventory availability at the retailer on the profits of the retailer and the manufacturer in vertically integrated, uncoordinated and coordinated decentralized supply chains. We assume that the retailer is subject to demand distributed according to a general distribution. Further, we explore the cases where a random fraction of items gets misplaced in the aforementioned settings.

3 - Demand Allocation Under Supply Uncertainty
Jianli Hu, Assistant Professor, Chapman University, One University Dr., Orange, CA, 92620, United States, jhu@chapman.edu, Mihaela Vajiac

The optimal choice in an environment with multiple potential suppliers is closely related to the tradeoffs between the respective aspects of direct purchasing costs and supplier performance. In this paper we present a decision model that optimizes the allocation of demand across multiple unreliable supply sources. Our approach integrates supplier costs, supplier reliabilities, demand uncertainty, initial inventory and firm specific inventory costs.

4 - Effectiveness of Synchronized Ordering in Decentralized Distribution Supply Chains
Lucy Gongtao Chen, Department of Decision Sciences, NUS Business School, National University of Singapore, 1 Business Link, BIZ 1 Building #04-29, Singapore, 117592, gc84@cornell.edu, Srinagesh Gavirneni

We study a decentralized distribution supply chain with one supplier and many retailers that face exogenous end-customer demands. For this supply chain, we consider a synchronized ordering policy where all retailers order freely in the same period of an ordering cycle, and receive fixed shipments in the other periods. Using the total supply chain cost per period as our performance measure, we analyze when sychronized ordering outperforms balanced ordering and free ordering

■ MA12

C-Room 615

Scheduling and Routing

Cluster: Scheduling
Invited Session

Chair: Philippe Baptiste, CNRS - Ecole Polytechnique, Route de Saclay, Palaiseau, France, Philippe.Baptiste@polytechnique.fr

1 - Fast Computation of Point-to-point Time-dependent Paths on Dynamic Road Networks

Giacomo Nannicini, LIX, Ecole Polytechnique, Palaiseau, NA, France, giacomo.nannicini@v-trafic.com, Philippe Baptiste, Leo Liberti, Daniel Krob

We propose a Polynomial-Time Approximation Scheme for the point-to-point time-dependent shortest path problem, using which good solutions may be quickly found in large graphs. This is useful for a typical server scenario, where the computation of point-to-point shortest paths in large road networks with time-dependent arc costs (travelling times) is needed, and each path has to be computed in a very short time. Our approach includes a time-consuming pre-processing phase and a fast query phase.

2 - Dominance Rules for Parallel Machines Scheduling Problems

David Savourey, University of Technology of Compiegne, Centre de Recherches de Royallieu, CompiËgne, FR, 60200, France, david.savourey@hds.utc.fr, Antoine Jouglet

We present some new dominance rules for parallel machines scheduling problems to minimize total cost, such that (weighted) sum of completion times or total (weighted) tardiness. Let P be a set of sheduled jobs. The idea is to examine under which it will always be more interesting to schedule a job i after P rather than another unscheduled job j. Numerical results comparing two tree-based searches, with or without these dominance rules, will be presented.

3 - Scheduling a Multifunction Radar

Philippe Baptiste, CNRS - Ecole Polytechnique, Route de Saclay, Palaiseau, France, Philippe.Baptiste@polytechnique.fr, Ruslan Sadykov, Emilie Winter, Bechir Tourki

Among several other tasks, the radar of a fighter has to search, track and identify potential targets. These tasks are repeated several times in a cyclic fashion. Altogether, this defines a complex scheduling problem that impacts a lot on the quality of the radar's output. We define a formal framework for this real time scheduling problem and we introduce several techniques to compute efficient schedules for the radar.

■ MA13

C-Room 616

Cutting Planes in Mixed-integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Ismael Regis de Farias JR., State University of New York, Dept.. of Ind. and Syst. Eng., 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu

1 - Polyhedral Analysis of the Set Covering Polytope

Anureet Saxena, Tepper School of Business, CMU, 5624 Fifth Ave, Appt C13, Pittsburgh, PA, 15232, United States, anureets@andrew.cmu.edu

This talk concerns the facial structure of the set covering polytope. We introduce the notion of cover hypergraphs and illustrate their application in generalizing well-known results from the literature. We introduce a new lifting procedure - Relaxation Lifting Procedure - which is more efficient than the conventional one. Finally, we give a compact polyhedral representation of the entire class of valid inequalities which can be obtained by sequential and simultaneous relaxation lifting.

2 - Facets for Flow Models with Cardinality Constraints From Multidimensional Superadditive Lifting

Bo Zeng, Purdue University, Industrial Engineering, West Lafayette, IN, 47906, United States, bzeng@purdue.edu, Jean-Philippe Richard

In this talk, we perform a polyhedral study of the single node flow model with cardinality constraints. We first derive necessary and sufficient conditions under which several flow cover inequalities are facet-defining. Then, we derive strong multidimensional superadditive approximations for their lifting functions. We describe the lifted flow cover inequalities obtained using this procedure and compare them to those obtained by Louveaux and Wolsey for the single node flow model with GUBs.

3 - Complexity for a Class of Stochastic Capacitated Lot-sizing Problems

Yongpei Guan, School of Industrial Engineering, University of Oklahoma, 202 West Boyd Street, Norman, OK, United States, yguan@ou.edu, Andrew Miller

In this talk, we study the complexity of stochastic capacitated lot-sizing problems with backlogging. We discuss both constant and variant capacitated cases. For the constant capacitated case, we develop a polynomial time algorithm for any general scenario-tree structure. For the variant capacitated case, the problem is NP-hard for the general scenario-tree structure case. However, the problem is polynomial solvable if each non-leaf node in the scenario tree contains at least two children.

■ MA14

C-Room 617

Large-scale Numerical Optimization

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Jim Burke, Professor, University of Washington, Box 354350, Seattle, WA, 98195, United States, burke@math.washington.edu

1 - Gradient Projection for Nonlinear Optimization

Richard Waltz, University of Southern California, rwaltz@usc.edu, Richard Byrd

Gradient projection is often the most efficient method for large-scale nonlinear optimization problems with simple bound constraints because of its ability to modify the active-set estimate by many constraints at a time. We will investigate attempts to extend gradient projection-type methods to general nonlinear optimization problems. The relationship between gradient projection methods and methods that estimate the active set by solving linear programming subproblems will be established.

2 - ASTRAL: An Active-Set Trust-Region Algorithm for Box Constrained Optimization

Liang Xu, University of Washington, Box 354350, Seattle, WA, 98195, United States, lxu@math.washington.edu, Jim Burke

An algorithm for solving large nonlinear optimization problems with simple bounds is described. The algorithm is in the framework of a Quasi-Newton active-set trust-region method. The local active set is identified using projected gradients. Limited memory curvature estimate is used and exploited in solving the trust-region sub-problems. A restart strategy ensures that the algorithm indentifies the optimal constraints in finite number iterations.

3 - A Coordinate Gradient Descent Method for Linearly Constrained Smooth Optimization

Sangwoon Yun, National University of Singapore, Department of Mathematics, Box 354350, 2, Science Drive 2, Singapore, 117543, Singapore, matys@nus.edu.sg, Paul Tseng

We propose a (block) coordinate gradient descent method for solving a linearly constrained smooth optimization, including a large-scale quadratic problem arising in the training of support vector machines (SVMs). We establish global convergence and, under a local error bound assumption, linear rate of convergence for our method when the coordinate block is chosen by a Gauss-Southwell-type rule. Our numerical experience suggests that the method can be efficient for SVM QP with nonlinear kernel.

4 - An Affine-scaling Interior-point CBB Algorithm and its Applications

Hongchao Zhang, IMA, University of Minnesota, 400 Lind Hall, 2007 Church Street S. E., Minneapolis, MN, 55455, United States, hozhang@ima.umn.edu, William Hager

We present an affine-scaling CBB algorithm for box-constrained optimization which has the property that each iterate is a scaled cyclic Barzilai-Borwein (BB) gradient iterate that lies in the interior of the feasible set. Global convergence is established for a nonmonotone line search and local R-linear convergence is established under proper conditions. This algorithm has received successful applications in PET medical imaging and signal precessing in MIMO channels.

■ MA15

C-Room 618

Linear Programming

Contributed Session

Chair: Francisco Lopez, Macon State College, 100 College Station, Division of Economics and Business, Macon, GA, 31206, United States, francisco.lopez@maconstate.edu

1 - Exploiting Problem Structure in the MOSEK Simplex Optimizers
Bo Jensen, MOSEK ApS, C/O Symbion Science Park Fruebjergvej 3, Copenhagen, 2100, Denmark, bo.jensen@mosek.com

The software package MOSEK is capable of solving large-scale sparse linear optimization problems. This talk will discuss details and tricks implemented in the simplex optimizers. We will show how significant improvement can be obtained by exploiting problem specific structure. Moreover, we will present numerical results demonstrating the optimizers performance.

2 - Constraint Optimal Selection Techniques (COSTs) for Large-scale Linear Programming Problems
Tai-Kuan Sung, Student, ELNP, 66 - 27 Ying Shih Rd, Taichung, 404, Taiwan - ROC, tsung@uta.edu, Bill Corley, Jay Rosenberger

We describe two classes of Constraint Optimal Selection Techniques (COSTs), which are efficient active set methods for linear programming. Algorithms of each type are developed for solving large-scale problems. In addition, geometric interpretations of these new algorithms are given, computational results for some large-scale problems are provided, and directions for future research are discussed.

3 - Obtaining Bounds for Linear Programs with Interval Coefficients
Danny Myers, Dept.. of Applied Statistics and Operations Research, Bowling Green State University, Bowling Green, OH, United States, myers@bgsu.edu, Robert Green

Linear programs with interval coefficients have a wide range of possible solutions. One useful approach to these problems is to determine the best and worst case objective values (given the range of potential coefficients). This provides managers with bounds on what they can expect to encounter in practice. Present approaches involve (potentially) intractable enumeration. We present a hybrid genetic algorithm/constraint selection method for efficiently determining these best/worst case values.

4- Optimal Operating Strategies Under Stochastic Cash Flows
Arnav Sheth, Rutgers, shetha@rutgers.edu

We solve a series of four stochastic control problems for a firm whose cash flows are a diffusion process (Xt) that includes (individually): (i) Financial distress costs; (ii) Costs of company politics; (iii) Agency costs of free cash flow and; (iv) Physical asset upgrades. Amongst other things, our results show that: (a) There are several conditions for which asset substitution (risk-taking when close to broke) is optimal, with financial distress costs; (b) When politicking amongst employees exists, it is optimal to keep the firm extremely small by downsizing frequently and rarely hiring; (c) Increasing the free cash boundary (or equivalently increasing cash obligations) would reduce the agency costs associated with free cash flow from overly negligent managers; (d) It is optimal to have a buffer cash zone before upgrading technologies, rather than as soon as cash reserves exceed upgrade costs. We solve for the optimal operating strategy using an algorithm that includes applying Itô calculus, the use of martingale theory and linear programming. With sparse matrix techniques, a manageable number of constraints and using the MOSEK solver embedded into Matlab, our methodology provides for a quick and easy way by which this class of stochastic control problems can be solved. We provide explicit solutions where it is possible to do so.

5 - An Algorithm to Find the Lineality Space of the Positive Hull of a Set of Vectors
Francisco Lopez, Macon State College, 100 College Station, Division of Economics and Business, Macon, GA, 31206, United States, francisco.lopez@maconstate.edu

The positive hull of a set of vectors in d-dimensional space is the set of all positive combinations of the vectors in the set. A positive hull contains a lineality space if the negative of at least one of the vectors can be expressed as a positive combination of the other vectors. I present an algorithm that finds the vectors that belong to the lineality space of a positive hull. I discuss computational results and comparisons to the best currently available method (to my best knowledge).

■ MA16

C-Room 619

Markov Decision Processes and Indexed Policies with Single and Multiple Criteria

Cluster: Optimization (Invited)
Invited Session

Chair: Eugene Feinberg, Professor, Stony Brook University, Department of Applied Mathematics, Stony Brook, NY, United States, efeinberg@notes.cc.sunysb.edu

1 - Stochastic Scheduling in an In-forest
Jay Sethuraman, Associate Professor, Columbia University, Dept.. of IEOR, New York, NY, 10012, United States, js1353@columbia.edu, Uriel G. Rothblum

We consider a problem of scheduling activities of a research and development project, where precedence relations of the activities constituting the project are represented by edges of an in-forest. The problem is to find a policy for attempting activities that minimizes the expected utility incurred until termination (successful completion of the project or first activity failure). We design an efficient algorithm to find an optimal sequence, and show that an optimal index policy may not exist.

2 - Splitting of Randomized Stationary Policies in Total-reward Markov Decision Processes
Eugene Feinberg, Professor, Stony Brook University, Department of Applied Mathematics, Stony Brook, NY, United States, efeinberg@notes.cc.sunysb.edu, Uriel G. Rothblum, Eric Denardo

For total-reward MDPs with Borel state and action sets, we present two results on splitting of a randomized stationary policy into a mixture of nonrandomized stationary policies. The first result is an explicit formula for the splitting at one state. The second result is a splitting of a randomized stationary policy that uses a finite number of randomization procedures. We discuss applications of these results to countable discounted MDPs and to constrained bandit problems.

3 - Unconstrained and Constrained Bandits via Parwise Comparison
Eric Denardo, Professor, Yale University, P.O. Box 208267, New Haven, CT, 06520-8267, United States, eric.denardo@yale.edu, Eugene Feinberg, Uriel G. Rothblum

A novel approach to the multi-armed bandit replaces stopping times with pairwise comparison. This approach is used to show that priority rules are optimal, it leads to efficient computation, it encompasses linear and exponential utility functions, and it allows for constraints that link the bandits.

4 - Variance Minimization for Constrained Discounted Continuous-time Markov Decision Processes
Jun Fei, Stony Brook University, Dept. of Applied Mathematics & Statistics, Stony Brook, NY, 11794, United States, royfei@yahoo.com, Eugene Feinberg

This paper compares variances of optimal policies for constrained discounted Continuous-Time Markov Decision Processes (MDPs). According to the existing theory, optimal policies exist in the form of switching and randomized policies. In the paper we interpret discounting as exponentially distributed stopping time. We provide an index-type formula for the switching policy with the minimal variance and show that it has the smaller variance than the optimal randomized policy.

■ MA17

C-Room 620

Empirical Research on IT and Firm Performance

Sponsor: Information Systems Society
Sponsored Session

Chair: Bruce Weber, Professor of Information Management, London Business School, Regents Park, London, NW1 4SA, United Kingdom, bweber@london.edu

1 - All Reviews are Not Created Equal: The Disaggregate Impact of Reviews and Reviewers at Amazon.com
Michael D. Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15217, United States, mds@cmu.edu, Samita Dhanasobhon, Pei-Yu Chen

Online product reviews play an important role in Internet commerce. In this research, we extend prior work by analyzing consumer responses to disaggregate review information. We find that reviews that the community finds helpful have a stronger impact on consumer purchase decisions than other reviews do. Moreover, these reviews have a stronger impact on less popular books than more popular books, where consumers may be able to use outside information sources to evaluate products.

2 - Financial Control Systems and Gains From SOX Remediation
Bruce Weber, Professor of Information Management, London Business School, Regents Park, London, NW1 4SA, United Kingdom, bweber@london.edu

Of 400 companies reporting ineffective control over financial reporting in their 2005 10Ks, 52 identify inadequate computer systems as the source of the deficiencies. About half of these companies address the IS problems and remediate their control problems by their 2006 10K filing date. Remediating firms show 2006 shareholder returns 23% greater than firms whose 2006 10Ks identify continuing material weaknesses in control over financial reporting, and 4% greater than the CRSP EW index.

3 - Distruptive IT and the New York Stock Exchange

Wonseok Oh, McGill University, 1001 Sherbrooke West, Montreal, QC, Canada, wonseok.oh@mcgill.ca, Henry C. Lucas, Jr.

This paper examines three eras of IT at the NYSE, presenting a detailed 22-year history, and offers evidence that IT investments have helped the Exchange defend its market share. We document the NYSE's investments in IT and improvements in capacity, market operations, and productivity. The NYSE used IT to defend its business model of a physical exchange floor, but finally had to surrender to the transformational and disruptive technology of competitive all-electronic exchanges.

4 - Information Technology and Firm Boundaries: Impact on Risk-return Profile

Sanjeev Dewan, Associate Professor, UC Irvine, Paul Merage School of Business, Irvine, CA, 92617, United States, sdewan@uci.edu, Fei Ren

In this paper, we empirically investigate the effects of information technology (IT) investment on the risk-return profile of firms, emphasizing interactions between IT and the firm boundary strategies of diversification and vertical integration.

■ MA18

C-Room 201

Integer Programming - Theory and Computation

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Karen Aardal, CWI, Kruislaan 413, Amsterdam, 1098 SJ, Netherlands, Karen.Aardal@cwi.nl

1 - New Rational Generating Function Techniques for Integer Programming

Matthias Koeppe, Otto-von-Guericke-Universitaet Magdeburg, FMA-IMO, Universitaetsplatz 2, Magdeburg, 39108, Germany, mkoeppe@merkur.math.uni-magdeburg.de

A. Barvinok (1994) presented a polynomial-time algorithm to count the number of integer points in a polytope, when the dimension is fixed, using his technique of polynomial-size rational generating functions. We present new efficient primal variants of the algorithm. We also present new applications in Integer Programming, based on the construction of discrete relaxations, for which rational generating techniques are used to compute strong bounds or prove infeasibility.

2 - P, NP and the Nullstellensatz: Lower Bounds for Stable Set Infeasibility Certificates

Susan Margulies, Graduate Student, University of California at Davis, 1 Shields Avenue, Davis, CA, 95616, United States, smargulies@ucdavis.edu, Shmuel Onn, Jes's De Loera, Jon Lee

When a polynomial system models a combinatorial problem, the Hilbert Nullstellensatz gives a certificate that the underlying problem is infeasible. Thus, unless P = NP, there must exist an infinite sequence of infeasible instances for which the minimal degree certificate grows. We show that the minimum-degree of a Nullstellensatz certifying the non-existence of stable set of a given size is the stability number of G. Moreover, such certificates contain at least one term per stable set in G.

3 - Lattice Based Extended Formulations for Integer Linear Equality Systems

Karen Aardal, CWI, Kruislaan 413, Amsterdam, 1098 SJ, Netherlands, Karen.Aardal@cwi.nl, Laurence Wolsey

We study extended formulations for a set of equations in integers in order to tackle the feasibility problem for the same set of equations in nonnegative integers. The goal is not to find an improved polyhedral relaxation of the convex hull of feasible solutions but to reformulate such that the new variables introduced provide good branching directions, and in certain circumstances permit one to deduce rapidly that the instance is infeasible. We analyze the case of one equation in more detail.

■ MA19

C-Room 203

Computer Science Techniques for Industrial Engineering

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Mayur Thakur, Google Inc., 1870 Miner Circle, Rolla, MO, 65401, United States

1 - Managing Changes in Service Networks

Kamal Bhattacharya, Research Staff Member, IBM T. J. Watson Research Center, 19 Skyline Dr, Hawthorne, NY, 10532, United States, kamalb@us.ibm.com

Services are a means to provide value to consumers and are often realized through processes hosted on applications. Current discovery technologies map out dependencies between individual applications and assess change impact. Yet there is a lack of understanding of the impact of change on specific processes hosted by one or more applications. We will illustrate some basics of service networks design and present a model for assessing the risk of changes under financial and structural constraints.

2 - An Intelligent Workflow Engine for Critical Parts Management

Sreeram Ramakrishnan, IBM, sramakr@us.ibm.com

It has been observed that quarter-end business pressures yield revenue opportunities, which are jeopardized by critical parts shortages. A real-time, automated workflow tool, based on communicating finite-state machines, that links departments or functions with critical parts shortages to those whose supply will support revenue generation is discussed in this talk.

3 - Human Decision-making Model Based on Enhanced BDI Framework

Young-Jun Son, Associate Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, son@sie.arizona.edu, Seungho Lee

We propose a novel human decision-making model based on the enhanced BDI (belief, desire, intention) framework. The model is capable of generating plans in real-time, supporting both reactive and proactive decision making, and maintaining situation awareness. Bayesian belief network is employed for the belief module. Decision field theory, a cognitive approach to human decision making, is employed for the intention module. SOAR architecture is employed for the learning capability of the model.

4 - Hidden Markov Models for Financial Engineering

Mayur Thakur, Google Inc., 1600 Amphitheatre Parkway, Mountain View CA 94043, United States

This talk will describe how Hidden Markov Models (HMMs)—-a stochastic model used widely in speech recognition systems—-can be used to model noisy financial time series, such as stock market data. A key difference between our approach and previous work in time series prediction is that our approach is symbolic rather than numerical. We show that this approach yields relatively good performance—-both in terms of accuracy of prediction and for algorithmic trading.

■ MA20

C-Room 204

Applications of Portfolio Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, Espoo, FI, 02015, Finland, ahti.salo@tkk.fi

1 - Determining Cost-effective Portfolios of Weapon Systems

Juuso Liesiö, Researcher, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, TKK, 02015, Finland, juuso.liesio@tkk.fi, Ahti Salo

Investments into weapon systems are expensive, yet they are hard to evaluate due to the presence of multiple impact criteria and interactions between weapon systems. We present a non-linear optimization model that helps identify cost-effective portfolios of weapon systems at different budget levels and also in view of different impact criteria. The model admits incomplete preference information about these criteria and accounts for interactions that exist between complementary weapon systems.

2 - A Dynamic Model for Multi-criteria Resource Allocation at the Finnish Road Administration

Pekka Mild, Researcher, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, TKK, 02015, Finland, pekka.mild@tkk.fi, Ahti Salo

Resource allocation decisions in road management have far-reaching impacts on asset values and future service levels. We present an award-winning decision model to help senior managers at the Finnish Road Administration allocate limited appropriations among different kinds of road products. The model gives budget ranges for each product for a 30-year period, based on annual deterioration of asset values, use of incomplete preference information, and computation of optimal maintenance portfolios.

3 - Efficiency and Sensitivity Analyses in the Evaluation of University Departments

Ahti Salo, Professor, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, Espoo, FI, 02015, Finland, ahti.salo@tkk.fi, Antti Punkka

We present a value efficiency model for comparing the efficiency of university departments and for allocating resources among them. The model permits extensive sensitivity analyses about the choice of key inputs/outputs and their weightings: thus, for example, it helps determine the highest and lowest possible rankings for the departments and characterizes those weights that would result in a given efficiency ranking. The model is generally applicable, and it has already been employed at TKK.

4 - Dynamic Risk Management of Electricity Contracts with Contingent Portfolio Programming

Janne Kettunen, Researcher, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, Espoo, 02150, Finland, jkettunen@london.edu, Derek Bunn, Ahti Salo

We develop a contingent optimization approach for the management of the electricity contract portfolio that accounts for the uncertain electricity prices and loads, and which permits the specification of Conditional Value-at-Risk requirements. We show that the modelling of price and load correlations is important and that our model yields higher expected return at a lower risk level than conventional approaches. We also derive insights from the perspective of competitive and risk averse players.

■ MA21

C-Room 205

Behavioral Decision Making

Sponsor: Decision Analysis
Sponsored Session

Chair: Manel Baucells, IESE, Avenida Pearson,21, Barcelona, Spain, MBaucells@iese.edu

1 - An Empirical Test of Gain-Loss Separability in Prospect Theory

Alex Markle, University of Chicago, 2958 N Clark St, Unit 3, Chicago, IL, 60657, United States, amarkle@chicagogsb.edu, George Wu

We investigate a basic premise of prospect theory, that the valuation of gains and losses is separable. In prospect theory, gain-loss separability implies that a mixed gamble is valued by summing the valuations of the gain and loss portions of that gamble. We demonstrate a systematic violation of the double matching axiom, an axiom that is necessary for gain-loss separability.

2 - Probability and Time Trade-off with Multiple Outcomes

Alessandra Cillo, ACillo@iese.edu, Manel Baucells

Previous work has introduced a preference model for simple lotteries in which both time and risk dimensions were fully integrated through the probability and time trade-off. In this paper we propose an extension of this work to multiple outcome lotteries with delay. More general measures of sensitivity to outcome magnitude, probability and time are also analyzed in the paper.

3 - Reference Point Formation Over Time: A Weighting Function Approach

Manel Baucells, IESE, Avenida Pearson,21, Barcelona, Spain, MBaucells@iese.edu

Our paper provides both a theoretical framework on reference point formation over time, based on cumulative prospect theory's inverse s-shaped weighting function, and a new experimental method for eliciting subjects' individual reference points in a finance context. Consistent with our model, we document our subjects' reference points to be best described by the first and the last price of the time series, with the equally weighted average and the highest price receiving smaller weights.

4 - Contingent Weighting of Time in Intertemporal Decisions Under Delay Uncertainty

Selcuk Onay, INSEAD, Blv de Constance, Fontainebleau, France, selcuk.onay@insead.edu

This paper investigates the choices between sooner-smaller and later-larger rewards under delay uncertainty. In five experiments, we find that people accord a smaller weight to the time dimension and, hence, they choose the LL-reward more often under uncertain delays than certain delays. In accord with our explanation, we also found that enhancing sensitivity to the time dimension diminishes the attractiveness of the LL-rewards more strongly under uncertain delays than under certain delays.

■ MA22

C-Room 206

An Interactive Panel/Audience Discussion: Operations Research in Engineering - Expectations for Junior Faculty

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Warren Powell, Professor, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, powell@princeton.edu

1 - An Interactive Panel/Audience Discussion: Operations Research in Engineering - Expectations for Junior Faculty

Moderator: Warren Powell, Professor, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, powell@princeton.edu, Panelist: Cynthia Barnhart, Mark Daskin, John Birge, Thomas Magnanti

In this interactive panel discussion, we will discuss the expectations that junior faculty in engineering schools face, and contrast these with the expectations of faculty in other engineering departments, as well as operations research faculty in business schools. The goal of the panel is to bring out differences in expectations and to compare traditional measures used in engineering to evaluate tenure cases to those used by other disciplines.

■ MA23

C-Room 208

Decisionmaking and Pricing

Sponsor: Behavioral Process Management (BPM)
Sponsored Session

Chair: Elena Katok, Associate Professor, Penn State University, 465 Business Building, Penn State University, University Park, PA, 16802, United States, ekatok@psu.edu

1 - Behavioral Product Quality Improvement

Gokhan Dogan, Massachusetts Institute of Technology, 30 Wadsworth Street E53-364, Cambridge, MA, 02142, United States, gdogan@MIT.EDU, Nelson Repenning

Product quality improvement process includes preventing potential problems or fixing existing ones. Using qualitative and quantitative data from a major manufacturer, we identify biases and heuristics that inhibit the effectiveness of the quality improvement process. We then test alternative policies for improvement with a simulation model.

2 - The Siren Call of Difficult Tasks: Some Experimental Findings

Enno Siemsen, Assistant Professor, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States, siemsen@uiuc.edu, Elena Katok

Theoretical research has established that autonomous agents can have a preference for difficult task solutions. Highly capable agents prefer somewhat more difficult solutions to simple solutions, in order to better establish their reputation. Less capable agents prefer highly difficult solutions to hide their lack of capability. We present results from a behavioral experiment testing this idea.

3 - Strategic Price Bundling in Competitive Markets: Complements, Substitutes, and Correlated Values

Cary Deck, University of Arkansas, 402 WCOB, Fayetteville, AR, 72701, United States, CDeck@walton.uark.edu, John Aloysius

We study how customer product valuation affects strategic mixed bundle pricing in competitive markets where a fraction of buyers comparison shop. The model allows for jointly distributed values where the super- or sub-additivity of the bundle (degree of substitutability or complementarity) is parameterized. Behavioral Study 1 manipulates bundle additivity and Study 2 varies value correlation. The impact of control variables on market outcomes is measured and the implications are discussed.

4 - A Behavioral Comparison of Scripted and Customized Service Delivery Processes Using Lab Experiments

Liana Victorino, PhD Candidate, University of Utah, David Eccles School of Business, 1645 E Campus Center Drive, Salt Lake City, UT, 84112, United States, liana.victorino@business.utah.edu, Rohit Verma

This study examines the use of scripted and customized service delivery approaches for face-to-face service encounters. A laboratory experiment using a series of video clips is conducted to explore the service quality, service design and operational performance effects of a standardized and customized approach to the service delivery process.

■ MA24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Vose Consulting US LLC - Building Sophisticated Risk Analysis Models with ModelRisk

Huybert Groenendaal, PhD, MBA, M.Sc., Partner, Vose Consulting, 2891 20th Street, Boulder, CO, 80304, Huybert@voseconsulting.com, Greg Nolder

ModelRisk for Insurance and Finance allows users to quickly build sophisticated probabilistic models in Excel without resorting to custom programming. The tool provides users easy access to advanced quantitative methods and techniques that were previously difficult or impossible to implement in a spreadsheet environment such as Copula correlations; aggregate distributions; fitting and simulating times series models including mean-reversion and GARCH; the use of distribution objects; and many others. Please stop by to pick up a trial copy and see a demonstration of ModelRisk.

2 - Palisade Corporation - @RISK 5.0 in Operations Research

David Doran, Palisade Corporation, 798 Cascadilla Street, Ithaca, NY, 14850, United States, ddoran@palisade.com

Palisade, a world leader in risk and decision analysis software for over 20 years, has just released an all-new version of its flagship risk analysis add-in to Microsoft Excel, @RISK 5.0. Using Monte Carlo simulation, @RISK 5.0 is used to solve a wide variety of operations research problems, from modeling cash flows of a new product to bidding models.

■ MA25

C-Room 210

The Pricing and Planning of Knowledge Based Services

Sponsor: Service Science
Sponsored Session

Chair: Emmanuel Fragniere, Professor, Haute Ecole de Gestion of Geneva, 7 route de Drize, Carouge, Ge, 1227, Switzerland, emmanuel.fragniere@hesge.ch

1 - Production System Dynamics Under the Control of Human Planners

Christoph Heitz, Professor, Zurich University of Applied Sciences, P.O. Box 805, Winterthur, 8401, Switzerland, htz@zhwin.ch, Tobias Roithner

We study the dynamics of a factory controlled by human production planners. We combine human behavior with basic factory dynamics in a simulation model. We find that human expert knowledge improves the performance for normal operating conditions, but may lead to instability and loss of control in overload situations.

2 - Collaboration and Joint Production in Services

Uday Karmarkar, Professor, Anderson School of Management at UCLA, 110 Westwood Plaza, P.O. Box 951481, Los Angeles, CA, 90095-1481, United States, uday.karmarkar@anderson.ucla.edu, Scott Carr, Guillaume Roels

Many services involve joint production or collaboration between the supplier and the customer, where the customer supplies inputs or effort to varying degrees. The management of joint production can pose problems because the objectives of customers and providers are quite different. We develop a framework for modeling and analyzing markets and contracts for joint production processes, and investigate the relationships to the principal-agent literature.

3 - The Concept of Shadow Price to Monetarize the Intangible Value of Expertise

Emmanuel Fragniere, Professor, Haute Ecole de Gestion of Geneva, 7 route de Drize, Carouge, Ge, 1227, Switzerland, emmanuel.fragniere@hesge.ch, Joelle Debely, Magali Dubosson, Francesco Moresino

The pricing of knowledge based services should be based on the 3 following components: the cost structure, the competition and the perceived value by the client. Practically, it is mainly based on the cost structure which does not account the real value provided to the client. Based on an integrated optimization model combining an aggregate planning model with a share of choice model, we produce implicit values of expertise. Preliminary results will be presented about a travel agency.

4 - Innovation Mechanisms in Knowledge Based Services

Hervé Mathe, Professor, ESSEC, BP 50105, Cergy Pontoise Cedex, 95021, France, hpmathe@yahoo.com

This paper introduces a typology of innovation mechanisms in knowledge based service firms. Based on the results of an empirical investigation, each identified generic situation may be characterized by the following components: - a specific set of processes aimed at generating and appraising new service concepts, - an organizational posture defining how players interact and coordinate their efforts, and - a code of relationships within the business ecosystem involved in the innovative process.

■ MA26

C-Room 211

Applications of Functional Data Mining

Sponsor: Data Mining (Sponsored)
Sponsored Session

Chair: Seoung Bum Kim, Assistant Professor, University of Texas at Arlington, 420K Woolf Hall, Arlington, TX, 76001, United States, sbkim@uta.edu

1 - Spatio-temporal Analysis for Ozone Concentration

Chivalai Temiyasathit, PhD Student, University of Texas at Arlington, P.O. Box 19017, Arlington, TX, 76019, United States, chivalai.temiyasathit@uta.edu, Seoung Bum Kim

Numerous statistical methods for air pollution modeling have been developed over the past decades. The main purpose of this study is to impute missing values, followed by forecast the pollutants concentration by taken into account both spatial and temporal variability. Our approach was applied to the ozone dataset in Dallas-Fort Worth area. The study reveals that our model can nicely incorporate spatial and temporal variability to facilitate the imputation and forecasting process.

2 - Identification of Major Metabolite Features in High-resolution NMR Spectra

Yajun Mei, Assistant Professor, Georgia Institute of Technology, School of Industrial and Systems Enginee, Groseclose 0205, Room 343, Atlanta, GA, 30332, United States, yajun.mei@isye.gatech.edu, Seoung Bum Kim, Kwok-Leung Tsui

In this talk, we will discuss the feature selection in a real metabolomic data set. There are two kinds of correlations in this data set: the correlation between different observations (NMR spectra) due to the repeated measure, and the local correlation between different chemical features within observations (NMR spectra). To take into account both correlations, we propose to combine longitudinal data analysis with multiple testing procedures to select significant metabolite features.

3 - Statistically Mining the Environmental Impact of Airport Deicing Activities

Huiyuan Fan, PhD Student, University of Texas at Arlington, IMSE Department, 420 Woolf Hall, Box 19017, UTA, Arlington, TX, 76019, United States, hyfan@uta.edu, Jay Rosenberger, Seoung Bum Kim, Victoria Chen, Dan Bergman

Deicing fluids can lead to increased bacterial growth in the receiving waters and reduced dissolved oxygen. This research studies the impact of deicing activities at DFW International Airport on its receiving water systems. The dissolved oxygen and chemical oxygen demand in the airport receiving waters during some deicing seasons were statistically analyzed. Decision tree models were developed to determine important explanatory variables to predict dissolved oxygen and chemical oxygen demand.

4 - Copula Based Independent Component Analysis

Kobi Abayomi, Visiting Assistant Professor, Duke University, Department Of Statistics, Durham, NC, 27707, United States, kaa71@columbia.edu

We propose a parametric version of Independent Component Analysis (ICA) via Copulas - families of multivariate distributions that join univariate margins to multivariate distributions. Our procedure exploits the role for copula models in information theory and offers a unified view of component analysis procedures, in particular, by parameterizing multivariate dependence.

■ MA27

C-Room 212

Data Mining and Information Privacy

Cluster: Data Mining (Invited)
Invited Session

Chair: Xiaobai (Bob) Li, College of Management, University of Massachusetts Lowell, One University Ave., Lowell, MA, 01854, United States, xiaobai_li@uml.edu

1 - Privacy Preserving Optimization
Ram Gopal, Professor, University of Connecticut, OPIM Department, School of Business, Storrs, CT, 06269, United States, Ram.Gopal@business.uconn.edu

We develop protocols that can help participants maximize a joint objective function in an environment where participants do not trust each other. Our protocol can help participants in optimally solving many traditional optimization problems in a privacy preserving manner. We also analyze our protocols against various types of threats including malicious participants.

2 - An Approximation Algorithm for the Frequent Itemset Hiding Problem
Sumitra Mukherjee, Nova Southeastern University, Grad School of Computer & Information Sc, Fort Lauderdale, FL, 33314, United States, sumitra@nova.edu, Michael Laszlo

The frequent itemset hiding problem, in data mining, involves sanitizing transactions so that sensitive itemsets are hidden, while minimizing the number of nonsensitive itemsets hidden. We present and analyze an approximation algorithm for this problem, based on the local ratio framework.

3 - Preserving Privacy When Sharing Distributed Transactional Data
Jing Hao, University of Texas at Dallas, 2601 N. Floyd Rd., SM 33, Richardson, TX, jhao@utdallas.edu, Sumit Sarkar, Syam Menon

Preserving privacy when sharing data has become an important issue. For transactional data privacy is typically preserved by hiding sensitive patterns. Often the shared data is distributed and the owner must hide the patterns in consolidated database and within each partition. We present an IP formulation for minimizing data distortion while hiding all patterns. For problems not solvable to optimality, we propose three procedures to decompose the problem into a series of sub-problems.

4 - Data Sharing, Information Privacy and Incentive-compatibility
Xiaobai (Bob) Li, College of Management, University of Massachusetts Lowell, One University Ave., Lowell, MA, 01854, United States, xiaobai_li@uml.edu

We analyze the conflict between data gathering/usage and information privacy using a game-theoretic approach. An incentive-compatible mechanism is developed for sharing/disseminating confidential data.

■ MA28

C-Room 213

Metaheuristics for Hard Discrete Optimization

Cluster: Joint Cluster Metaheuristics/ ICS: Metaheuristics
Invited Session

Chair: Sergiy Butenko, Industrial and Systems Engineering, Texas A&M University, College Station, TX, butenko@tamu.edu

1 - GRASP with Path-relinking for Network Migration Scheduling
Mauricio G. C. Resende, Lead Member of Technical Staff, AT&T Labs Research, 180 Park Avenue, Room C241, Florham Park, NJ, 07932, United States, mgcr@research.att.com, Diogo V. Andrade

Network migration occurs when inter-nodal traffic from an outdated network is migrated to a new network. When a node is migrated, one or more temporary arcs may need to be set up since the node migrated may be adjacent to more than one still active node in the old network. One seeks an ordering of the migration of the nodes that minimizes the maximum sum of capacities of the temporary arcs. We propose a hybrid heuristic which combines GRASP with path-relinking for this problem.

2 - A Path Relinking Algorithm with Ejection Chains for the Quadratic Assignment Problem
Tabitha James, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, tajames@vt.edu, Fred Glover, Cesar Rego

In a recent study we demonstrated the superiority of ejection chain (EC) methods over state-of-the-art very large scale neighborhood algorithms (VLSN) for the QAP. In addition, a path-relinking (PR) approach with simple neighborhood search has proved very effective in solving classical instances from QAPLIB. In the present study, we introduce a specialized approach that combines PR with EC neighborhoods for the solution of large QAP instances.

3 - Solving Max-Cut Problem Using Global Equilibrium Search Techniques
Shylo Oleg, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, shylo@ufl.edu

An efficient application of Global Equilibrium Search for Max-Cut problem is discussed.

■ MA29

C-Room 214

Open Source MIP Solvers

Sponsor: INFORMS Computing Society/ICS/COIN-OR
Sponsored Session

Chair: Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, tkralphs@lehigh.edu

1 - The Design and Implementation of BLIS
Yan Xu, Optimization Developer, SAS Institute Inc, yax2@lehigh.edu, Laszlo Ladanyi, Ted Ralphs, Matthew Saltzman

BLIS is one the libraried in COPS, which is a framework for implementing parallel algorithms based on tree search. BLIS is the layer for solving mixed-integer linear programs (MIPs) in parallel or sequential. We will give an overveiw of design and implementation BLIS and also present some computational results of solving MIPs and the vehicle routing problem.

2 - The Symphony Callable Library
Menal Guzelsoy, Lehigh University, 200 West Packer Ave, Room 362, Bethlehem, PA, 18015, United States, megb@lehigh.edu, Ted Ralphs

SYMPHONY is an open source callable library for solving mixed integer linear programs. It is fully customizable through user-callback functions, a large assortment of parameter settings and compile time options and can be run on a variety of architectures including parallel environments. In this talk, we will give an overview of SYMPHONY and its advanced features such as the ability to solve bicriteria MILPs and to warm start the solution procedure.

3 - SCIP - A Framework for Constraint Integer Programming
Tobias Achterberg, PhD, ILOG, Ober-Eschbacher Strasse 109, Bad Homburg, 61352, Germany, tachterberg@ilog.de

SCIP integrates techniques from MIP, CP, and SAT to solve constraint integer programs. User plugins can provide additional functionality like new constraint types, cut separators, or branching rules. All plugins needed to solve MIPs are included in the distribution. SCIP is available in source code and free for academic and non-commercial use. We give an overview of the software and present benchmark results.

4 - And Two More ...
Lou Hafer, Simon Fraser University, Computing Science, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, lou@cs.sfu.ca

Previous talks in this session have discussed individual MIP solvers (BLIS, SYMPHONY, SCIP). This talk will consider two more solvers, cbc (from COIN-OR) and glpk (from the GNU Linear Programming Kit). The emphasis will be on usability (installation, interfaces, user and developer documentation, performance), with a quick tour of the underlying algorithms.

■ MA30

C-Room 2A

Naval Research Logistics/Quality, Statistics and Reliability Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Barry L Nelson, Professor, Northwestern University, Department of Ind. Eng. & Mgmt. Sci., 2145 Sheridan Road, Evanston, IL, 60208, United States, nelsonb@northwestern.edu

1 - X-Bar and R Control Charts for Long-tailed Symmetrical Distributions
Pandu Tadikamalla, Professor, University of Pittsburgh, KGSB-Business Admin, Pittsburgh, PA, 15260, United States, pandu@pitt.edu, Mihai Banciu, Dana Popescu

This paper proposes a kurtosis correction (KC) method for constructing the X-bar and R control charts for symmetrical long-tailed distributions. These charts are similar to the traditional Shewhart control charts, and are derived based on the degree of kurtosis estimated from the actual (subgroup) data. In a subsequent paper, we also propose a range quantile approximation (RQA) method for the R charts, and provide the tables for the R chart constants for the leptokurtic and normal distributions.

2 - Optimal Sample Size Allocation for Multi-stress Tests Using Extreme Value Regression

Hon Keung Tony Ng, Assistant Professor, Southern Methodist University, Department of Statistical Science, 3225 Daniel Avenue, Dallas, TX, 75275, United States, ngh@mail.smu.edu, Ping Shing Chan, N. Balakrishnan

The optimal sample size allocation in a multi-group life-testing experiment with complete or Type-II censored samples when the extreme value regression model is used for statistical analysis will be discussed. We will derive the maximum likelihood estimators (MLEs), expected Fisher information and the asymptotic variance-covariance matrix of the MLEs. Three optimality criteria and different settings will be introduced and some numerical results of the optimality allocations will be presented.

3 - One-bug-look-ahead Policies and Beyond

Xiaoyue Jiang, Assistant Professor, Louisiana State University, Department of Construction Management, and Industrial Engineering, Baton Rouge, LA, 70803, United States, jiang@lsu.edu, Thomas Ray, Donglei Du

The OLA policy for software releasing is re-examined in Nav Res Logist 54 (2007): 346–355. A counterexample is constructed to show that OLA is not optimal in general. The optimal stopping approach is then called upon to prove that OLA possesses a weaker sense of optimality under conditional monotonicity and the strong sense of optimality holds under a more restrictive sample-wise monotonicity condition. A further derivation of the optimal policy under conditional monotonicity is presented here.

■ MA31

C-Room 2B

Joint Session QSR/HAS/Sevice: Quality and Statistical Decision-making in Healthcare Applications III

Sponsor: Quality, Statistics and Reliability, Health Applications Section, Service Science
Sponsored Session

Chair: Jing Li, Arizona State University, Tempe, AZ, United States, jinglz@umich.edu

Co-Chair: Julie Simmons Ivy, jsimmons@bus.umich.edu

1 - Improving Mass Vaccination Clinic Operations

Jeffrey W. Herrmann, Associate Professor, University of Maryland, Dept.. of Mechanical Engineering, College Park, MD, United States, jwh2@umd.edu

This research has created mathematical and simulation models of mass dispensing and vaccination clinics and implemented these in decision support tools to help emergency preparedness planners design clinics that have enough capacity to serve residents quickly while avoiding unnecessary congestion. This has led to new queueing system approximations for estimating the performance of workstations with batch arrivals, workstations with batch processes, and self-service workstations.

2 - Interpreting Laboratory Test Results as a Dynamic Model

Jose Zayas-Castro, Professor & Chair, University of South Florida, 4202 E Fowler Avenue, Industrial Engineering Department, Tampa, FL, 33620, United States, josezaya@eng.usf.edu, Alcides Santander-Mercado

It is estimated that diagnostic laboratory and imaging procedures is a major source of healthcare costs in US. This research is to develop a dynamic model to detect relationships between laboratory test components over time. The goal is assist doctors in deciding what type of treatment to prescribe.

3 - The Effects of Lead Time and Prior Patient Behavior in Predicting Attendance at Outpatient Clinics

John Norris, Purdue University, Krannert Graduate School of Management, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, norrisjb@purdue.edu, Suresh Chand, Deanna Willis, Herb Moskowitz

This paper provides an empirical analysis with newly acquired scheduling data on patient attendance with three discrete patient outcomes; Arrival, Cancellation, and No-Show. Results focus on how shorter lead times (call appointment intervals) and prior patient attendance behavior explain patient attendance. Removing access barriers may reduce waste of missed appointments.

4 - Simulation for Syndromic Surveillance

Thomas Lotze, University of Maryland, Applied Math and Scientific Computation, College Park, MD, 20742, United States, lotze@math.umd.edu, Galit Shmueli

We describe a method for simulating daily counts from multivariate syndromic timeseries with a specified statistical structure, including autocorrelation, covariance, day-of-week, and seasonality. The method can also mimic an existing syndromic dataset, thereby creating new datasets with the same statistical properties but no privacy concerns. Methods for outbreak simulation are also considered.

■ MA33

C-Room 303

Containerization Mini Cluster: Overview and History of Containerization

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ernest Koenigsberg, University of California at Berkeley, W A Haas School of Business, Berkeley, CA, 94115, United States, ekoenigsb@aol.com

1 - A Brief History of OR/MS in the Development of Containerization

Ernest Koenigsberg, University of California at Berkeley, W A Haas School of Business, Berkeley, CA, 94115, United States, ekoenigsb@aol.com

Fifty to sixty years ago the concept of containerization was ready to be developed into the reality we know today. It took leadership, analysis, and technology to make it happen. We briefly review the history of containerization and note the role that OR/MS played in it. OR was essential in determining such factors as the size and speed of the ships, the size of the fleet, the dimensions of the containers, and the equipment used in terminals and the method of operation of the container terminals. Progress in OR models and techniques has matched the growth of intermodal transportation.

2 - The Role of Research in Containerization at Matson

Lloyd Yates, Consultant, 200 Molino Avenue, Mill Valley, CA, 94941, United States, macyates1@mac.com

The Research Department established by Matson Navigation in 1956 was the first among steamship companies. The initial objective of the research program was to evaluate the economic potential of containerizing cargo in their West Coast – Hawaii service. After detailed study the Research Department recommended a two-phase implementation and projected high financial returns. In 1957 the Matson Board of Directors approved implementing the first phase. The first vessel sailed with containers in August 1958. Resounding success of the pioneering effort in Pacific cargo transportation led to a program to fully convert all containerizable cargo to containers. This summary will also report on initial efforts of other US flag carriers in the US and world markets.

3 - Critical Regulatory Changes Made and Rejected that Supported Containerization of Ocean Intermodal Traffic

Bertram E. Rifas, Director of Operations Research for Pacific Intermountain Express Company, Oakland, CA, bertramrifas@rcfn.com

It is an irony of political philosophy that the most highly regulated industry in the United States was the source for a worldwide technical revolution in the industry. That industry is the domestic maritime trade and the domestic overland rail and highway transportation trade. Even the intermodal ports were highly regulated. The most persistent constraints involved the eight foot wide vehicle Operations research in overland transportation helped reduce constraints among the states, cities, and national regulatory agencies. Examples are given.

4 - A Survey on Container Terminal Operations and Operations Research

Stefan Voss, University of Hamburg (IWI), Institute of Information Systems, Von-Melle-Park 5, Hamburg, DE, 20146, Germany, stefan.voss@uni-hamburg.de, Robert Stahlbock

Increasing containerization and competition among seaport container terminals have become quite remarkable. Operations are nowadays unthinkable without effective and efficient IT use and appropriate optimization (operations research) methods. We describe and classify the main logistics processes and operations in container terminals and present a survey of methods for their optimization.

■ MA34

C-Room 304

Location Analysis and Routing

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Wooseung Jang, University of Missouri - Columbia, E3437 Lafferre Hall, Columbia, MO, United States, jangw@missouri.edu

1 - An Integrated Systems Approach to the Development of Winter Maintenance Systems

Wooseung Jang, University of Missouri - Columbia, E3437 Lafferre Hall, Columbia, MO, United States, jangw@missouri.edu, Cerry Klein, James Noble

Winter road maintenance operations require many complex strategic and operational decisions. This research presents a systematic, heuristic-based optimization approach to integrate planning decisions for depot location, sector design, vehicle route design, vehicle scheduling, and fleet configuration. The approach is illustrated through a rural transportation network in Boone County, Missouri.

2 - Inventory Allocation in a Non-Profit Distribution System
Robert Lien, Northwestern University, robertlien@northwestern.edu, Karen Smilowitz, Seyed Iravani

Customer demands are observed as they are visited along a delivery route. The inventory allocation decision is made to optimize a fill-rate objective which serves to give equitable distribution to all customers on the route. We characterize the optimal solution as well as develop and analyze heuristics. In addition we study the effect of different sequencing of customers.

3 - Solving Integrated Location, Routing and Scheduling Problems
Zeliha Akca, Lehigh University, Industrial and Systems Engineering, Bethlehem, PA, United States, zelihaakca@lehigh.edu, Rosemary Berger

We discuss solution methods for optimization models that integrate facility location, vehicle routing, and scheduling decisions. A two-phase branch, cut, and price algorithm for instances with capacitated facilities and capacity- and time-limited vehicle routes and schedules will be described. The talk will cover heuristics for determining initial upper bounds, methods for generating violated valid inequalities, and various heuristic and exact column-generation algorithms.

4 - Large-scale Contiguous Geographic Clustering
Ahmad Jarrah, Assistant Professor, Department of Management & Marketing, College of Business, University of Wyoming, Laramie, WY, 82072, United States, jarrah@uwyo.edu, Jonathan Bard

The focus of this problem class is that of partitioning a region into geographically contiguous sub-areas while optimizing an objective measure and adhering to capacity constraints. The motivating application is that of large pickup-and-delivery networks involving thousands of loads each day. Modeling paradigms, solution schemes and computational experiences are discussed.

■ MA35

C-Room 305

Facility Logistics III

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Sunderesh Heragu, Professor and Duthie Chair in Engineering Logistics, University of Louisville, Room 309, JB Speed Building, Department of Industrial Engineering, Louisville, KY, 40292, United States, s.heragu@louisville.edu

1 - Allocation of Trucking Requirements to Carriers
Xu Yang, Graduate Research Assistant, University of Louisville, 305, JB Speed Bldg, Louisville, KY, 40292, United States, x0yang07@louisville.edu, Sunderesh Heragu, Gerald Evans

Several linear programming models were formulated to aid a leading multinational company in the allocation of their trucking requirements among various carriers. Each of the models determined the number of trips assigned to each carrier on each shipping lane in order to minimize total shipping costs.

2 - Continuing the Saga: A Top-down, Sequence-pair Formulation for the Facility Layout Problem
Russell Meller, Hefley Professor of Logistics, University of Arkansas, Center for Engr Logistics and Distrb., 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, rmeller@uark.edu, Zeynep Kirkizoglu

This talk concerns the facility layout problem, which is an extremely difficult optimization problem. We discuss two recent modeling efforts, a top-down approach to facility layout and the sequence-pair representation, and combine them into a new model. Unfortunately, the saga continues in that the new model is still an extremely difficult optimization problem. However, we are able to provide evidence of why the top-down model, rather than the traditional, bottom-up model, is the one to use.

3 - Web Interface for AS/RS Design Conceptualization
Cai Xiao, Graduate student, University of Louisville, JB Speed Building, Department of Industrial Engineering, Louisville, KY, 40292, United States, x0cai001@louisville.edu

A platform of conceptualization tools for the design of Autonomous Vehicle Storage and Retrieval Systems (AVSRS) and Automated Storage and Retrieval Systems (AS/RS) has been developed. For each design entered by a system designer, the software provides approximate estimates and key performance measures, thus allowing a comaprison of alternate design configurations.

■ MA36

C-Room 306

Emergency Response and Relief Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Elise Miller-Hooks, Associate Professor, University of Maryland, Department of Civil & Environmental Eng., 1173 Glenn Martin Hall, College Park, MD, 20742, United States, elisemh@umd.edu

1 - Planning for Disruptions: Pre-positing of Supplies for Disasters
Wilfredo Yushimito, Graduate Student, Rensselaer Polytechnic Institute, 5308 Jonsson Engineering Center, Department of Civil and Env. Eng., Troy, NY, 12180, United States, yushiw@rpi.edu, Satish Ukkusuri

Very little can be done after a disruption occurs, hence, it is important to account these possible events since the design phase. In this paper, we model the pre-positioning of supplies for disasters as a reliable facility location model identifying optimal locations for warehousing inventories for initial deployment of aid, trying to assure maximal and fair coverage and accounting for possible disruptions in the supply chain.

2 - Incorporating Behavior in Decentralized Facility Location Problems
Jessica Heier, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, jheier@isye.gatech.edu, Ozlem Ergun, Julie Swann

We study facility location problems motivated by emergency response scenarios, such as anti-viral distribution during a flu pandemic. In these problems, decentralized users choose among the facilities opened by a centralized planner. Our models incorporate user behavior in facility location decisions. We demonstrate that the impact of failure to account for user behavior is substantial and show that providing incentives and information can improve the performance of decentralized systems.

3 - Modeling Survivability for Emergency Medical Service Systems
Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W Main Street, Richmond, VA, 23284, United States, lamclay@vcu.edu, Jason Merrick

Recent medical studies indicate that traditional approaches for managing and modeling emergency medical service systems do not maximize survivability for out-of-hospital cardiac arrests. This presentation explores issues for modeling patient survivability, and explicitly ties logistical issues of locating emergency medical service vehicles to patient outcomes.

4 - Solution Methods for Pre-positioning of Emergency Supplies Under Uncertainty
Mark Turnquist, mat14@cornell.edu, Carmen Rawls

We describe two solution algorithms for a two-stage stochastic optimization model that determines locations and quantities of emergency supplies to be pre-positioned in anticipation of potential natural disasters – an exact method based on the L-shaped method for integer stochastic programs and a heuristic based on an approximation method for the second-stage objective function. The solution quality and computational effort are compared in a case study based on the southeastern U.S.

■ MA37

C-Room 307

PHM Methods and Applications

Sponsor: Military Applications
Sponsored Session

Chair: Daniel Briand, Sandia National Laboratories, P.O. Box 5800 MS 1011, Albuquerque, NM, 87185, United States, dbriand@sandia.gov

1 - PHM System Components and Applications
Robert Cranwell, Sandia National Laboratories, P.O. Box 5800 MS 1011, Albuquerque, NM, United States, rmcranw@sandia.gov

Prognostic and Health Management (PHM) systems are being developed at an increased rate due to potential cost savings and DoD mandates. A capable PHM system should be able to predict component failure far enough in advance to allow the modification of operations and maintenance schedules so that downtime and costs can be minimized. This presentation will provide an overview and representative applications of the three general areas of a PHM system: data, evidence, and consequence analysis.

2 - Modeling the Application of Prognostics and Health Management in Large-scale Logistic Simulations
Kimberly Welch, Sandia National Labs, P.O. Box 5800 MS 1011, Albuquerque, 87185, United States, kmwelch@sandia.gov

Prognostics is a growing concept in system design and is a requirement for military systems, such as the JSF F-35 Fighter Jet and the Future Combat Systems. Algorithms have been developed by SNL in order to model the effects of prognostics in large-scale reliability and logistics simulations. These prediction algorithms allow for an intelligent response to preventative maintenance concepts. Two different modeling approaches were developed and will be discussed along with results.

3 - MEMS-based Prognostic & Health Management Solution for Internal Combustion Engines
Kelly Lowder, Mathematician, Sandia National Laboratories, P.O. Box 5800, MS 1011, Albuquerque, NM, 87185, United States, kslowde@sandia.gov, Stephen Martin, Justin Ford, Vince Hietala, Clint Furrer

First year results are presented of research to develop hardware and software to support time-to-failure (TTF) predictions for internal combustion engines. A long-life battery-powered sensor wireless relays vibration measurements and in-situ IR spectroscopy on oil. Novel algorithms use the combined sensor info to determine point estimates and uncertainty bounds for TTF and probabilistic estimates of likely failure modes. A highly reliable monolithic silicon end-state is sought.

4 - Flowgraph Models for PHM in Complex Systems
Aparna Huzurbazar, Technical Staff Member, Los Alamos National Laboratory, P.O. Box 1663, MS-F600, Los Alamos, NM, 87545, United States, aparna@stat.unm.edu, Valerie Peters

Flowgraph models are especially useful for analyzing time-to-event data. In recent years, they have been used in system reliability and prediction for complex systems. Prognostics and Health Management (PHM) is increasingly important in today's complex systems. PHM is the capability to make decisions about maintenance, based on prognostics information, resources, and operational conditions. We will provide an introduction to flowgraph models and discuss their applicability as a PHM tool.

■ MA38

C-Room 308

INFORMS Communities/Subdivisions Session on INFORMS Web Pages

Cluster: INFORMS Communities/Subdivisions
Invited Session

Chair: Barry List, INFORMS, Director of Communications, Barry.List@INFORMS.org,

Co-Chair: Mary Magrogan, INFORMS, Director of Subdivision Services, Mary.Magrogan@INFORMS.org

1 - INFORMS Communities/Subdivisions Session on INFORMS Web Pages
Barry List, INFORMS, Director of Communications, Barry.List@INFORMS.org, Mary Magrogan, Shirley Mohr

A special training session that introduces webmasters for INFORMS societies, fora, chapters, and student chapters to the Content Management System (CMS) that INFORMS uses to update web pages. Session includes background on how INFORMS creates web pages in CMS and how webmasters can easily make changes to their websites.

■ MA39

C-Room 309

Resource Scheduling and Allocation Problems in Healthcare

Sponsor: Health Applications Section
Sponsored Session

Chair: Amy Cohn, Assistant Professor, University of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, amycohn@umich.edu

1 - Constructing OnCall Schedules for Medical Residents
Amy Cohn, Assistant Professor, University of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, amycohn@umich.edu, Joseph Norman

Over the course of a year, medical residents need to complete several on-call shifts both to satisfy educational requirements and also to meet staffing needs at the hospital. We discuss the complexity of this problem, particularly associated with defining a measurable objective function, and present a solution methodology and real-world results from a major teaching hospital.

2 - Approximate Dynamic Programming for Dynamic Ambulance Deployment
Huseyin Topaloglu, Cornell University, Rhodes Hall, Ithaca, NY, United States, ht88@cornell.edu, Shane Henderson, Mateo Restrepo

We present algorithms for repositioning ambulances in an emergency medical service system. Our approach is based on approximating the value functions in the dynamic programming formulation of the problem, and using simulation- and regression-based techniques to fine-tune the approximations.

3 - A Heuristic Procedure for Optimal Open Access Scheduling Templates
Xiuli Qu, Assistant Professor, North Carolina A&T State University, 1601 E. Market Street, 424 McNair Hall, Greensboro, NC, 27411, United States, qu@ecn.purdue.edu, Ronald Rardin, Julie Ann Williams

The purpose of open access scheduling is to improve the accessibility to outpatient clinics and reduce patient no shows. In this talk, we formulate a stochastic integer programming (SIP) model to determine an optimal provider scheduling template, and then develop a procedure to search a heuristic optimal solution to the SIP model. Our sensitivity analysis results show that heuristic optimal scheduling templates are sensitive to the cost coefficients and the no-show rates.

4 - The Impact of Hospital Mutual Aid Agreements on Emergency Stockpiling
Po-Ching DeLaurentis, Purdue University, 315 N. Grant St., West Lafayette, IN, United States, chenp@purdue.edu, Dulcy Abraham, Mark Lawley

Our research analytically tests the hypothesis that aggregating hospital inventories through a mutual aid agreement mechanism in a pandemic influenza scenario can lower the probability of short-term stock-out among the participating facilities. Furthermore, this work will focus on finding the optimal stockpile levels and ordering policies of a single critical item in individual hospitals with minimum or minimum acceptable shortage.

■ MA40

C-Room 310

Health Care Operations Management I

Sponsor: Health Applications Section
Sponsored Session

Chair: Xuanming Su, University of California, Haas School of Business, Berkeley, 94720, United States, xuanming@haas.berkeley.edu

1 - Selfish Drug Allocation for Containing an International Influenza Pandemic
Francis de Vericourt, Professor, European School of Management and Technology, devericourt@esmt.org, Peng Sun

Recent epidemiological studies suggest the prophylactic use of antiviral drugs or imperfect vaccines to slow down an influenza epidemic, which gives rise to a game where each country allocates its stockpile in order to protect its own population. We develop a Reed-Frost model for an epidemic at its onset, and show that the underlying game is supermodular and a unique Pareto optimal Nash equilibrium exists. We also provide results for the optimal centralized solution.

2 - Scaling up HIV Treatment in Resource Constrained Settings
Sarang Deo, Kellogg School of Management, 596 Leverone, 2001 Sheridan Road, Evanston, IL, 60208, United States, 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 stochastic dynamic program, derive the optimal policy for the number of new enrollments and compare its performance with that of policies used in practice. We discuss the relevance of our model to the resource allocation decision in non-profits.

3 - A Dynamic Two-stage Model of HIV Transmission in MSM for Policy Evaluation
Maria Vlasiou, Research Engineer II, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, vlasiou@gatech.edu, Paul Griffin, Tom Gift, Julie Swann

The role of bathhouses and sex clubs in HIV transmission is a cause of concern. We present a dynamic HIV epidemic transmission model that includes the acute and chronic stages of HIV and parameters for two interacting populations with different characteristics. We use data from the 1997 Urban Men's Health Study as parameters for the model to study the role that bathhouses and sex clubs play in the epidemic, and we discuss the effects of various policies regarding bathhouses.

4 - Evidence-based Incentiveneering for a Healthcare Delivery System

Donald Lee, Stanford University, Terman Engineering Center #494, Stanford, CA, 94305, United States, dklee@stanford.edu, Stefanos Zenios

How should shareholders pay a CEO for stock performance? What strategies can a casino use to retain player loyalty? What's the best way to pay a healthcare provider for patient outcomes? Incentive issues in OM are traditionally analyzed using principal-agent models, but these are impractical because some required components (e.g. agent cost function) are rarely ever known. This talk introduces a practical, data-driven remedy that will be applied to Medicare's dialysis payment system.

■ MA41

C-Room 3A

Joint Session HAS/ICS: Optimization in Medicine and Biology

Sponsor: Health Applications Section, INFORMS Computing Society
Sponsored Session

Chair: Gino Lim, University of Houston, 4800 Calhoun Rd, E211 Engr. Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu

1 - Making High Quality Clinical Decisions: Influence Diagrams for Cost-effectiveness Analysis

Ram Duriseti, Clinical Assistant Professor, Stanford University, 1890 Oak Knoll Lane, Menlo Park, CA, 94025, United States, ram1@stanford.edu

Medical decisions involve the interplay of many probabilistic variables, and decision alternatives with disparate outcomes, making model design and implementation difficult. Structural conditions on the ID related to d-separation can determine if a variable's presence or absence will impact the scope and/or the normative results of the model. We demonstrate the impact of these conditions by constructing two versions of a decision model for the diagnosis of pulmonary embolism.

2 - Iterative Solution Methods for Beam Angle and Fluence Map Optimization in IMRT Planning

Gino Lim, University of Houston, 4800 Calhoun Rd, E211 Engr. Bldg 2, Houston, TX, 77204, United States, ginolim@uh.edu, Jaewon Choi

We present computational approaches for optimizing beam angles and fluence maps in Intensity Modulated Radiation Therapy (IMRT) planning. A MIP model and an LP model are used to find an optimal set of beam angles and their corresponding fluence maps. We introduce iterative beam angle elimination algorithms in which an insignificant beam angle is eliminated in each iteration. Experiments show the computational advantage of the iterative methods of this approach.

3 - Integer Programming Models for DNA Sequencing Problems

Kapil Gupta, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, kgupta@isye.gatech.edu, Eva K. Lee

Recent years have witnessed a large number of innovations in the field of bioinformatics, as exemplified by the Human Genome Project. Consequently, the rapid increase in the amount of sequence data requires efficient algorithms to analyze and make important discoveries in this exciting field. The talk will present Integer Programming models to address this need. Computational results on large-scale sequence analysis problems will be provided to demonstrate the robustness of proposed methodology.

■ MA42

C-Room 3B

Cancer Therapeutics

Cluster: Operations Research in Medicine and Health Care
Invited Session

Chair: Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Strong Relaxations for Fluence Map Optimization Under Dose-volume Restrictions

Ronald Rardin, White Chair and Distinguished Professor, University of Arkansas, Ctr for Innov in Healthcare Logistics, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, rrardin@uark.edu, Mark Langer, Jean-Philippe Richard, Ali Tuncel

In radiation therapy planning, the fluence map optimization problem (FMOP) aims to optimally adjust beam/beamlet intensities to control dose distributions over various tissues. When subject to dose-volume restrictions, FMOP becomes NP-Hard and is typically formulated as a MILP. We show how this problem can be expressed as a disjunctive program, present new linear programming relaxations strengthened with valid inequalities, and report computational results.

2 - Incorporating Biological Objectives Within Cancer Treatment and Analysis of Dose Escalation Effect

Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Tsung-Lin Wu, Kyungduck Cha

MRS can identify regions of the diseased organ that have denser populations of tumor cells. This talk focuses on our research effort in registering tumor cell spatial information from MRS images to treatment images (Ultrasound/CT), the design of a computerized planning system capable of generating treatment plans with localized hot spots in identifiable tumor regions while maintaining minimal dose to critical and normal tissue, and the potential improvement in tumor control probability.

3 - Treatment Planning for Radiofrequency Ablation of Liver Tumors

Ariela Sofer, George Mason University, asofer@gmu.edu

In radiofrequency ablation, one or more needles are placed at the tumor site and generate heat. Temperatures above 50 Celsius kill tissue. Treatment planning determines the number of needles and their positions to kill the tumor and limit damage to vital tissue. We discuss solution approaches to the problem.

■ MA43

S-Grand Ball. A (Lev. 2)

GE Financial Engineering and Portfolio Analytics

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Andrew Barnes, Researcher, Quantitative Methods, General Electric Global Research, 1 Research Circle, Room K14A58, Niskayuna, NY, 12309, United States, barnesa@research.ge.com

1 - A Sequential Linear Programming Algorithm for Portfolio Optimization

Srinivas Bollapragada, GE Global Research Center, 1 Research Circle, Schenectady, NY, United States, bollapragada@research.ge.com, Kete Chalermkraivuth

In asset-liability management (ALM) situations, portfolio managers attempt to maximize return and minimize risk while matching the risk characteristics of assets with those of the liabilities. The ALM problem can be formulated as a traditional Markowitz model with side constraints. For real world problems with thousands of assets, it is not possible to generate the portfolio efficient frontier in a reasonable time. We developed and patented a novel, sequential linear programming algorithm that can generate the efficient frontier for real world problems in a few minutes. Our algorithm is currently being used to manage assets worth over $80 billion.

2 - A Robust Optimization Technique for an Integer-programming Problem With Uncertain Cost Coefficients

Jayanth Marasanapalle, GE India Technology Center, Plot #122, Export Promotion Industrial P, Phase 2, Hoodi Village, Whitefield Road, Bangalore, KT, 560066, India, jayanth.marasanapalle1@ge.com, Jitendra Kachhawa

Dealing with uncertain data in Optimization problems has been an important concern for researchers. Uncertainty in data occurs due to many reasons, one of them being that the data comes from a prediction model. We consider an integer-programming problem with uncertain cost coefficients, where the coefficients come from a prediction model. We propose a robust formulation, which uses simulated values of the cost coefficients, to optimize for the near worst-value of the objective function.

3 - Efficient Estimation of Portfolio Credit Risk Without Monte Carlo Simulation

Andrew Barnes, Researcher, Quantitative Methods, General Electric Global Research, 1 Research Circle, Room K14A58, Niskayuna, NY, 12309, United States, barnesa@research.ge.com

Monte Carlo simulation has become a de facto standard for a large variety of financial simulations. We show that the problem of computing the credit risk loss distribution of a portfolio of loans is amenable to a more efficient probabalistic treatment than that offered by Monte Carlo simulation. Besides reducing computation time, this approach has the following advantages: (1) It clarifies the structure of complex portfolio credit risk models by focusing attention on the most significant drivers, while ignoring effects that merely contribute to noise. (2) There is a considerable reduction in run time compared to Monte Carlo simulation. This time gain can be harnessed to answer a variety of questions that are too time consuming via Monte Carlo.

4 - Valuation and Hedging of Actual Balance Interest Rate Swaps
Adrian Becker, PhD Candidate, MIT Operations Research Center, 77 Mass Ave, Bldg E40-130, Cambridge, MA, 02139-4307, United States, adrianbb@mit.edu

In an asset-backed securitization deal, when investors demand interest payments in a different basis than that of the securitized assets, it is necessary to engage in a swap on the actual asset balance. This differs from traditional swaps in that the notional amounts are stochastic. We propose a valuation method based on the relationship between changes in the market cost of borrowing and underlying obligor payment activity. We then develop a robust optimization approach to hedge risk exposure.

5 - Agent Based Simulation-optimization Approach for Initiating Technology Positioning Investments
Bex Thomas, Researcher, GE Global Research, 1 Research Circle, Niskyuna, NY, 12309, United States, thomasb@ge.com

Conventional valuation techniques show limitations when applied to strategic investments, which require substantial capital commitment under conditions of significant uncertainty. In the face of deep uncertainty, analytical methods make several assumptions to simplify the problem. Rather than hide from this situation, agent-based approach exploits uncertainty and provides a level set of policy recommendations for deeply uncertain system using simulation, optimization and real-options framework.

■ MA44

S-Grand Ball. B (Lev. 2)

Education

Contributed Session

Chair: Elizabeth Schott, MAJ, U.S.Army/NMSU, 234 Polaris St, WSMR, NM, 88002, United States, libby.schott@gmail.com

1 - Teaching Service Competition Through Mobile Operator Business (MOB) Game
Juuso Töyli, Professor, Helsinki School of Economics, P.O. Box 1210, Helsinki, 00101, Finland, juuso.toyli@hse.fi, Heikki Hämmäinen, Mathias Tallberg

Reviews the Mobile Operator Business game model, the design process, the validation framework, the teaching event settings, and elaborates the lessons learnt. MOB is designed for student and managerial training and focuses on teaching service competition among mobile operators. The model captures the dynamics of rapid evolution of technology and emerging business models. Observations, interviews, questionnaires, and feedback reports were used to gather the validation data.

2 - Content Analysis of Books on Lean Manufacturing
Hiral Shah, Instructor, Eastern Michigan University, 118 Sill Hall, Ypsilanti, MI, 48197, United States, hiral.shah@emich.edu, Tracy Tillman

The purpose of this study was to conduct a content analysis of books on lean manufacturing and determine the areas of focus in lean. The results of this study will serve as a foundation for creating a body of knowledge and identify competency areas in the field of lean manufacturing.

3 - Integral Maintenance System for Medical Equipment of the Health Institute in Aguascalientes
Alejandro Davila, Universidad Politecnica de Aguascalientes, Av. Prol. Mahatma Gandhi Km. 2, Col. San Francisco del Arenal, Aguascalientes, Ag, 20280, Mexico, alejandro.davila@upa.edu.mx

To design and implement efficient procedures that will help administrate the maintenance efforts of the medical and electromechanical equipment of the ISEA. Follow up of all processes should be done through a platform and it should guarantee the reliable operation of the equipment at minimum costs of operation. This platform should also aid the institute's certification efforts in different quality norms and should generate statistical information to support different decision making processes.

4 - Presence and Management of Language Ambiguity in Science and Technology Education in English
Kyung-ha Jung, Administrator, Korea Institute of Science and Technology(KIST), # 39-1, hawalgok-dong, sungbuk-gu, seoul, ,Korea, seoul, Korea, Republic of, khjung@kist.re.kr, Yong-Gil Lee

Non-native English-speaking scientists don't understand completely what scientists from English-speaking countries say in international seminars about progress of the international cooperation project. Differences in culture and in the area of research are the reasons for such problems. This study aims at analyzing some kinds of scientist at KIST by observing the conversations of Korean scientists.

5 - Using Logic Models to Evaluate the NM AMP Undergraduate Research Assistantship Program
Elizabeth Schott, MAJ, U.S.Army/NMSU, 234 Polaris St, WSMR, NM, 88002, United States, libby.schott@gmail.com, Delia Valles-Rosales, Ricardo Jacquez, A. Michele Auzenne, Barbara Lugo, Anthony Hyde

This paper presents an innovative approach to evaluate research program structures at a college level. The purpose was to evaluate the structure of a program (program goal of student development by increasing quality of educational experiences and motivating future graduate studies) for areas of improvement not identified by current evaluations. Methodology employs logic models with value stream management techniques. We discuss overall processes, initial results, and recommendations.

■ MA45

S-Capitol Hill (Lev. 3)

Credit and Interest Rate Risk Modeling

Sponsor: Financial Services
Sponsored Session

Chair: Lyn Thomas, Professor, University of Southampton, School of Management, Faculty of Law, Arts and Social Sciences, United Kingdom, L.Thomas@soton.ac.uk

1 - Loss Given Default Modelling In Consumer Lending
Lyn Thomas, Professor, University of Southampton, School of Management, Faculty of Law, Arts and Social Sciences, United Kingdom, L.Thomas@soton.ac.uk

The Basel Accord has highlighted the importance of Loss Given Default modeling. Work has focused on corporate lending, but little research has been done on consumers. We explain why one needs to model both the probability the defaulter will want to pay back anything, the uncertainty on payback amounts, but also the lender's strategic and tactical decisions in the collections process. Using data from large portfolios, we built a model combining decision trees and generalised linear regression.

2 - Leverage, Options Liabilities, and Corporate Bond Pricing
Yildiray Yildirim, Associate Professor, Syracuse University, Management-Finance, Whitman SOM-Suite 615, Syracuse, NY, United States, yildiray@syr.edu, Hueng-Ming Huang

This paper imposes option liabilities on the firm's capital structure to resolve the drawbacks of the Collin-Dufresne and Goldstein (2001) model in explaining credit spread. We find that the credit spread overestimation problem in the CDG (2001) model can be resolved by combining option liabilities and the regime-switching interest rate process when dealing with an investment grade bond, whereas with junk bonds, only the regime-switching interest rate process is needed.

3 - Modelling Expected Loss
Catalina Stefanescu, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, cstefanescu@london.edu

In this paper, we address the modelling of expected loss over multi-year horizons in internal models allowed by the New Basel Accord, using a joint specification of the probability of default and the loss given default. We estimate different models using an extensive default and recovery data set that contains the majority of defaults between 1980-2004 of AMEX, NYSE and NASDAQ listed companies, and undertake extensive out-of-sample performance tests.

4 - Nonlinear Optimization of Bank Deposit and Loan Prices
Bruce Moore, Director of Business Intelligence, Credit Union of Texas, 8131 LBJ Freeway, Suite 550, Dallas, TX, 75251, United States, bmoore@cuoftexas.org

Banks and other financial institutions set deposit and loan prices on a daily or weekly basis to maximize net income while limiting credit, interest rate and other risks. We present a constrained nonlinear optimization model for setting deposit and loan prices and forecasting their respective volumes for a $1.2 billion financial institution. The model incorporates constraints for deposit and loan price variability, price relationships between products, credit risk, and interest rate risk.

■ MA46

S-Ballard (Lev. 3)

Modeling Energy Systems Risk

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Ian Dobson, Professor, University of Wisconsin, ECE Department, 1415 Engineering Drive, Madison, WI, 53706, United States, dobson@engr.wisc.edu

1 - Can We Quantify the Risk of Cascading Failure Blackouts with Branching Processes?

Ian Dobson, Professor, University of Wisconsin, ECE Department, 1415 Engineering Drive, Madison, WI, 53706, United States, dobson@engr.wisc.edu, Janghoon Kim

Blackouts of the electric power transmission infrastructure are complicated events in a huge network with diverse, interacting failures. The failures cascade by weakening the system and making further failures more likely. We model cascading in a bulk statistical fashion as initial failures propagating probabilistically according to a branching process. We estimate branching process parameters from data and hence compute the probability of cascading failures of various sizes.

2 - Complex Infrastructure Systems: Their Characteristics and the Impact of Control

David Newman, Professor, Univ. of Alaska Fairbanks, Physics Department, P.O. Box 755920, Fairbanks, AK, 99775, United States, ffden@uaf.edu, Ben Carreras, Ian Dobson

Critical infrastructures such as power transmission networks and communication systems display many of the characteristic properties of complex systems. They exhibit infrequent large cascading failures that often obey a power law distribution in their PDF as well as long time correlations. This behavior suggests that conventional risk analysis cannot be applied to these systems. These system dynamics and their counterintuitive response to attempts at control will be discussed.

3 - A Dynamic Model for the Mitigation of Transmission Failure Risk

Johannes Enders, PhD Candidate, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, jenders@princeton.edu, Warren Powell

Catastrophic failures of high-voltage transformers constitute an increasingly important operational risk as failures adversely affect system economics and reliability. We present a model that supports risk mitigation efforts by determining optimal policies for transformer purchasing and replacement. The model supports the capital investment planning performed by RTOs and transmission owners. The problem presents methodological challenges that we address with approximate dynamic programming.

■ MA47

S-Admiral (Lev. 3)

Forestry V: Nature Reserve Design

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Robert Haight, USDA Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States, rhaight@fs.fed.us

1 - Estimating Usable Habitat for the California Spotted Owl

Richard Church, Department of Geography, University of California, Santa Barbara, Santa Barbara, CA, 93106, United States, church@geog.ucsb.edu, Ross Gerrard

Activities such as thinning and fuels removal to reduce the risk of fire alter the extent and quality of specific habitat types. The focus of this paper deals with estimating the impact of such activities on the habitat of the California spotted owl. This paper develops a modeling framework, including a spatial optimization model that attempts to estimate effective or useful habitat both pre- and post-treatment.

2 - Population Aggregation and Selection of Nature Reserves

Hayri Onal, Professor, Dept.. of Agricultural and Consumer Economics, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States, h-onal@uiuc.edu, Robert Briers

When designing conservation reserves, the location of species populations within the reserve is important since this affects species' dispersal and long-term persistence. We present an integer programming model that maximizes the aggregation of species populations and an empirical application of the model to a real data set. The results show that much greater aggregation is achieved by using this approach than alternative configurations based on economic efficiency and spatial compactness.

3 - How do Open-space Reserves Affect Housing Prices and Urban Growth?

Robert Haight, USDA Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States, rhaight@fs.fed.us, Liaila Tajibaeva, Stephen Polasky

We use an urban-economic model to study the effects of open space on the spatial pattern of housing and property values in a city. Households choose where to live and how much to spend on housing and transportation. The government chooses property tax and the location of open space. We show that open space does not stop growth but attracts people and increases nearby housing and land price. Planners can maximize welfare by locating open space on the edge and housing near the center of the city.

■ MA48

S-Fremont (Lev. 3)

Simulation-based Intruder Behavior and Detection

Sponsor: Simulation
Sponsored Session

Chair: Jeff Smith, Professor, Auburn University, 207 Dunstan Hall, Auburn University, AL, 36849, United States, jsmith@auburn.edu

1 - Simulation-based Intruder Detection Analysis

Jeff Smith, Professor, Auburn University, 207 Dunstan Hall, Auburn University, AL, 36849, United States, jsmith@auburn.edu

This talk describes a general methodology and associated tools for assessing a fixed-site facility's susceptibility to breach by one or more intruders. The methodology is based on a discrete-event simulation system that models the facility and its sensor network along with the intruders and their strategies for breaching the facility.

2 - Spatiotemporal Analysis of Physical Crime Patterns

Uwe Glässer, Associate Professor and Director, Computing Science, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, glaesser@cs.sfu.ca

Criminal events are understood in the context of complex interactions between the most important elements of crime, namely: the law, the offender, the target and the place. We outline here a computational framework capturing these elements in abstract mathematical terms as required for analyzing multi-dimensional aspects of crime patterns by means of computational methods and tools.

3 - The Visual Interactive Site Analysis Code (VISAC)

Joe Lake, Software Engineer, Oak Ridge National Laboratory, 1 Bethel Valley Road, MS - 6085, Oak Ridge, TN, 37831, United States, lakeje@ornl.gov

VISAC is a Java-based, expert system that provides security analysts with a coordinated capability to predict and analyze the outcomes of multiple accidents/incidents at various facilities. The incidents can range from simple individual equipment sabotage to complex sorties that utilize a wide range of weapons. Using event/fault tree methodology, VISAC provides the probability of facility kill, the probability of undesirable collateral effects, and an estimate of facility down time.

4 - Human Behavior Representation in Physical Security Systems Simulation

Volkan Ustun, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, ustunvo@auburn.edu, Jeff Smith

Realistic and credible agent-based simulations of physical security systems require incorporation of human behavior models for an effective agent model. Operating / patrol strategies of these agents must explicitly include situational awareness, cooperative team behavior, planning and deliberative decision-making processes to improve realism, credibility, and variability. In this talk, we discuss and demonstrate our design for the computational behavior representation for agents.

■ MA49

S-Greenwood (Lev. 3)

Robust and Risk-averse Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Aurelie Thiele, P.C. Rossin Assistant Professor, Lehigh University, ISE Dept., 200 W Packer Ave Rm 329, Bethlehem, PA, 18015, United States, aurelie.thiele@lehigh.edu

1 - Impact of Risk Attitudes on Revenue Management Decisions

Ayse Kocabiyikoglu, Bilkent University, Faculty of Business Administration, Bilkent, Ankara, 06800, Turkey, aysekoca@bilkent.edu.tr

Revenue management models usually focus on risk neutral decision makers. We consider an extension of the standard EMSR model where a risk averse decision maker determines the optimal allocation of capacity with the objective of maximizing utility. We obtain optimality conditions and comparative static results with respect to several parameters and compare risk averse and risk neutral allocation policies. We report computational results on various extensions of the model.

2 - Contracts in the Risk-averse Supply Chain
Rockey Myall, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States, rrm204@lehigh.edu, Aurelie Thiele

We examine the affect of risk aversion on supply chain contracts in a classic newsvendor model, where both retailer and supplier are risk-averse. We characterize the optimal order quantity, discuss how it differs from the risk-neutral case and provide insights into the impact of risk aversion. We also investigate the implementation of a buy-back contract in a risk-averse supply chain and describe how it relates to the issue of supply chain coordination.

3 - The Value of Information in Inventory Management
Gokhan Metan, PhD Candidate, Department of Industrial & Systems Engineering, Lehigh University, 200 West Packer Avenue, Harold S. Mohler Laboratory, Bethlehem, PA, 18015, United States, gom204@lehigh.edu, Aurelie Thiele

Traditional inventory management assumes the precise knowledge of the underlying demand distribution and a risk-neutral manager. New product introduction does not fit this framework because (i) not enough information is available to compute probabilities and (ii) managers are generally risk-averse. In this work, we investigate the impact of information when the optimal cost is computed using a robust, distribution-free approach. We derive optimality conditions and present simulation experiments.

4 - A Data-driven Approach to Pricing with Learning in Competitive Environments
Soulaymane Kachani, Professor, Columbia University, 334 Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States, kachani@ieor.columbia.edu, Georgia Perakis, Carine Simon

We consider a Bertrand oligopoly for perishable products. Firms' demands are initially unknown and are learnt through a data-driven approach. The goals of the firms are twofold: learn the price-demand relationship in order to find their best response pricing policies, and learn the equilibrium strategies. We study markets that are out of equilibrium as well as in equilibrium. We implement our approach on real data.

■ MA50

S-Issaquah A & B (Lev. 3)

Pricing for Networks and Services

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Parijat Dube, IBM T J Watson Research Center, 19 Skyline Drive, Hawthorne, NY, United States, pdube@us.ibm.com, \

Co-Chair: Rahul Jain, IBM, rahul.jain@us.ibm.com

1 - Price and Capacity Competition
Asu Ozdaglar, Professor, EECS/MIT, 77 Massachusetts Avenue, Cambridge, MA, United States, asuman@mit.edu, Kostas Bimpikis, Daron Acemoglu

We study the efficiency of oligopoly equilibria in a model where firms compete over capacities and prices. We establish the existence of pure strategy subgame perfect equilibria and characterize the set of equilibria. We then investigate the efficiency properties of these equilibria, where efficiency is defined as the ratio of surplus in equilibrium relative to the first best.

2 - Network Neutrality from Agency Perspective
Jean Walrand, Prof. of EECS, University of CA, Berkeley, 257M Cory Hall, Berkeley, CA, 94720, United States, wlr@EECS.Berkeley.EDU, John Musacchio, Galina Schwartz

This paper analyzes the impact of network neutrality on provider incentives when investment irreversibility is present. At the aggregate level, we model the network as a monopolistically competitive industry (Dixit-Stiglitz (1977)), which produces a variety of goods. Each variety is produced by two providers (transit and content), who share the surplus. We model the network as a collection of simultaneous surplus sharing games, in which provider interactions are subject of a hold-up problem.

3 - Incentive-compatible Resource Allocation in Wireless Networks and Two-commodity Markets
Tara Javidi, UCSD, 9500 Gilman Dr., La Jolla, CA, 92103, United States, tjavidi@ucsd.edu, Jennifer Price

Many resource allocation schemes are known to suffer from incentive compatibility issues when users hold private information and the interests of users are not aligned with the interests of the system. We focus on an alternate approach to pricing that exploits natural incidences of two-commodity markets in realistic wireless networks - for example, leveraging users' demand for downlink bandwidth to regulate their use of uplink bandwidth.

4 - Dynamic Pricing Through Adjustable Robust Optimization
Georgia Perakis, Associate Professor, Sloan School, MIT, 50 Memorial Drive, Cambridge, MA, 02139, United States, georgiap@mit.edu, Ruben Lobel

We consider a robust optimization approach to dynamic pricing for perishable products. The main issues in this talk are how to model demand uncertainty and how to optimize the pricing strategy. While the traditional robust optimization models are tractable, the pricing policies are static. This paper explores adaptable robust optimization approaches to the pricing problem. We analyze a variety of models and compare them through simulations.

5 - Duopolistic Competitive Markets for Queued Services with QoS Guarantees
Parijat Dube, IBM T J Watson Research Center, 19 Skyline Drive, Hawthorne, NY, United States, pdube@us.ibm.com, Rahul Jain

We consider the problem where competing providers offer queued services with QoS guarantees. Users have quasi-linear utility functions that depends on delay and the price paid. We identify the non-existence of competitive equilibria of this market. We then analyze conditions for the existence of Nash equilibrium and obtain equilibrium market shares of providers.

■ MA51

S-Kirkland (Lev. 3)

Pricing and Revenue Management I

Contributed Session

Chair: Abdullah Dasci, York University, School of Administrative Studies, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, dasci@yorku.ca

1 - Pricing of Hybrid Products During the Development Process
Brigitte Werners, Prof. Dr., Ruhr-University Bochum, Fac. of Economics and Management, Bochum, 44780, Germany, or@rub.de, Niels Becker

Not only machine tool companies focus on integrated or additional services for their technical products. They increasingly offer hybrid products which consist both of machinery and services. Due to the rising variability of the product program, it becomes an important challenge to design, bundle and price such products. We suggest a new price-bundling model to select optimally the spectrum of products to be designed as an important part of the development process.

2 - An Optimal Design of Toll Pricing Problem for Road Networks
Suh-Wen CHIOU, National Dong Hwa University, 1 Dahsueh Road Sec. 2, Shoufeng, Hualien, 97401, Taiwan - ROC, chiou@mail.ndhu.edu.tw

This paper addresses a new scheme for a toll optimisation problem in road networks. The toll optimisation problem can be formulated as a mathematical program with equilibrium constraints. A projected subgradient approach is presented to solve the toll optimisation problem together with global convergence analysis. Numerical calculations are conducted and good results have been obtained.

3 - A Mixed-bundling Pricing Strategy for the TV Advertising Market
Mihai Banciu, PhD Student, University of Pittsburgh, Katz Graduate School of Business, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, mibanciu@katz.pitt.edu, Prakash Mirchandani, Esther Gal-Or

Both network and cable television companies face the challenging problem of maximizing revenue generated from commercials. While the supply of prime-time advertising slots is constrained, the availability of nonprime-time slots is relatively unrestricted. We develop a model for maximizing revenue by bundling and pricing different types of time-slots, present several structural properties of the model, and provide and test an algorithm for pricing arbitrary numbers of such bundles.

4- Monte Carlo Optimization
Aihong Wen, PROS Revenue Management, 3100 Main St. Suite 900, Houston TX 77002, awen@prosrm.com

In real life, optimization problems can take a long time to be solved by formal methods, especially when there are multiple objectives and efficient frontiers are required. We developed a heuristic approach where the objectives are evaluated at samples of feasible points and the solution is the point giving the best result. The feasible points are created by solving a series of random artificial optimization problems. This method can significantly lessen the computational expense while still achieving an objective that is comparable to the optimum given by formal methods.

5 - Dynamic Pricing Under Costly Price Modifications
Abdullah Dasci, York University, School of Administrative Studies, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, dasci@yorku.ca, Rongbing Huang

We consider a problem of pricing a single product over a finite time period. The demand is modeled as a deterministic process as a function of price. The firm is restricted from making arbitrary number of price changes due its costly nature. We present a heuristic solution method to determine the number and time of price changes and what prices to charge.

■ MA52

S-Leschi (Lev. 3)

New Operations Research Models for Railroad Planning

Sponsor: Railway Applications
Sponsored Session

Chair: Ravindra Ahuja, Professor, University of Florida, 303 Weil Hall, Industrial & Systems Engineering, Gainesville, FL, 32611, United States, ahuja@ufl.edu

1 - LocoSim: A Decision Support System for Simulating Locomotives
Kamalesh Somani, CSX Transportation, Operations Research, 3019 Warrington Street, Jacksonville, FL, 32254, United States, Kamalesh_Somani@csx.com, F. Zeynep Sargut, Ravindra Ahuja, Artyom Nahapetyan

We have developed a locomotive simulation/optimization decision support system, LocoSim, that simulates a real-life environment in which train travel times are random variables, some trains may be cancelled or added, locomotives visit shops for quarterly maintenances or for breakdown repairs. LocoSim responds to these events intelligently by mimicing locomotive managers logic. This talk will present details of LocoSim as well as its computational results on real-life railroad data.

2 - Optimization-based Railroad Blocking Case Studies at BNSF
Xiaoyun Ji, Senior Operations Research Specialist, BNSF Railway, Service Design, 2400 Lou Menk Drive, Fort Worth, FL, 76131, United States, Xiaoyun.Ji@BNSF.com, Pooja Dewan

In this presentation, we describe the use of an optimization-based blocking tool to improve the current train blocking plan. We will present incremental study cases to illustrate the role of this tool, the integration into the current business process, the implementation and impact of its recommendations, finally the remaining challenges.

3 - Optimizing Train Plans: Case Studies from the Field
Arvind Kumar, Director - Research & Development, Innovative Scheduling, Inc., GTEC, 2153 Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States, arvind@InnovativeScheduling.com, Ravindra Ahuja, Krishna Jha, Larry Shughart

The train plan design is central to a railroad's operating plan development process and dictates the movement of railcars, locomotives, and crews over the railroad's network. This talk presents results of several pilot studies on real-life data to demonstrate that optimized train plans can improve operations significantly. The focus of theses studies was to identify opportunities where small changes can result in big improvements in a railroad's costs.

■ MA53

S-Medina (Lev. 3)

Facility Location for Public Policy and Management

Sponsor: Location Analysis
Sponsored Session

Chair: Michael Johnson, Associate Professor, Department of Public Policy and Public Affairs, John W. McCormack Graduate School of Policy Studies, University of Massachusetts Boston, 100 Morrissey Blvd, Boston, MA, 02125-3393, United States, michael.johnson@umb.edu

1 - Redesign of Elderly Service Network
Osman Ozaltin, Doctoral Student, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15260, United States, oyo1@pitt.edu, Michael Johnson

Senior centers coordinate and offer a variety services to make independent living a viable option for older adults . In this paper, we present novel math models to redesign a county-wide senior center service network by considering some innovative service mechanisms. There are three tasks associated with this goal: determining the best locations for the senior centers of different types, designing staffing schedules among the different senior centers, and redistributing government funding among the service centers.

2 - Design and Management of Preventive Healthcare Facility Networks
Yue Zhang, McGill University, 1001 Sherbrooke Stree West, Montreal, QC, H3A1G5, Canada, yue.zhang3@mail.mcgill.ca, Vedat Verter, Oded Berman

This paper provides a methodology for designing a preventive healthcare facility network so as to maximize participation. Each client would patronize the facility with minimum expected total time. The expected number of participants decreases with the expected total time. The facilities cannot be operated unless participation exceeds a requirement. Since the formulation is highly nonlinear, we provide a heuristic solution framework. Finally, a real life application in Montreal is investigated.

3 - Bayesian Evaluation of Sensor Network Designs for Environmental Contaminants Monitoring
Jianhua Xu, Doctoral Candidate, Carnegie Mellon University, Dept.. of Engineering and Public Policy, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, jianhuax@andrew.cmu.edu, Michael Johnson, Paul Fischbeck, Mitchell Small, Jeanne VanBriesen

The application of sensor networks to monitor environmental contaminants in water distribution networks has recently gained more attention. However, most of the research on designing senor networks assumes perfect sensors. In our research, we account for imperfect sensors and apply Bayesian belief networks to evaluate sensor networks.

4 - Practitioner-oriented Models for Urban Affordable Housing Development
Michael Johnson, Associate Professor, Department of Public Policy and Public Affairs, John W. McCormack Graduate School of Policy Studies, University of Massachusetts Boston, 100 Morrissey Blvd, Boston, MA, 02125-3393, United States, michael.johnson@umb.edu, Sung-Hee Kim, Meredith Fisher

Many affordable housing providers manage large inventories of parcels, few of which can be developed at a time. We choose parcels to develop using a variant of the fixed charge model. A generalization allows for spatial interactions. We apply these models to data from an actual affordable housing provider and demonstrate significant tradeoffs between model realism and ease of solution.

■ MA54

S-Queen Anne (Lev. 3)

Joint Session AP/ICS: Resource Allocation for Distributed Computing Systems

Sponsor: Applied Probability, INFORMS Computing Society
Sponsored Session

Chair: Douglas Down, McMaster University, 1280 Main Street West, Hamilton, ON, Canada, downd@mcmaster.ca

1 - Resource Allocation in Grid Computing
Rhonda Righter, Professor, UC Berkeley, 4141 Etcheverry Hall, Berkeley, CA, United States, rrighter@ieor.berkeley.edu, Ger Koole

We consider task replication for grid computing, and show that under fairly mild and often reasonable conditions, maximal task replication stochastically maximizes the number of task completions by any time. Maximal task replication is also robust.

2 - Optimal Job Replication Policies on Homogeneous Parallel Servers
Yusik Kim, PhD Student, UC Berkeley, 4141 Etcheverry Hall, IEOR Department, Berkeley, CA, 94720, United States, ykim@newton.berkeley.edu, Rhonda Righter, Ronald Wolff

We consider scheduling jobs over a system of homogeneous servers with stochastic job processing times. When job replication is allowed, we study the degree of replication that yields the best system performance under various processing time distributions.

3 - A Push-and-pull Based Distributed Control of Stream Processing Networks
Cathy H. Xia, Research Scientist, IBM Research, TJ Watson Research Center, Yorktown Heights, NY, 10598, United States, cathyx@us.ibm.com, Li Zhang, Hanhua Feng, Zhen Liu

A fundamental problem in stream processing systems is how to meet various quality of service (QoS) requirements using effective admission control and resource allocation mechanisms. We consider a stream processing system with a network of cooperating servers, collectively providing processing services for multiple data streams. We present a pull-and-pull based distributed control algorithm that guarantees the network stability and achieves the maximum system utility in the long run.

4 - Affinity Scheduling for Heterogeneous Computing Systems
Douglas Down, McMaster University, 1280 Main Street West, Hamilton, ON, Canada, downd@mcmaster.ca, Issam Al-azzoni, Yu-Tong He

The mapping of tasks to servers is an important function in controlling heterogeneous computing (HC) systems. The HC system is modelled as a system of parallel (heterogeneous) queues. Many different mapping heuristics have been proposed in recent years. We discuss modifications to policies from the flexible server queueing literature and discuss tradeoffs in performance (including guarantees) versus implementation concerns.

■ MA55

S-Ravenna (Lev. 3)

Models and Data in Dynamic Air Traffic Management

Sponsor: Aviation Applications
Sponsored Session

Chair: David Lovell, Associate Professor, University of Maryland, 1173 Martin Hall, College Park, MD, 20742, United States, lovell@eng.umd.edu

1 - Efficiency vs. Equity in Dynamic Air Traffic Flow Management
Amedeo Odoni, Professor, M.I.T., 77 Massachusetts Avenue 33-219, Cambridge, MA, 02139, United States, arodoni@MIT.EDU, Michael Hanowsky

The tradeoff between efficiency and equity/fairness presents a major challenge for ATFM optimization models. Recent work on dynamic ground delay programs under uncertainty highlights the issues involved. Efficient solutions may be strongly biased with respect to flight distance and, by implication, airline and aircraft type.

2 - A Stochastic Optimization Model to Dynamically Reroute Flights in Presence of En Route Weather
Avijit Mukherjee, Associate Project Scientist, U.C. Santa Cruz, MS 210-8, NASA Ames Research Center, Moffett Field, CA, 94035, United States, itsavijit@gmail.com

A stochastic optimization model is presented for strategic planning of ground delay and rerouting decisions in presence of en route weather. The model is applied to a problem consisting of weather impact at one or more arrival fixes of an airport. Experimental results suggest significant delay saving by virtue of dynamic rerouting compared to a static ground delay program without any options to reroute aircraft.

3 - Sequential Decision Models and Stochastic Programs for the Single Airport Ground Holding Problem
Barry Liu, Booz Allen Hamilton, 3 Admiral Drive #F452, Emeryville, CA, 94608, United States, barryliu@gmail.com, Mark Hansen

We model the single airport ground holding problem with airport capacity uncertainty using two approaches: multi-stage stochastic integer programs with probabilistic capacity scenario trees and sequential decision dynamic programs with Markov capacity evolution processes. In this paper, we discuss the mathematical relationship between the models and compare their performance in a real-world setting.

4 - Weather Normalization for Evaluating National Airspace System (NAS) Performance
Jing Xiong, NEXTOR, UC Berkeley, 107E McLaughlin Hall, University of California at Berkeley, Berkeley, CA, 94720, United States, jingxiong@berkeley.edu, Mark Hansen

The need to benchmark air traffic management performance, predict future performance, and improve our understanding of air traffic operations has created a growing literature on the statistical modeling of delays in the National Airspace System (NAS). We will quantify delays by casual factors such as traffic, weather, and etc.

■ MA56

S-Wallingford (Lev. 3)

Auctions from a Computational Perspective

Cluster: Auctions
Invited Session

Chair: Kevin Leyton-Brown, University of British Columbia, 201-2366 Main Mall, Vancouver, BC, V6T1Z4, Canada, kevinlb@cs.ubc.ca

1 - Optimal VCG Redistribution Mechanisms
Vincent Conitzer, Assistant Professor, Duke University, LSRC, Box 90129, Duke University, Durham, NC, 27708, United States, conitzer@cs.duke.edu, Mingyu Guo

It is impossible for an auction mechanism to simultaneously satisfy efficiency, strategy-proofness, individual rationality, and (strong) budget balance. Nevertheless, it is possible to satisfy the first three and come close to budget balance, using redistribution mechanisms. I will cover worst-case optimal, undominated, and optimal-in-expectation redistribution mechanisms.

2 - Potential-aware Automated Abstraction of Sequential Games, and Holistic Equilibrium Analysis of Texas Hold'em Poker
Tuomas Sandholm, Cernegie Mellon University, Pittsburgh, PA, United States, sandholm+@cs.cmu.edu, Troels Bjerre Soerensen, Andrew Gilpin

Prior abstraction algorithms for sequential games employ expected value as the similarity metric. Ours considers a higher-dimensional space consisting of histograms over abstracted states from later stages. Therefore it can capture potential. With a fast equilibrium finding algorithm, this yielded GS3, a highly competitive bot for heads-up limit Texas Hold'em.

3 - Matroids, Secretary Problems, and Online Mechanisms
Moshe Babaioff, Researcher, Microsoft Research, 1065 La Avenida St., Mountain View, CA, 94043, United States, moshe@microsoft.com, Nicole Immorlica, Robert Kleinberg

We design online approximation mechanisms for various combinatorial problems in which agents arrive in random order, based on generalizations of the well known secretary problem. In particular, we present a truthful competitive auction for the unit-demand domain, in which there is a finite set of goods for sale and each agent wants to receive one good from a specified subset of goods.

4 - Auctioning a Networked Good
Nicole Immorlica, CWI, Amsterdam, Netherlands, 6 Purgatory Road, Mont Vernon, NH, 03057, United States, nickle@eecs.northwestern.edu, Ning Chen, Arpita Ghosh

We study auctions for an unlimitted supply of a networked good such as access to an online gaming system like Xbox Live. We assume each bidder is a node in a graph, and the value of a bidder for the good is a function of the number of neighbors who also have the good. In this setting, we design an auction whose revenue competes with that of the best single-price revenue. Our auction uses graph theoretic techniques combined with ideas from the random sampling literature for digital goods auctions.

■ MA57

S-Columbia (Lev. 4)

Joint Session TELECOM /ICS: Discrete Network Optimization Challenges

Sponsor: INFORMS Telecommunications Section, INFORMS Computing Society
Sponsored Session

Chair: J. Cole Smith, Associate Professor, University of Florida, P.O. Box 116595, Gainesville, FL, 32607, United States, cole@ise.ufl.edu

1 - A Cutting Plane Algorithm for Solving a Robust Edge Partitioning Problem
Zeki Caner Taskin, PhD Student, University of Florida, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, taskin@ufl.edu, Shabbir Ahmed, J. Cole Smith, Andrew Schaefer

The edge partitioning problem is inspired by a SONET design problem, and considers the partitioning of a graph's edge set into a set of subgraphs. Each subgraph is limited by the (weighted) sum of edges and number of nodes assigned to it. This talk considers a stochastic version of the problem in which there are several scenarios regarding edge weights. We formulate this problem as an MIP, and prescribe a two-stage cutting-plane approach with binary variables in both stages.

2 - Cutting Plane Approach for Facility Location Problems with Binary First- and Second-Stage Variables
John Penuel, Graduate Student, University of Florida, P.O. Box 116595, Gainesville, FL, 32607, United States, jpenuel@ufl.edu, J. Cole Smith

We study a stochastic scenario-based facility location problem. The first-stage variables are traditional binary facility location variables. Second-stage recourse variables include binary facility activation variables (limited to those facilities located in the first stage), and flow variables from activated facilities to demands. We derive L-shaped cutting planes from the recourse solutions to each MIP subproblem, and compare our method to the integer L-shaped method of Laporte and Louveaux.

3 - Generalized Network Inequalities for Fixed-charge Network Polyhedra
Simge Kucukyavuz, University of Arizona, 1127 James E Rogers Way, Tucson, AZ, 85721-0020, United States, simge@sie.arizona.edu

We propose a generalization of the network inequalities valid for capacitated fixed-charge network flow problems. We show the relationship between the generalized network inequalities and submodular inequalities. We give separation algorithms to identify violated generalized network inequalities. Finally, we illustrate the usefulness of these inequalities for a multi-echelon supply chain problem.

■ MA58

S-Pike (Lev. 4)

Empirical Research in Innovation and Technology Management

Cluster: New Product Development
Invited Session

Chair: Kamalini Ramdas, Ramdask@Darden.virginia.edu

1 - Not All Experience is Equal: Evidence from Indian Software Services
Brad Staats, Doctoral Candidate, Harvard Business School, Morgan Hall 428A, Boston, MA, 02163, United States, bstaats@hbs.edu, David Upton, Robert Huckman

In much of the existing literature, experience is treated as a unidimensional concept. We use detailed data from an Indian software services firm to examine how operational performance might be affected by different types of group member experience. We find that previous experience with group members has a positive effect on performance, but that conventional measures of individual experience do not. However, we do find that role-specific experience helps explain performance in our context.

2 - R&D Productivity, IT Investments, and Firm Performance
Vish Krishnan, Professor, University of California, San Diego, CA, vkrishnan@ucsd.edu, Indranil Bardhan, Gokcen Arkali

We study the interactions between R&D productivity, IT investments, and firm performance using archival data from 1998-2003 for a large cross section of 492 firms. Preliminary results suggest that IT spending has a significant moderating impact on the relationship between R&D and firm performance. These results shed new light on the relationship between R&D and firm performance.

3 - Conservation or Diversification? The Role of Organizational Slack in Young Firms and Mature Business
Nitin Joglekar, Boston University, Boston, MA, United States, joglekar@bu.edu, Jane Davies

This research compares the role of organizational slack in young firms and mature businesses. It hypothesizes that the management of organizational slack differs between young and established firms, and specifically considers the effect of the conservation of cash at differing stages of the firm's lifecycle on financial performance. Our findings link organizational slack with alternative strategies for managing flexibility, R&D and operational efficiency.

■ MA59

S-Seneca (Lev. 4)

Making Capacity Acquisition Decisions Under Uncertainty

Cluster: Capacity and Technology Management
Invited Session

Chair: Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States, billerb@andrew.cmu.edu

1 - Adoption of Cost Reducing Technology by Asymmetric Duopolists
Chester Chambers, Asst. Professor, Cox School of Business, Southern Methodist University, P.O. Box 750333, Dallas, TX, 75275, United States, cchamber@mail.cox.smu.edu, Panos Kouvelis, Ping Su

This work considers the adoption of technology that will reduce unit production costs by one or two players sharing a single market. We develop 3 models involving: a monopolist, a Stackelberg game involving two firms with a designated order of adoption, and an open loop game with no pre-specified order. In each setting, market-size evolves according to Geometric Brownian Motion.

2 - Evaluating Flexible Capacity Across Multiple Markets
John Birge, University of Chicago, Chicago, IL, John.Birge@ChicagoGSB.edu

Flexible capacity that can respond to demand, supply, and pricing variations across multiple markets presents challenges for evaluation. This talk will focus on evaluating capacity in different markets in the context of exchange rate uncertainty. Assuming an underlying stochastic exchange rate process, we will present a general analytical framework that allows characterization of parameter sensitivities and bounds on the value of capacity with limited information.

3 - Impact of Product Substitution/Complementarity on Prices and Capacity and Flexibility Investments
Betul Lus, University of Massachusetts Amherst, 160 Governors Drive, Amherst, MA, United States, blus@acad.umass.edu, Ana Muriel

We compare two alternative measures of product substitutability/-complementarity for linear demand functions that are commonly used in the literature in a variety of price/quantity decision and capacity investment problems. Using the right measure of product substitutability, we find that the optimal investment in manufacturing flexibility for a monopoly firm tends to decrease as the products become closer substitutes/complements and identify the conditions under which it increases.

4 - Characterization of a Capacity Investment Strategy for a Global Firm
Chester Xiang, PhD Candidate, Carnegie Mellon University, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States, ccx@cmu.edu, Bahar Biller

We study the optimal flexible capacity investment decision a global firm has to make under demand and exchange rate uncertainties. We restrict our attention to a two-market setting and identify the structure of the optimal investment strategy. We investigate the impact of various investment drivers on the structure of this strategy using a comprehensive input-modeling framework for demand and exchange rate processes.

■ MA60

S-University (Lev. 4)

Joint Session TM/NPD: Innovation: Problem Solving Processes and Creativity

Sponsor: Technology Management, New Product Development
Sponsored Session

Chair: Christian Terwiesch, Professor, The Wharton School, 3730 Walnut St, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu

1 - Noncompetes and Knowledge Spillovers
Lee Fleming, lfleming@hbs.edu, Matt Marx

We exploit Michigan's inadvertent reversal of its noncompete enforcement legislation as a natural experiment to investigate the impact of noncompetes on knowledge spillovers.

2 - Comparison of Idea Generation Processes
Karan Girotra, INSEAD, karan.girotra@insead.edu, Christian Terwiesch, Karl Ulrich

In this talk, we present results from an experimental study that compares three different idea generating structures- individuals working by themselves, individuals working in groups and a new hybrid structure, where individual work is followed by group work. In contrast to the existing research that has focused on comparing the number and average quality of ideas generated; we study the quality of the best ideas generated by the three different structures.

3 - Creative Problem Solving as a Stochastic Search Problem
Christian Terwiesch, Professor, The Wharton School, 3730 Walnut St, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Karl Ulrich, Karan Girotra

We present a framework of problemsolving in settings of innovation, product development, and design. We show how problem solving can be seen as a stochastic search problem in which the solver takes draws from some underlying performance function. Based on several experiments, we establish the shape of the underlying performance function and discuss different problem solving approaches.

Monday, 10:00am - 11:30am

■ MB01

C-Room 602

Supply Chain Management VI

Contributed Session

Chair: Craig Hill, Assistant Professor, Georgia State University, P.O. Box 4014, Atlanta, GA, 30302-4014, United States, chill4@gsu.edu

1 - Adopting Supply Chain and Resource Planning in a Small and Medium Company

Chang Won Lee, Jinju National University, Department of Venture Management, 150 Chilam Dong, Jinju 660-758, Korea, Republic of, cwlee@chinju.ac.kr

This paper presents planning and implementing supply chain and business resource planning in a small and medium size company. A case is utilized for this study. The supply chain and business resource planning adoption model is utilized for analyzing current business performance in a company. This study suggests that the management gain strategic competitiveness by process planning in a certain industry and other similar settings.

2 - Quality Improvement in a Supply Chain with Asymmetric Information

Xiaowei Xu, Assistant Professor, Rutgers Business School, 180 University Avenue, Ackerson Hall, Room 208, Newark, NJ, 07102, United States, xiaoweix@andromeda.rutgers.edu

We study a quality improvement problem. A firm outsources production to a contract manufacturer. Moral hazard and adverse selection both arise in our model. We find that the firm should spend more engineering time on a low production technology manufacturer, but share less warranty cost with the manufacturer.

3 - Inside the Black Box of CPFR: An Empirical Analysis of the Learning Process

Yuliang Yao, Assistant Professor, Lehigh University, 621 Taylor Street, Bethlehem, 18015, United States, yuy3@lehigh.edu, Susan Sherer, Rajiv Kohli, Jerry Cederlund

We analyze the learning process through which benefits from CPFR are realized using a unique operational level dataset from Motorola and a retailer. Forecasting and replenishment exhibited distinct learning curves. Forecasting accuracy improved immediately after CPFR but at a decreasing rate, whereas inventory turns first decreased before eventually increasing. Learning mechanisms between the manufacturer and the retailer that may cause the distinct learning curves are discussed in detail.

4 - The Revenue Driven Newsvendor Under Information Asymmetries

Zhengping Wu, Lee Kong Chian School of Business, Singapore Management University, 50 Stamford Road, Singapore, 178899, zpwu@smu.edu.sg, Wanshan Zhu

We consider the impact of advertisement revenue on the newsvendor's inventory decision. The newsvendor also has to appropriately decide how much to charge advertisers without knowing their marginal benefit from the advertisement. We discuss managerial insights obtained from our model.

5 - An Empirical Evaluation of CPFR and its Impact on a Firm's Operational Performance

Craig Hill, Assistant Professor, Georgia State University, P.O. Box 4014, Atlanta, GA, 30302-4014, United States, chill4@gsu.edu, Yusen Xia, Peter G. Zhang

This research investigates the impact of the implementation of the CPFR program on a firm's operational performance. CPFR is expected to help firms better coordinate activities that serve their customers and suppliers with increased supply chain visibility. Our study uses publicly available data to provide empirical evidence on the effect of the CPFR adoption on the financial and operational performance of the firm.

■ MB02

C-Room 603

Empirical Studies of Supply Chain Management

Cluster: Supply Chain

Invited Session

Chair: Serguei Netessine, Associate Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu

1 - Competing Retailers and Inventory: An Empirical Study of U.S. Auto Dealerships

Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris Hall #417, New York, NY, 10027, United States, molivares@columbia.edu, Gerard Cachon

We estimate empirically the effect of local competition on inventory holdings of U.S. automobile dealerships. Competition can affect inventory through two mechanisms: (1)by influencing dealers demand; (2) by affecting the buffer stock that retailers choose to carry. Using cross-sectional variation across geographically isolated markets, we estimate the effect of sales and local competition on inventory. We find a strong positive non-linear effect of competition on service level.

2 - An Empirical Study of Inventory Policy Choice and Inventory Level Decisions

Justin Ren, Boston University School of Management, 595 Commonwealth Ave, Boston MA, United States, ren@bu.edu, Gokhan Usanmaz, Sean Willems

This paper empirically investigates how managers set and maintain their inventory levels using field data collected from a large nation-wide dealer network. We find that even though dealers receive inventory stocking recommendations from the manufacturer, a multitude of economic and organizational factors jointly determine dealers' actual inventory policy choice and inventory levels. Those factors include demand pattern, holding cost, competition, management capability and infrastructure.

3 - The Effect of Demand-Supply Mismatches on Equity Volatility

Vinod Singhal, Georgia Institute of technology, 800 West Peachtree Street NE, Atlanta GA 30332, United States of America, Vinod.Singhal@mgt.gatech.edu, Kevin Hendricks

This paper documents the effect of demand-supply mismatches on long-run equity volatility by examining the volatility changes associated with three different types of supply chain risks: production disruptions, excess inventory, and product introduction delays. The results are based on a sample of nearly 2400 demand-supply mismatches announced by publicly traded firms. All types of demand-supply mismatches result in volatility increases, with increases averaging 25%.

4 - Linking Inventory Management and Profitability

Serguei Netessine, Associate Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu, Sergey Rumyantsev

Using financial accounting panel data from the COMPUSTAT database, we develop a statistical methodology that links managerial decisions related to inventory with accounting returns. We find that inventory growth or decline relative to sales is associated with lower profitability.

■ MB03

C-Room 604

New Product Introduction in Supply Chains

Cluster: Supply Chain

Invited Session

Chair: Ozalp Ozer, Stanford University, Stanford, CA, 94305, United States, oozer@stanford.edu

1 - Optimal Pricing and Rebate Strategies in a Two-Level Supply Chain

Soo-Haeng Cho, UCLA Anderson School of Management, 110 Westwood Plaza, Gold Hall, Suite B512, Box 951481, Los Angeles, CA, 90095, United States, scho@anderson.ucla.edu, Kevin McCardle, Christopher Tang

In many product categories, both manufacturers and retailers use rebate promotions. While rebates have been recognized as an effective tool, firms are debating whether to continue the rebate programs due to the high cost associated with rebates. In this paper, we analyze the rebate and pricing decisions of a supply chain comprising a manufacturer and a retailer. We provide insights about how the strategic behavior of both parties affects the conditions under which a firm should offer rebates.

2 - Optimal Pricing and Inventory in Product Rollovers

Gilvan Souza, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu, Eylem Koca, Cheryl Druehl

We study product rollovers (single and dual roll) strategies and its impact on optimal pricing and inventory. Using optimal control theory, the firm finds the optimal final build quantity and price pattern for the older product generation, and the price pattern for the new product generation. We show that capacity plays a key role in product rollover management. The best overall strategy can be identified numerically.

3 - An Empirical Analysis of Software Auctions

Christian Terwiesch, Professor, The Wharton School, 3730 Walnut St, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu, Elena Krasnokutskaya

We econometrically study a global market place for software projects. We analyze how the buyer is choosing which coder bid to accept. We are specifically interested in the role of location and distance, two attributes that have been shown in traditional research on trade, but require a new interpretation in the digital world.

4 - Integrating Time-to-market, Pricing and Production Decisions

Ozalp Ozer, Stanford University, Stanford, CA, 94305, United States, oozer@stanford.edu

We study the time-to-market and subsequent pricing and production decisions for a firm that faces three major uncertainties: product qualification outcome, competitor behavior and demand. We will characterize an optimal market timing, production and pricing policy. We will also discuss the impact of market environment and operating conditions on the firm's decisions and the resulting profit.

■ MB04

C-Room 606

Tutorial: Generating Robust Project Baseline Schedules

Cluster: Tutorials
Invited Session

1 - Generating Robust Project Baseline Schedules

Willy Herroelen, Katholieke Universiteit Leuven, Naamsestraat 69, Leuven, 3000, Belgium, willy.herroelen@econ.kuleuven.be

Most research efforts in resource-constrained project scheduling assume a static and deterministic environment within which the pre-computed baseline schedule will be executed. Project activities, however, may be subject to considerable uncertainty which may lead to schedule disruptions during project execution. We discuss proactive project scheduling procedures for generating robust baseline schedules that are sufficiently protected against anticipated time and resource disruptions and reactive policies that may be deployed to repair the schedule during project execution.

■ MB05

C-Room 607

Panel Discussion: The Industry Job Search

Cluster: Job Placement Committee
Invited Session

Chair: Talisa Murray,Systems Analyst, The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel MD 20723, Talisa.Murray@jhuapl.edu

1 - Panel Discussion: Industry Job Search

Moderator: Talisa Murray,Systems Analyst, The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel MD 20723, Talisa.Murray@jhuapl.edu, Panelist: Jack Keane, Russ Labe, Grace Lin, Anne Robinson

The panel will lead an informal discussion concerning the industry interview process, the appropriate steps to take during the job search, and the challenges that may be faced along the way. Time will be provided for questions and answers.

■ MB06

C-Room 608

Managing Operations with Strategic Customers

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Martin Lariviere, Professor, Kellogg School of Management, Northwestern Univeristy, 2001 Sheridan Rd, Evanston, IL, 60091, United States, m-lariviere@kellogg.northwestern.edu

1 - Strategic Customer Behavior: Forward versus Backward Intertemporal Substitution

Xuanming Su, University of California, Haas School of Business, Berkeley, 94720, United States, xuanming@haas.berkeley.edu

Intertemporal substitution allows the strategic consumer to shift demand and avoid high prices. Previous work has considered how consumers may strategically postpone purchases and wait for sales (forward substitution). Here, we consider the reverse case where consumers take advantage of periodic promotions by stockpiling for future consumption (backward substitution), and we analyze the optimal dynamic pricing policy.

2 - Impact of Price Matching Policy on Pricing, Inventory Investment and Profit

Laurens Debo, Tepper School of Business, Carnegie Mellon Universitry, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, laurdebo@andrew.cmu.edu, Guoming Lai

Strategic consumers may postpone a purchase in anticipation of future markdowns. With a price matching policy, a seller commits reimbursing the price difference to a customer that bought before the seller marked down the product. This paper examines the impact of a price matching policy on the consumers' purchasing behavior, the seller's pricing strategy, inventory investment and profit.

3 - The Frequency of New Product Introductions When Consumers are Strategic

Robert Swinney, Doctoral Student, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, rswinney@wharton.upenn.edu, Gerard Cachon

We analyze a firm selling a series of products with uncertain demand to strategic consumers. The firm chooses inventory levels, when (and how much) to mark down prices, and when to introduce new products. Consumers choose to purchase the product that is on sale when they arrive, wait for that item to be marked down in price, or wait for the introduction of a new product (which they may value more than the current item). We discuss how the firm's decisions are affected by such strategic behavior.

4 - Saving Seats: Reservation Policies with Strategic Customers

Martin Lariviere, Professor, Kellogg School of Management, Northwestern Univeristy, 2001 Sheridan Rd, Evanston, IL, 60091, United States, m-lariviere@kellogg.northwestern.edu, Eren Cil

Consider a service provider dealing with two sets of customers. The first segment contacts the provider before the date of service and only patronize the firm if they can reserve access to the provider's limited capacity. The second segment is made up of walk-in customers who only arrive at the time of service and have a cost to access the provider. We examine the interplay between the amount of reservations given out and demand from walk-in customers.

■ MB07

C-Room 609

Behavioral Issues in Operations

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Karen Donohue, Associate Professor, The Carlson School, University of Minnesota, 321 19th Ave S, Minneapolis, MN, 55455, United States, kdonohue@csom.umn.edu

1 - Relationship as Coordination Mechanism in a Supply Chain

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, christoph.loch@insead.edu, Yaozhong Wu

Double marginalizaton is a well-known problem in supply chains. We show that parties partially motivated by status and relationships may achieve supply chain coordination in the presence of even weak selection over time.

2 - Conducting Behavioral OM Experiments via Multi-media Discrete Choice Analysis

Rohit Verma, Associate Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States, rv54@cornell.edu

Discrete choice analysis has its roots in economics but is being widely used to study a variety of research topics in operations management, marketing, product and service development and other related fields. The purpose of this presentation is to introduce the participants with the theory and different applications of discrete choice analysis. Examples from manufacturing, healthcare and service sector industries will be presented.

3 - Experimental Evaluation of Quantity-discount and Price-only Contracts Under Asymmetric Information

Feryal Erhun, Assistant Professor, Stanford University, MS&E, Stanford, CA, 94305, United States, ferhun@stanford.edu, Basak Kalkanci, Kay-Yut Chen

We study all-unit quantity discount (QD), incremental QD, and price-only contracts in a setting where a manufacturer, who is better informed about demand, procures a component from a supplier. With experiments, we test the relative performance of all-unit and incremental discounts (theory predicts that all-unit discount leads to higher profits) and the effect of number of price breaks (theory predicts that increasing the number of price breaks leads to higher profits) on supplier's profits.

4 - Newsvendor Information Gathering and Decision Making: Observations from Verbal Protocol Analysis
Srinagesh Gavirneni, Assistant Professor, Cornell University, Johnson Graduate School of Management, Ithaca, NY, 14853, United States, sg337@johnson.cornell.edu, Alice Isen

From protocol analyses of audio recordings of subjects' thought processes, we report our observations on the information gathering and decision making efforts in a newsvendor setting. Many participants correctly identified the overage and underage costs, but failed to convert that into the optimal order quantity leading us to conclude that the mathematics involved is not as intuitive as commonly perceived. Subjects sought the basic information, but failed to seek relevant advanced information.

■ MB08

C-Room 611

Joint Session Managing Disruptions/ Homeland: Risk Management in Large Scale Supply Chains

Cluster: Managing Disruptions in Supply Chains, Homeland Security
Invited Session

Chair: Jose Cruz, Assistant Professor, University of Connecticut, School of Business, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States, Jose.Cruz@business.uconn.edu

1 - Risk Handling Pattern of Large-scale Construction Project
Nengpai Lin, Professor, National Taiwan University, 6th Floor,NO.17, Suchow Rd., TAIPEI, 100, Taiwan - ROC, nengpai@mail2000.com.tw, Miao Fan

The Uncertainty of a project will increase as the scale of the project increase so as the importance of project risk management. From the management perspective, risk handling plays the key role in the project risk management process. Based on case study method, this article explored factors that influence the risk handling selection. After analyzing several risk events and their handling of two large scale construction projects, a framework described the selection of risk handling is created.

2 - A Model for Risk Management in a Supply Chain
Helene Tokou, Student (PHD), The University of Iowa, Department of CS 14 MacLean Hall, Iowa City, IA, 52242, United States, htokou@engineering.uiowa.edu, Dennis L. Bricker

Robust operation of a supply chain should allow for corrective actions (recourses) to recover from any possible disruption (scenario). A stochastic program can manage risk of disruption by selecting decisions to minimize the maximum regret over all foreseeable scenarios. Because 100% reliability of the supply chain may be unrealistic, it allows for the exclusion of a set of scenarios with acceptably low total probability. A decomposition scheme is described for the optimization of the model.

3 - Global Supply Chain Networks Sustainability: Corporate Social Responsibility and Risk Management
Jose Cruz, Assistant Professor, University of Connecticut, School of Business, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States, Jose.Cruz@business.uconn.edu

This paper develops a dynamic framework for the modeling and analysis of global supply chain networks sustainability. We model the multicriteria decision-making behavior of the various decision-makers. We explore the dynamic evolution of the product flows, the associated product prices, as well as the levels of social responsibility activities on the network until an equilibrium pattern is achieved. We illustrate the model and computational procedure with several numerical examples.

4 - A Framework for Managing Risk in Supply Chains
Joseph Mazzola, Professor, Georgetown University, McDonough School of Business, 37th and O Streets, NW, Washington, DC, 20057, United States, mazzolaj@georgetown.edu, Robin Dillon-Merrill

Risks arising from natural and human-induced disruptions in supply chains must be managed effectively to ensure continuity of operations and continued competitiveness. We present a risk-management model based on an expanded supply-chain framework and discuss implications for the allocation of resources to more effectively manage these risks.

■ MB09

C-Room 612

Mathematical Models in Homeland Security and Counterterrorism

Cluster: Homeland Security
Invited Session

Chair: Lawrence Wein, Stanford University, Graduate School of Business, Stanford, CA, United States, wein_lawrence@gsb.stanford.edu

1 - Modeling the Incubation Period of Inhalation Anthrax
Dean Wilkening, Stanford University, CISAC, Encina Hall, Stanford, CA, 94305-6165, United States, wilkening@stanford.edu

A model is developed for the inhalation anthrax incubation period distribution which is in good agreement with human data from the 1979 accidental atmospheric anthrax release in Sverdlovsk, Russia and limited non-human primate data. This model is used to determine the time at which clinical diagnosis might first detect an anthrax outbreak based on early symptomatic cases, the efficacy of medical intervention and the recommended duration for antibiotic treatment.

2 - DADs for Protecting Critical Infrastructure
Kevin Wood, Professor, Naval Postgraduate School, Monterey, CA, 93943, United States, kwood@nps.edu, Pablo Alvarez

A defender-attacker-defender model (DAD) prescribes optimal allocation of limited defensive resources to an infrastructure system so that a worst-case attack causes the least possible damage to system operation. We devise two decomposition algorithms for DAD, one of which computes an optimistic bound by reordering the stages of the DAD to create an ADD. We improve that bound by supplementing the attacker's resources appropriately, and illustrate by protecting a road network against attack.

3 - A Network-of-networks Approach to Terrorist Detection
Michael Atkinson, Institute for Computational and Mathemat, Stanford, CA, 94305, United States, mpa33@stanford.edu, Lawrence Wein

We formulate a model to identify terrorists through their participation in non-terror networks such as money laundering and dealing in illicit drugs. The government allocates resources among these networks to maximize the number of terrorists identified, but only the degree distribution within each network and overlap distribution between networks are known. The government performs both an initial global search and a secondary local search to detect terrorists in these interconnected networks.

■ MB10

C-Room 613

Strategies and Tactics for Managing Supply Risks

Cluster: Inventory
Invited Session

Chair: Brian Tomlin, University of North Carolina, CB3490, McColl Building, Chapel Hill, NC, 27599, United States, Brian_Tomlin@unc.edu

1 - Contingency Strategies in Managing Supply Systems with Uncertain Lead Times
Panos Kouvelis, Professor, Washington University in St Louis, Olin School of Business, Campus Box 1133, 1 Brookings Lane, St Louis, MO, 63130, United States, kouvelis@wustl.edu, Jian Li

Conventionally in the literature and practice, the strategy of Safety Leadtime (SL) is used to deal with leadtime uncertainty, ignoring future available information on the delivery status and other possible resources for emergency response. In this paper, we study the potential use of two contingency strategies on top of the SL approach: Strategic Inventory (SI) and Dynamic Emergency Response (DER). We provide sensitivity analysis and numerical experiments to illustrate the effectiveness of these strategies and to derive managerial insights.

2 - Mitigating Supply Risk Under Regulatory Trade Barriers
Yimin Wang, UNC Chapel Hill, McColl Building, CB3490, Chapel Hill, NC, 27599, United States, yimin_wang@unc.edu, Brian Tomlin, Wendell Gilland

We study a firm's procurement problem when its suppliers face regulatory trade barriers. In particular, we investigate four potential supply risk mitigation strategies when its suppliers are subject to quota restrictions. We fully characterize the firm's optimal policy under all four strategies. In addition, we provide managerial insights regarding the relative attractiveness of each strategy.

3 - Multi-period Procurement Strategies in the Presence of Unreliable Suppliers

Awi Federgruen, Professor, Columbia University, 419 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, af7@columbia.edu, Nan Yang

We analyze multi-period planning models for a firm which needs to cover uncertain demands by procuring supplies from multiple sources with random yields. The suppliers differ in terms of their yield distributions, prices and capacities. A procurement strategy determines, in each period, how much to order and from whom, as a function of the prevailing inventory. We characterize the structure of an optimal procurement strategy and develop efficient algorithms to compute the strategy.

4 - Supply Disruptions, Asymmetric Information, and Dual Sourcing

Zhibin Yang, zhibiny@umich.edu, Goker Aydin, Damian Beil, Volodymyr Babich

We examine how the manufacturer uses dual sourcing and supplier backup production under asymmetric information about supplier reliability. Dual sourcing encourages competition and reduces informational rent paid to a supplier, but it may increase total informational rent paid by the manufacturer. We find conditions under which dual sourcing enhances the value of perfect information for the manufacturer. Compared to sole sourcing, dual sourcing may increase the quantity risk of the manufacturer.

■ MB11

C-Room 614

Flexibility in Supply Chain Management

Cluster: Manufacturing
Invited Session

Chair: Ruixia Shi, School of Management, University of Texas at Dallas, Richardson, TX, 75083, United States, rxs048100@utdallas.edu

1 - Competing Investment Strategies with Fixed Costs and Uncertainty

Shu-Jung Sunny Yang, University of Melbourne, Parkville Victoria 3010, Australia, sj.sunny.yang@gmail.com, Eddie Anderson

We propose a new model of strategic investment to explore investment-timing trade-offs. Our model incorporates two distinctive elements compared with conventional output-setting games. First we allow firms to announce and commit to a generic investment strategy in advance. Second we include a fixed cost for investment. By applying the proposed modeling framework to a symmetric-duopoly capital-intensive industry, we find that a symmetric preemptive equilibrium is the most likely outcome.

2 - Impact of Operations Flexibility on Contract Design

Li Jiang, Assistant Professor, Hong Kong Polytechnic University, Department of Logistics, Hung Hom, KN, Hong Kong - ROC, L.Jiang@inet.polyu.edu.hk

We consider a supply chain consisting of one manufacturer and one retailer. The retailer offers a revenue share to the manufacturer who has the capability to postpone price and production decisions until demand uncertainty is resolved. We characterize optimal contract terms and the resultant channel performances, and compare them to the results in existing literature to evaluate the impact of flexibility.

3 - Supply Chain Power Structure and Performance

Ruixia Shi, School of Management, University of Texas at Dallas, Richardson, TX, 75083, United States, rxs048100@utdallas.edu, Jun Zhang

We study the impacts of supply chain power structure on the performance of a supply chain. We model three different scenarios where the supply chain members' powers are different in the supply chain and characterize the impact of the power structure on the performance of the supply and its members.

4 - Retail Assortment Competition: Effect of Inventory Costs on the Assortment Decisions

Nan Xia, PhD Candidate, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, Nan.Xia.2008@marshall.usc.edu, Yehuda Bassok

We propose a modeling framework to analyze the assortment competition between two retailers. From a given set of product variants of a category, both retailers must determine what variants to stock as well as the purchasing quantities. Taken into account of the consumer choice, we obtain interesting structural properties of the optimal assortment strategy and the equilibrium assortments. We also analyze the effects of various factors on the equilibrium assortments.

■ MB12

C-Room 615

Models for Machine Scheduling and Autonomous Agents

Cluster: Scheduling
Invited Session

Chair: Alessandro Agnetis, Professor, Universit di Siena, Dip. di Ingegneria dell'Informazione, via Roma 56, Siena, SI, 53100, Italy, agnetis@dii.unisi.it

1 - Multiple Part-type Production in Robotic Cells: The Equivalence of Two Real-world Models

Milind Dawande, Associate Professor, University of Texas at Dallas, School of Management, Richardson, TX, 75083, United States, milind@utdallas.edu, Chelliah Sriskandarajah, Michael Pinedo

We address the scheduling of operations in a robotic cell producing multiple part-types. The objective is to obtain a schedule that maximizes the throughput. We show the equivalence of two real-world models. The first is a single-gripper cell with a unit-capacity output buffer at each machine. The second is a bufferless dual-gripper cell.

2 - Connectivity Measures for Internet Topologies on the Level

Frits Spieksma, Professor, KULeuven, Naamsestraat 69, Leuven, BE, 3000, Belgium, frits.spieksma@econ.kuleuven.be, Linda Moonen, Thomas Erlebach, Danica Vukadinovic

Classical measures of connectivity are the number of disjoint paths, and the size of a minimum cut. We adapt these classical measures to the so-called valley-free path model which is relevant for the Internet on the level of Autonomous Systems. We describe and report on exact algorithms for these measures.

3 - Worst-case Analysis of the Quality of Neighborhoods for Minimizing Makespan on Identical Machines

Johann Hurink, Professor, University of Twente, Department of Applied Mathematics, P.O. Box 217, Enschede, 7500 AE, Netherlands, j.l.hurink@utwente.nl

In this talk we consider local search methods for a multiprocessor scheduling problem where jobs have to be scheduled on identical parallel machines such that the latest completion of jobs (the makespan) is minimized. We give worst-case performance guarantees for local optima with respect to several large scale neighborhood structures for the considered problem.

4 - A Lagrangian Approach to Single-machine, Two-agent Scheduling Problems

Alessandro Agnetis, Professor, Università di Siena, Dip. di Ingegneria dell'Informazione, via Roma 56, Siena, SI, 53100, Italy, agnetis@dii.unisi.it

Two agents must schedule their jobs on a single machine. Each agent has an objective function depending on the schedule of his/her jobs only. We present theoretical and computational results for the (NP-hard) problem of determining Nash and Kalai-Smorodinsky solutions of the underlying bargaining problem.

■ MB13

C-Room 616

Discrete Optimization in Memory of Peter L. Hammer

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Endre Boros, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscawatawy, NJ, 08854, United States, boros@rutcor.rutgers.edu

1 - The De-blurring of Medical Images with Image Segmentation

Dorit Hochbaum, University of California Berkeley, hochbaum@ieor.berkeley.edu

An image is segmented by modifying the pixels' colors while minimizing the penalty of modification and a penalty associated with adjacent pixels having different colors. A very efficient and best possible polynomial algorithm of Hochbaum, based on parametric cut procedure, removes blur from medical images and improves significantly their quality.

2 - On Some Disjunctive Relaxations Related to Pseudo-boolean Optimization

Michel Minoux, michel.minoux@lip6.fr

The use of the so-called "elementary closure of Lift-and-Project" cuts has been shown to provide good bounds for some classes of quadratic pseudo-boolean problems such as MAX-2SAT (see Bonami & Minoux, 2006). We investigate further disjunctive relaxations for such problems, exhibit links to other known relaxations (Sherali-Adams, Lovasz-Schrijver) and provide some preliminary computational results.

3 - A Faster Algorithm for Submodular Function Minimization
Jim Orlin, MIT, jorlin@mit.edu

We consider the problem of minimizing a submodular function f defined on a set V with n elements. We give a combinatorial algorithm that improves the previous best strongly polynomial running time by more than a factor of n.

4 - Preprocess or Not to Preprocess: That is the Question
Endre Boros, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscawatawy, NJ, 08854, United States, boros@rutcor.rutgers.edu, Gabriel Tavares, Peter Hammer

A set of preprocessing tools based on roof-duality and its extensions is proposed in order to simplify and possibly decompose the Quadratic Unconstrained Binary Optimization (QUBO) problem at hand. The number of variables simplified by the proposed method is maximum possible in the framework of standard linearizations of QUBO problems. Practical evidence of the usefulness of the method is illustrated in various applications (e.g., Ising model, VLSI, graph stability, medical imaging).

■ MB14

C-Room 617

Stochastic Nonlinear Programming

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Ankur Kulkarni, Industrial and Enterprise Systems Engg, UIUC, Urbana, IL, United States, akulkar3@uiuc.edu

1 - Decomposition Methods for Nonlinear Programming Under Uncertainty
Ankur Kulkarni, Industrial and Enterprise Systems Engg, UIUC, Urbana, IL, United States, akulkar3@uiuc.edu, Uday Shanbhag

We consider the two-period stochastic nonlinear programming and consinder the use of sequential quadratic programming for the solution of such problems. To solve the quadratic approximations, we present two stochastic QP solvers. The first is based on the inexact cut version of the L-shaped method for stochastic QPs. The second is a QP extension of the trust-region method suggested by Linderoth and Wright. We test the performance of the algorithm(s) on a nonlinear programming test problem set.

2 - Variance Reduction Techniques for Adaptive Nonlinear Stochastic Programming
Fabian Bastin, Assistant Professor, Unviersity of Montreal, C.P. 6128, Succursale Centre-Ville, Montreal, QC, H3C 3J7, Canada, bastin@iro.umontreal.ca, Pierre L'Ecuyer

Stochastic programs are often approximately solved by considering sample average approximations, based on Monte Carlo samplings. We have previously constructed an adaptive trust-region algorithm that allows the use of sub-samples when possible, adjusting the sample size at each iteration. We here consider extensions of this algorithm that are based on variance reduction techniques, such as quasi-Monte Carlo sampling, and show that substantial numerical gains can then be achieved.

3 - On the Combination of Lagrangian and Interior Approaches for Stochastic Nonlinear Programs
Di Zhang, Dept. of Industrial and Enterprise Systems Engg, UIUC, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States, zhangdi.mail@gmail.com, Uday Shanbhag

General-purpose optimization algorithms for two-period stochastic nonlinear program are not equipped to deal with the size. We address precisely an extension, focusing primarily on a Lagrangian approach. Crucial to the implementability of such ideas is the need to introduce decomposability into the primal scenario problems, by using Schur complement ideas in conjunction with a primal-dual approach. Furthermore multiplier updates can be obtained in parallel.

4 - Multi-stage Stochastic Decomposition
Zhihong Zhou, The University of Arizona, 2519 Indianola Ave. Apt. A, Columbus, OH, United States, zhzhou@email.arizona.edu, Suvrajeet Sen

Stochastic decomposition (SD) has been very successful at solving two-stage stochastic programming problems. In this talk, we generalize the ideas underlying SD to multi-stage SLP. It turns out that Rockafellar's primal-dual stochastic programming framework for SP plays a critical role in this algorithm.

■ MB15

C-Room 618

Optimization and Decision Making Under Uncertainty in Defense Applications

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Paul Krokhmal, Assistant Professor, University of Iowa, 2403 Seamans Center, Iowa City, IA, 52242, United States, krokhmal@engineering.uiowa.edu

1 - Stochastic Optimization of Sensor Network
Michael Zabarankin, Assistant Professor, Stevens Instiute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Michael.Zabarankin@stevens.edu, Anton Molyboha

A two-stage stochastic optimization problem for optimal configuration of a sensor network for protecting an anchored vessel from underwater threats has been considered. The second stage adapts signal processing to environmental conditions (ambient noise, etc.) and, as a result, combines signals from network sensors optimally. Various network configurations with the same number of sensors have been considered, and among those, an optimal network configuration has been identified.

2 - Modeling Information Sharing and Cooperation in Multi-agent Systems
David Jeffcoat, Senior Research Engineer, AFRL/MNGN, 101 W. Eglin Blvd, Eglin AFB, FL, 32542, United States, david.jeffcoat@eglin.af.mil, Paul Krokhmal

This research is concerned with the modeling and analysis of cooperation within a heterogeneous, multi-agent team. Our focus is on a special form of cooperation, namely information sharing. The objective is to develop mathematical models for cooperation via information sharing in complex large-scale systems. The approach is based on the techniques of discrete-state, continuous-time Markov chain models. The primary application context is the search for targets in a combat scenario.

3 - Target-tracking Model for Independent Sensors
Eduardo Pasiliao, AFRL Munitions Directorate, 101 West Eglin Boulevard, Eglin AFB, FL, 32542, United States, eduardo.pasiliao@eglin.af.mil

The presentation introduces an integer programming model with a maximum likelihood function for the data association problem in track fusion. The multitarget multisensor problem has traditionally been formulated as a multidimensional assignment problem, which has a complexity that grows exponentially with the number of sensors. Our model relies on solving a series of two-dimensional assignment problems to give it a complexity that only grows linearly.

■ MB16

C-Room 619

Optimizing Automotive Product Development and Manufacturing

Cluster: Optimization (Invited)
Invited Session

Chair: Daniel Reaume, Staff Researcher, General Motors Operations Research, M/C 480-106-155, 30500 Mound Road, Warren, MI, 48090, United States, daniel.reaume@gm.com

1 - Product Development Performance Improvement Through Efficient Use of Prototypes
Ryan Pereira, D.ENG Candidate, University of Michigan, 2822 Longview Ave, Rochester Hills, MI, 48307, United States, rpereira@umich.edu, Jeff Liker

The primary purpose of this research is to understand how efficient use of prototypes can enhance PDP. There is a preference for virtual prototypes but we have also uncovered that excessive reliance on this tool can lead to poor quality. Literature review shows a gap in knowledge about how firms use prototypes. Our research will develop propositions on the behavior of successful PD firms.

2 - Using Design Structure Matrix to Improve Product Development Performance
Sappinandana Akamphon, Massachussets Institute of Technology, 77 Massachusetts Avenue Rm E40-422, Cambridge, MA, 02144, United States, sup@mit.edu, Bob Bordley, Richard Roth, Daniel Reaume, Randolph Kirchain

Product development is a highly complex process with intricate network of dependency between various activities. Design structure matrix (DSM) has been developed to model the interdependency and repetitive problem solving nature

of product development processes. By combining DSM, activity time and cost distributions, along with Monte-Carlo simulation, the total cost or time effect of a change can be approximated to identify activities with highest impact.

3 - Optimizing Manufacturing Validation Builds

Daniel Reaume, Staff Researcher, General Motors Operations Research, M/C 480-106-155, 30500 Mound Road, Warren, MI, 48090, United States, daniel.reaume@gm.com, Hallie Kintner

Manufacturing validation builds (MVBs) are an essential, but expensive, tool to ensure the launch of high-quality vehicles. We propose a hybrid model to optimize the number of such builds. The model recognizes the benefits of early issue detection and the fundamental differences between the automated and manual production processes involved in vehicle assembly.

4 - The Implications of Utility for Supply Chain Dynamics

Bob Bordley, General Motors Operations Research, M/C 480-106-256, 30500 Mound Road, Warren, MI, 48090, United States, robert.bordley@gm.com

While most supplier contracts specify fixed deadlines, consumers typically have more flexible preferences over project completion times. If the customer's preferences satisfy utility theory, then this is equivalent to replacing the fixed deadline by a random deadline. This paper examines the implications of this random deadline for supply chain dynamics.

■ MB17

C-Room 620

Joint Session ISS/ICS: Trends in Information Privacy and Security

Sponsor: Information Systems Society, INFORMS Computing Society
Sponsored Session

Chair: Ram Gopal, Professor, University of Connecticut, OPIM Department, School of Business, Storrs, CT, 06269, United States, Ram.Gopal@business.uconn.edu

1 - A Peer-to-peer Network Security Pricing Model to Increase Networks' Resistance to Virus Propagation

Daniel Rice, Loyola College in Maryland, 4501 N. Charles Street, Baltimore, MD, 21210, United States, drice2@loyola.edu, George Wright

This research presents a peer-to-peer (P2P) network security pricing model (NSPM) that promotes the growth of P2P networks having an increased resistance to malicious code propagation. The P2P NSPM integrates findings from recent developments in complex network theory with an incentive-compatible pricing model. Prices are a function of the Pearson coefficient. Early results demonstrate that the P2P NSPM impacts the overall structure of the network, creating more secure P2P networks.

2 - Data Reconstruction for Identity Disclosure Protection

Xiaobai (Bob) Li, College of Management, University of Massachusetts Lowell, One University Ave., Lowell, MA, 01854, United States, xiaobai_li@uml.edu, Dan Zhu

We propose a data reconstruction approach for privacy protection in data mining. The proposed approach uses a set of techniques, including aggregation, swapping, and instance selection via genetic algorithms, to reconstruct data to achieve k-anonymity protection in predictive data mining.

3 - Anonymous Data Collection Protocol

Rajeev Kumar, University Of Connecticut, Hill side Road, Storrs, CT, 06269, United States, Rkumar@business.uconn.edu, Ram Gopal, Robert Garfinkel

We develop flexible, cryptography-based anonymous data collection protocol that can collect data from individuals without the use of a trusted third party. Our protocol is flexible in that it can be easily modified depending on the type of threat or desired level of security. The protocol is also robust against malicious participants.

■ MB18

C-Room 201

Integer Programming - Theory, Computation, Visualization

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Karen Aardal, CWI, Kruislaan 413, Amsterdam, 1098 SJ, Netherlands, Karen.Aardal@cwi.nl

1 - Strengthened GMICs for 0-1 Mixed Integer Programs

Jean-Philippe Richard, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, jprichar@purdue.edu

Generating strong cuts for unstructured mixed integer programs is an important but difficult problem. A traditional way of circumventing this difficulty is to generate cuts from single row relaxations of the problem, often using superadditive lifting. In this talk, we describe a sequential lifting procedure to obtain strong valid inequalities that can produce, among other cuts, strengthened GMICs for 0-1 mixed integer programs.

2 - Visualization Tools for Branch-and-bound Algorithms

Brady Hunsaker, University of Pittsburgh, 1036 Benedum Hall, Pittsburgh, PA, United States, hunsaker@engr.pitt.edu, Osman Ozaltin, Ted Ralphs

We present methods to visualize the behavior of branch-and-bound algorithms. Our implementation has interfaces for three open-source solvers: CBC, SYMPHONY, and GLPK. We give examples to demonstrate the potential usefulness of these methods in understanding the progress of the algorithm, understanding differences between instances, and learning about branch-and-bound algorithms.

3 - Estimating Solution Time of Branch-and-bound Algorithm

Osman Ozaltin, Doctoral Student, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15260, United States, oyo1@pitt.edu, Brady Hunsaker, Ted Ralphs

We consider methods for evaluating the progress of B&B algorithms. One main goal is to provide users with more useful information on the progress of the algorithm and the other is to develop a method to predict the total solution time. A novel progress measure is computed and total solution time predictions are calculated based on that measure. Three open-source solvers, COIN/Cbc, Symphony, and Glpk are used to study B&B tree development for a number of different test problems.

4 - Polyhedral Results for an Equal-split Network Flow Problem

Shabbir Ahmed, Georgia Institute of Technology, sahmed@isye.gatech.edu, Joel Sokol, Amandeep Parmar

We consider a network flow problem where flow out of a node has to be equally split across the chosen out-going arcs. Several families of cutting planes are developed for an integer programming formulation of the problem, and these cuts are integrated within a branch-and-cut scheme. Computational results from an application in communication networks is presented.

■ MB19

C-Room 203

Recent Progress in Integer and Nonlinear Optimization

Sponsor: INFORMS Computing Society
Sponsored Session

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

1 - Continuous and Discrete NLP - State-of-the-Art

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

Mainly based on our benchmarks we will give an overview of the capabilities of exiating software for NLP and MINLP.

2 - Benchmarking a Mip Solver

Tobias Achterberg, PhD, ILOG, Ober-Eschbacher Strasse 109, Bad Homburg, 61352, Germany, tachterberg@ilog.de

Computational research needs experiments to evaluate the impact of new algorithms. Therefore, many scientists present benchmark results to demonstrate the significance of their ideas. In this talk, we offer examples of pitfalls in the context of benchmarking MIP solvers and give hints on how benchmarks can be set up in a reasonable way. We present benchmarks that show the significant performance improvements of the new CPLEX release.

3 - FilMINT: A Linearizations-based MINLP Solver
Kumar Abhishek, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States, kua3@lehigh.edu

We describe a solver for mixed integer nonlinear programs that implements a linearization-based algorithm in a branch-and-cut framework. We offer new suggestions for generating and managing linearizations that are shown to be efficient on a wide range of MINLPs. We also use the advanced features of the MILP framework. FilMINT uses MINTO for solving the MILP, and Filter-SQP for solving the NLPs. Detailed computational experiments are presented, highlighting the framework's effectiveness.

4 - LOQO, an Interior-point Code for Nonconvex Nonlinear Programming
Hande Y. Benson, Assistant Professor, Drexel University, Dep. of Decision Sciences, 3141 Chestnut Street, Philadelphia, PA, 19104-2875, United States, benson@drexel.edu, Robert Vanderbei, David Shanno

We will present the latest advances in LOQO, a general-purpose code that implements an interior-point method for solving nonconvex nonlinear programming problems. Of particular note will be the primal-dual penalty approach for solving and warmstarting nonlinear programming problems, including its application to mixed-integer nonlinear programming.

■ MB20

C-Room 204

Panel Discussion: Essential Topics in Teaching Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Ronald Howard, Professor and Director Decisions and Ethics Center, Stanford University, Stanford, CA, 94305, United States, rhoward@stanford.edu

1 - Panel Discussion: Essential Topics in Teaching Decision Analysis
Moderator: Ronald Howard, Professor and Director Decisions and Ethics Center, Stanford University, Stanford, CA, 94305, United States, rhoward@stanford.edu, Panelist: Ali Abbas, James Smith, Ralph Keeney, Eric Bickel

Decision analysis is taught in various contexts with different objectives. The question of which topics should be covered in texts and classes will be discussed by a panel of those experienced in teaching and then by the audience. The comments of practitioners are particularly welcomed.

■ MB21

C-Room 205

Presenting and Conveying Models

Sponsor: Decision Analysis
Sponsored Session

Chair: Jenna Marquard, University of Wisconsin - Madison, Industrial and Systems Engineering, 1513 University Avenue, Madison, WI, 53706, United States, jlhetland@wisc.edu

1 - From OR to PR and Back
Sam Savage, Conbsulting Prof., Stanford University, Dept.. of MS&E, 326 Terman, Stanford, CA, 94305, United States, savage@stanford.edu

Many important OR concepts lie fallow because they are not understood by the general public. Small interactive OR models designed with Public Relations in mind can serve as channels of communication with your client. Once you understand what they understand, you will know what kind of OR is really needed.

2 - DA Tools for Communication between Modelers and DMs
Mayank Mohan, Research Assistant, USC - CREATE, 1124 W 29th Street, #12, Los Angeles, CA, 90007, United States, mayank_mg@yahoo.com

User interaction is important for decision analysis models. This helps incorporating expert judgment on the values variables may take. It assists in keeping the model input dynamic. To achieve this level of user interaction we use tools like influence diagrams, color coding to ascertain bounds of variable values, user input using sliders and other control mechanisms. In this presentation we briefly demonstrate some of the tools using a real life example.

3 - Making Decisions with Models: Uncovering Perceptual and Cognitive Challenges
Jenna Marquard, University of Wisconsin - Madison, Industrial and Systems Engineering, 1513 University Avenue, Madison, WI, 53706, United States, jlhetland@wisc.edu, Stephen Robinson

Models can aid decision makers by providing structure to problems, but we must attend to how these models are presented to decision makers. Well known perceptual and cognitive challenges still affect decision makers who use models to guide their decision making.

■ MB22

C-Room 206

Health Care Research from an OR/OM Perspective

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Gal Raz, Associate Professor, Darden Graduate School of Business, University of Virginia, Charlottesville, VA, 22906-6550, United States, razg@darden.virginia.edu

1 - Operations Management in Health Care
Stefanos Zenios, Professor, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, stefzen@exch-gsb.stanford.edu

In the field of Operations Management we study technological systems which execute ongoing tasks though the coordinated function of technology, people, and operating procedures. In this talk I will review three health care systems that exemplify this definition of Operations Management, will discuss research done to date and explore open research questions. These systems are: organ allocation systems; health care services reimbursement systems; OR scheduling systems.

■ MB23

C-Room 208

Emerging Areas in Behavioral Operations

Sponsor: Behavioral Process Management (BPM)
Sponsored Session

Chair: Neil Bearden, INSEAD, Decision Sciences Area, NA, Singapore, jneilb@gmail.com

1 - On Applying (Optimally) to Colleges (and Jobs)
Ryan Murphy, Research Scientist / Post doc, Columbia University, 601 W. 115th #42A, New York, NY, 10025, United States, rom2102@columbia.edu, Neil Bearden

We present theoretical and experimental results on a portfolio selection problem that maps closely onto the problem faced by students applying to colleges. The decision maker (DM) must select a subset of schools to which to apply. Each application is costly and acceptances are probabilistic. Importantly, the DM's payoff is based exclusively on the best school to which she is accepted. We find that subjects depart from the dictates of the optimal application policy in several systematic ways.

2 - Some Experimental Studies of Dynamic Pricing
Neil Bearden, INSEAD, Decision Sciences Area, NA, Singapore, jneilb@gmail.com, Bill Becker, Amnon Rapoport

We present results from three experimental studies of dynamic pricing of perishable goods in the face of constant, increasing, and decreasing demand. Our results show that actual decision makers systematically mis-price their goods; that their pricing errors are systematically related to how demand changes with time; and that they incur significant revenue losses. We argue that laboratory studies can help demonstrate that decision makers would benefit a great deal from optimal pricing models.

3 - Job Offer Game
Wenjie Tang, PhD Student, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, Wenjie.TANG@insead.edu, Ilia Tsetlin, Neil Bearden

We study how the subjects play the game where the perspective employer should set an offer deadline and the employee should decide whether to accept it or to wait for more attractive offer from another employer. We discuss the observed deviations from the Nash Equilibrium and compare them to the ones observed in the experiments on ultimatum game. We also consider extensions to multiple employers and employees and discuss the implications for the optimal matching.

4 - An Empirical Investigation of the Impact of Secondary Markets on Supply Chain Performance

Mirko Kremer, mirko.kremer@bwl.uni-mannheim.de, Wedad Elmaghraby

We present the results of a laboratory experiment set up in order to empirically test the impact of secondary markets on supply chain performance.

■ MB24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - LINDO Systems, Inc. - Efficient Tools for Optimization Modeling

Mark Wiley, LINDO Systems, Inc., 1415 North Dayton St., Chicago, IL, 60622, 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. Find out how easy it is to: quickly build complex optimization models; effortlessly access data in Excel and databases; seamlessly embed optimization into your own applications.

2 - Maximal Software, Inc. - Introducing New Release of MPL Modeling System for Optimization with New and Enhanced Features

Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

We will be demonstrating the newest release of MPL, one of the fastest and most scalable modeling languages on the market today. The innovative OptiMax 2000 Component Library, which allows MPL models to be easily embedded into end-user applications, has been augmented to include several new objects and methods. The speed and scalability of the model generation has been greatly enhanced, and with the new 64-bit Itanium version capable of solving much larger models than ever before. Several new solvers have been added and existing solvers updated. Data access has been improved with new native drivers and now offers full XML/SOAP support for Internet connectivity.

■ MB25

C-Room 210

Services Workforce Management I

Sponsor: Service Science
Sponsored Session

Chair: Dagan Gilat, Senior Manager, Business Transformation and Optimization, IBM, IBM Haifa Research Lab, Haifa University, Mount Carmel, Haifa, 31905, Israel, dagang@il.ibm.com

1 - Shift Scheduling for Third Level IT Support: Challenges, Models and Case Study

Dagan Gilat, IBM, IBM Research Lab, Haifa University, Mount Carmel, Haifa, NA, 31905, Israel, SEGEVW@il.ibm.com, Shai Taub, Sergey Zeltyn, Dagan Gilat, Vladimir Lipets, Zohar Feldman, Avishai Mandelbaum

Outsourcing IT support of an enterprise requires that third level IT support is provided as a service by an outsourcer. Despite the large body of existing work regarding demand forecasting and shift schedule creation in various domains, very little work exists for third level IT support. We present an end–to-end methodology for forecasting and scheduling this type of work, and demonstrate it in the context of a specific case study, in which significant potential savings were demonstrated.

2 - Workforce Capacity Planning for Systems with Discontinuous Workflows and Highly Variable Job Sizes

Ana Radovanovic, IBM, Route 134, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, aradovan@us.ibm.com

Motivated by emerging applications in workforce management, we consider a capacity planning problem where usual loss network or call center approach might not be appropriate for modeling and analysis. We propose an analytic approach to address two novel features: only specific tasks in job processing are executed by an observed workforce team member, and task durations are subexponentially distributed. Our theoretically obtained capacities match surprisingly well real system simulations.

3 - Workforce Planning and Scheduling in Large Call Centers: Towards a Unified Approach

Itai Gurvich, Doctoral Student, Columbia Business School, Uris Hall, 3022 Broadway, New York, NY, 10027, United States, ig2126@columbia.edu, Tolga Tezcan

We study the problem of workforce planning in a large-scale call center with multiple customer classes and multiple agent types. We propose a comprehensive yet simple solution to the short-term staffing and routing problems as well as to the long-term hiring and training problems. Our analysis highlights key tradeoffs between the short-term and long-term decisions and suggests a new perspective on operational flexibility in call centers.

4 - Stochastic Scheduling for Workforce Management

Noah Gans, OPIM Dept. - Wharton - Penn, 3730 Walnut St, Suite 500, Philadelphia, PA, 19104, United States, gans@wharton.upenn.edu, Yong-Pin Zhou, Haipeng Shen, Herbert Ristock, Alan McCord

Arrivals of customers to call centers and other consumer systems are often doubly stochastic. We investigate workforce management scheduling techniques that account for this form of uncertainty.

■ MB26

C-Room 211

Joint Session DM/ ICS/Computational Methods for Data Mining: Mining and Modeling for Optimizing Complex Systems

Sponsor: Data Mining (Sponsored), INFORMS Computing Society, Computational Methods for Data Mining
Sponsored Session

Chair: Victoria Chen, University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, vchen@uta.edu

1 - Uninhabited Aerial Vehicle Routing with Limited Wind Risk

Siriwat Visoldilokpun, PhD Student, University of Texas at Arlington, Campus Box 19017, The University of Texas at Arlington, Arlington, TX, 76019, United States, svisoldilokpun@uta.edu, Jay Rosenberger, Victoria Chen

We propose a branch-and-price-and-cut methodology to solve the UAV routing problem with limited risk incurred by wind. Risk is approximated via a design and analysis of computer experiment and a convex Multi-adaptive regression splines (MARS) model. A column-and-cut generation algorithm is solved that dynamically adds routes and risk cuts within the branch-and-bound tree. We compare the MARS risk model to a traditional quadratic model. Computational results and extensions are provided.

2 - Incorporating Decision Makers' Inputs in a Dynamic Multistage Multiobjective Model

Prashant Tarun, PhD Candidate, Graduate Research Assistant, The University of Texas at Arlington, P.O. Box 19017, Arlington, TX, 76019, United States, prashy@uta.edu, Victoria Chen, Bill Corley

Methods of geometric mean (GM) and successive geometric mean (SGM) of non-ones provide a practical way to compute pairwise comparison matrices at each stage of a multistage multiobjective (MSMO) model. However, the efficacy of these methods in producing consistent matrices depends solely on the quality of decision makers' inputs. We present an approach for obtaining meaningful decision makers' inputs, which enables GM and SGM to produce consistent pairwise comparison matrices.

3 - Use of U.S. EPA MARKAL Model for Better Decision Making in Renewable Energy Alternatives

Ozge Kaplan, US Environmental Protection Agency, 109 T.W. Alexander Drive, Mail Drop: E305-02, Research Triangle Park, NC, 27711, United States, Kaplan.Ozge@epamail.epa.gov

The goal of this study is to place urban wastes in the context of national energy system while considering technological change. A variety of renewable energy technologies for waste and landfill-gas are included in the U.S. EPA MARKAL model to understand how they compete against technologies using fossil fuels to meet the energy demands. The variation of cost, emissions, technology penetrations in different emission reduction scenarios, and the robustness of the technology choices are analyzed.

4 - Platform Identification Using Data Mining for Service Family Design

Timothy Simpson, Professor, Penn State University, 329 Leonhard Building, University Park, PA, 16802, United States, tws8@psu.edu, Seung Ki Moon, Soundar Kumara

In this paper, we introduce a new methodology to identify a module-based platform for service family design using service-based process analysis and data mining techniques. We employ fuzzy clustering to determine modules for platform design in a given service family. The clustering result is identified as a platform by the fuzzy set theory and classification. To demonstrate implementation of the proposed methodology, we use a case study involving a family of banking services.

■ MB27

C-Room 212

E-voice of the Customer: Mining News, Blogs and Discussion Boards

Cluster: Data Mining (Invited)
Invited Session

Chair: Ronen Feldman, School Of Business Administration, Hebrew University, Jerusalem, ronenf@gmail.com

1 - Mining News Articles Using Unsupervised Learning

Ronen Feldman, School Of Business Administration, Hebrew University, Jerusalem, ronenf@gmail.com, Benjmain Rosenfeld

Web extraction systems attempt to use the immense amount of unlabeled text in the Web in order to create large lists of entities and relations. SRES is a Web relation extraction system that performs its task in a totally unsupervised way. SRES learns the extraction patterns from unlabeled text. In this paper we show how we can use SRES to mine large collections of business news articles.

2 - Assessing Market Structure by Listening to Consumers Using Text Mining

Ronen Feldman, School Of Business Administration, Hebrew University, Jerusalem, ronenf@gmail.com, Jacob Goldenberg, Oded Netzer

Can one organize the information posted by consumers on the Internet to allow managers to assess market potential and market structure? The wide spread of the internet has lead to a colossal amount of information posted by consumers on the web through mediums such as forums, blogs, and product reviews. This type of information offers the firm an opportunity to listen to consumers. We rely on large network analysis techniques in converting the text mining data into market structure analysis. The networks in our research are not consumer networks but rather semantic ones in which the nodes consist of concepts, products, or commonly used terms.

3 - Mining Product Discussion Forums for Market Structure

Ronen Feldman, School Of Business Administration, Hebrew University, Jerusalem, ronenf@gmail.com, Jacob Goldenberg, Oded Netzer, Lyle Ungar

Product discussion forums are a potential rich source of information about how users view different products. Researchers and practitioners are starting to extract user sentiment about products from user product reviews. Users often compare different products, stating which they like better and why. We present a case study in extracting information about comparisons between cars, and running shoes, describe an effective methodology, and show how it produces insight into how consumers view the running shoe market and the cars market.

4 - How Much and How Heartfelt: The Relationship Between Buzz, Sentiment, and Sales

Jonathan Schler, jonathan.schler@buzzmetrics.com, Kate Niederhoffer, Rob Mooth, Jonathan Gordon

In this paper we analyze the relationship between volume and sentiment of online discussions in relation to sales. Our research offers empirical evidence to classify the conditions under which buzz and sales are optimized. Potential implications offer guidance to manufacturers in strategizing their marketing effort for new initiatives.

■ MB28

C-Room 213

Metaheuristics

Contributed Session

Chair: Stacey Hollis, North Carolina A&T State University, 131 E Meadowood St, Greensboro, NC, 27409, United States, sahollis@bellsouth.net

1 - Applying Ant Colony Algorithm to Solving a Two-Stage Integrated Production and Distribution Problem

Yung-Chia Chang, Assistant Professor, National Chiao Tung University, Hsinchu, Taiwan, 1001 Ta Hsueh Road, Hsinchu, 30050, Taiwan - ROC, yungchiachang@mail.nctu.edu.tw, Phongchai Jittamai, Tian-Wei Wang

We consider a problem in which jobs are first processed in a manufacturing facility and then delivered to multiple customer locations by vehicles. The objective is to find a joint production and distribution schedule so that the total weighted completion times is minimized. We designed an ant colony algorithm to solve this problem in order to find near-optimal solutions in reasonable computation times. Computational analysis is performed to evaluate the effectiveness of the proposed approach.

2 - Variable Neighbourhood Search for the Minimum Labelling Steiner Tree Problem

Sergio Consoli, PhD Student, Brunel University, 101 John Crank building, Brunel Uni, uxbridge, middlesex, London, LN, UB83PH, United Kingdom, sergio.consoli@brunel.ac.uk, Kenneth Darby-Dowman, Nenad Mladenovic, José Andrés Moreno Perez

We present several metaheuristics for the Minimum Labelling Steiner Tree problem, a special case of the Minimum Labelling Spanning Tree problem. Given an undirected labelled connected graph, the aim is to seek a spanning tree covering a subset of nodes of the graph and whose edges have the smallest number of distinct labels. Computational experiments show that a Variable Neighbourhood Search metaheuristic is the most successful approach for this problem.

3 - Gradient Estimation in Population-dynamics Global Optimization

Maya Gupta, Asst. Professor of Electrical Engineering, University of Washington, Box 352500, Seattle, WA, 98103, United States, gupta@ee.washington.edu, Megan Hazen

Local gradient information is of limited utility in global optimization due to the presence of local minima. However, it is still desirable to direct search processes 'down hill' towards promising search regions. We look at the use of gradient estimations to guide population-based search techniques, showing that the concept of a regional gradient is useful both analytically and in practice.

4 - Manpower Scheduling for Airline Catering Using Tabu Search

Janny Leung, The Chinese University of Hong Kong, Systems Engineering &. Eng. Mgt. Dept., Shatin, Hong Kong - ROC, janny@se.cuhk.edu.hk, Sin Ho

We study a manpower scheduling problem with job time-windows and job-skills compatibility constraints. Given the jobs to be serviced and the roster of workers, the problem is to form teams and assign teams and start-times for the jobs, so as to service as many flights as possible, and balance the workload balance among the teams. We present a tabu search heuristic which employs strategic oscillation and diversification strategies.

5 - A Genetic Algorithm for Data Allocation in RFID Tags

Stacey Hollis, North Carolina A&T State University, 131 E Meadowood St, Greensboro, NC, 27409, United States, sahollis@bellsouth.net, Lauren Davis, Funda Samanlioglu, Paul Stanfield

Ideally all available relevant information could be stored on RFID tags with new information being added to the tags as they arrived. However, because of the finite memory capacity of RFID tags, users need to be more selective in data allocation. A genetic algorithm is developed to allocate data such that the value of unexplained data off the tag is minimized while tag memory capacity is not exceeded.

■ MB29

C-Room 214

Comparisons of State-of-the-art Linear Math Programming Software

Sponsor: INFORMS Computing Society/ICS/COIN-OR
Sponsored Session

Chair: William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185, United States, wehart@sandia.gov

1 - Comparisons of State-of-the-art Linear Math Programming Software

William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185, United States, wehart@sandia.gov, Jean-Paul Watson, Cynthia Phillips

This session will include presentations that compare the performance of math programming solvers for integer programming: 1) Linear programming solvers, 2) MILP incubment generators, 3) MILP solvers with an optimal incumbent value, and 4) MILP solvers with no incumbent. We will also discuss experimental techniques for making comparisons. These comparisons will highlight the strengths and weaknesses of open source solvers, and assess how well they compare to commercial solvers.

2 - Comparing MILP Heuristics: Implementations and Analysis

Jean-Paul Watson, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185-1318, United States, jwatson@sandia.gov

Heuristics for incumbent generation and improvement are a crucial performance component of commercial and open-source MIP solvers. We contrast the various algorithms available in these MIP solvers. We focus - to the extent possible given available information - on specific implementation decisions and architecture within the branch-and-bound/cut framework. The incumbent-finding and improvement capabilities of several solvers is then contrasted on a range of difficult MIP benchmarks.

3 - Experimental Comparison of Current Integer-programming Solvers

Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185, United States, caphill@sandia.gov

We compare the performance of commercial and open-source/free integer programming codes on MIPLIB instances and other challenging problems. Other talks in this session focus on specific parts of the search process. In this talk we consider the total time to find a solution. We hope to enlist the participation of a developer from each IP code in this study.

■ MB30

C-Room 2A

Best Student Paper Competition

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Roshan Vengazhiyil, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, roshan@isye.gatech.edu

1 - Best Student Paper Competition

This session includes presentations from four finalists for the QSR best student paper award. The four finalists are selected after reviewing all of the submitted papers for this competition. The results will be announced at the QSR business meeting.

■ MB31

C-Room 2B

Joint Session QSR/HAS/Service Science: Quality and Statistical Decision-making in Healthcare Applications IV

Sponsor: Quality, Statistics and Reliability, Health Applications Section, Service Science
Sponsored Session

Chair: Jing Li, Arizona State University, Tempe, AZ, United States, jinglz@umich.edu

Co-Chair: Julie Simmons Ivy, jsimmons@bus.umich.edu

1 - Associated Infections: A System Level Risk Model for the ICUs

Shreyas S. Limaye, PhD Student, University of Washington, 5505, 15th Ave NE, Apt # 306, Seattle, WA, 98105, United States, shreyas@u.washington.edu, Christina Mastrangelo

This research takes a systemic view at the operational level of ICUs in order to reduce the transmission of Hospital-associated infections. This talk focuses on the development of a risk-of-transmission model and how the model integrates with a simulation model of the physical and functional areas.

2 - Mathematical Programming Methods for the Optimization of the Emergency Health-care Service in Milan

Giovanni Righini, University of Milan, Via Bramante 65, Crema, CR, Italy, righini@dti.unimi.it, Marco Trubian, Roberto Cordone, Alberto Ceselli, Andrea Pinciroli

In this talk we will present a case study we have done for the emergency health care service in the city of Milan. The main subproblem concerns real-time relocation of available ambulances. Related subproblems concern the choice of the parking areas for the ambulances, the trade-off between the level of service provided to non-urgent calls and the probability of not responding to urgent calls in time, service cost minimization and night duties scheduling of heart surgery wards.

3 - Mammography Breast Cancer Risk Prediction Model Based on Logistic Regression

Jagpreet Chhatwal, University of Wisconsin-Madison, 4126 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53706, United States, jchhatwal@wisc.edu, Oguzhan Alagoz, Charles Kahn, Elizabeth Burnside

While interpreting mammograms, radiologists need to assimilate huge amount of information to make judgment about the risk of breast cancer. Variations in interpretations exist among radiologists and practices. Our model, based on mammography descriptors and demographic factors, predicts the probability of cancer and performs significantly better than radiologists in discriminating malignant from benign lesions. It also identifies the important risk predictors of breast cancer.

4 - Error Minimization in Healthcare Settings Through the Dynamic Analysis of Near-misses

Jose Zayas-Castro, Professor & Chair, University of South Florida, 4202 E Fowler Avenue, Industrial Engineering Department, Tampa, FL, 33620, United States, josezaya@eng.usf.edu, Laila Cure, Peter Fabri

There are about 98,000 annual U.S. deaths due to medical errors. The potential to reduce this error exists by conducting systematic analysis of near-misses. A dynamic methodology is proposed to report, classify and analyze near-misses to then assess the likelihood of the occurrence of errors and trigger a timely alarm.

■ MB32

C-Room 302

Shipping, Port and Logistics Finance and Investment

Cluster: Shipping, Maritime, and Supply Chain Logistics
Invited Session

Chair: TL Yip, Assistant Professor, Hong Kong Polytechnic University, Department of Logistics, Hung Hom, Hong Kong, China, lgttly@polyu.edu.hk,

Co-Chair: Jia Yan, Assistant Professor, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, China, lgtjiay@inet.polyu.edu.hk

1 - The Dynamics of Term Structure and Volatility of Freight Rates

Amir H Alizadeh, Faculty of Finance, Cass Business School, London EC1Y 8TZ, UK, United Kingdom, a.alizadeh@city.ac.uk, Nikos K Nomikos

We examine the impact of the term structure of freight rates on the volatility of the spot market, using data from January 1999 to September 2006. The findings would be useful for investors in various diverse industries (ranging from banking and finance to utility companies and trading houses) who are interested in the expanding and dynamic freight derivatives market.

2 - Linking the Cash-to-cash Cycle to Corporate Performance

David A. Menachof, Sr. Lecturer in International Logistics, Cass Business School, City University, 106 Bunhill Row, London, EC1Y 8TZ, United Kingdom, d.menachof@city.ac.uk

This study will attempt to link Cash-to-Cash(C-to-C) cycle (a key SC performance metric) and corporate performance on a global scale; an empirical link that is so far missing to date. The implication is that the clearer the link, the more incentive the SC Manager has to actively manage this recognized metric.

3 - The Role of Political Culture in Port Reform and Governance

Koi Yu Adolf Ng, Assistant Professor, Dept. of Logistics, Faculty of Business, Hong Kong Polytechnic University, Hong Kong, China, kyng@few.eur.nl

With the perplexing relationship emerging within hybrid organisational entities, the concept of port governance had been introduced. While much concentration was linked to the relation between governance and port functions, attention on how political culture affected settings and strategies of such reformed institutions was limited. In this study, I will investigate how political culture affects port reform and governance, with emphasis on the power distribution among port's stakeholders.

■ MB33

C-Room 303

Containerization Mini Cluster: Berth Allocation, Berth Scheduling and Vessel Planning

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Maria Boile, Associate Professor and Director of Research and Education, CAIT/MIEMP, Rutgers University, 100 Brett Road, Piscataway, NJ, 08854, United States, boile@rci.rutgers.edu

1 - Simultaneous Berth and Quay Crane Scheduling for Container Ports

Aykagan Ak, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, aak@isye.gatech.edu, Alan Erera

This paper concentrates on the scheduling problem of berth and quay cranes, simultaneously because of the fact that the service time of vessels depend on the crane allocation. We determine berthing positions and times of vessels as well as the assignment of quay cranes to holds of vessels so that the total service time and total lateness penalty is minimized. A MIP is formulated and used to solve small problems optimally. Tabu search methods are proposed for large problems.

2 - A Linear MIP Formulation of the Berth Allocation Problem Reflecting Service Priority Arrangements

Maria Boile, Associate Professor and Director of Research and Education, CAIT/MIEMP, Rutgers University, 100 Brett Road, Piscataway, NJ, 08854, United States, boile@rci.rutgers.edu, Sotiris Theofanis, Michail Golias

The discrete and dynamic BAP is formulated as a linear MIP problem with the objective to simultaneously minimize the cost from ships' late departures and maximize the benefits from ships' early departures and timely departures, as these are specified in contractual agreements. A proof that the proposed formulation is the general case of previous BAP formulations presented in the literature is provided along with a numerical comparison.

3 - Berth and Quay Crane Scheduling: A Multi-objective Formulation

Michail Golias, Graduate Research Assistant, Civil and Environmental Engineering, Rutgers University, 623 Bowser Road, Piscataway, NJ, 08854, United States, golias@rci.rutgers.edu, Maria Boile, Sotiris Theofanis

A formulation for simultaneous berth and quay crane scheduling with multiple objectives is presented. A genetic algorithm based heuristic is proposed for solving the resulting problem. We consider the minimization of costs from not meeting agreed (un)loading vessel performance, waiting and handling, and tardiness of completion of service.

4 - A Lagrangian Relaxation Approach to the Vessel Planning Problem

Jose Fernando Alvarez, Universitat Pompeu Fabra, Ramon Trias Fargas, 25, Barcelona, 08005, Spain, josefernando.alvarez@upf.edu

The vessel plan must comply with the stowage instructions provided by the shipping company, but should also expedite container transport operations in the yard. We present an algorithm to generate optimal vessel loading plans. We consider disutility from container rehandling, ground travel, and on-board weight distribution. The algorithm uses Lagrangian relaxation to generate bounds within a branch and bound framework. Computational performance is assessed using data from a Spanish terminal.

■ MB34

C-Room 304

Current Research in Transportation Science and Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Stephen Hill, PhD Candidate, The University of Alabama, Box 870226, Tuscaloosa, AL, 35487, United States, shill@cba.ua.edu

1 - Heuristics for the Location Routing Problem with Intermediate Storage Facilities

Stephen Hill, PhD Candidate, The University of Alabama, Box 870226, Tuscaloosa, AL, 35487, United States, shill@cba.ua.edu, John Mittenthal

In this work we discuss the characteristics of and potential solution approaches for the Location Routing Problem with Intermediate Storage Facilities. We present several heuristic approaches to generate high-quality solutions to the problem.

2 - Heuristics and Bounds for the Storage Constrained, Inbound Inventory Routing Problem

Charles Sox, Professor and Director, The University of Alabama, Operations Management, Box 870226, Tuscaloosa, AL, 35487, United States, csox@cba.ua.edu, Malini Natarajarathinam, Jennifer Stacey

We present heuristics and a lower bound for route design and inventory management of inbound parts for a facility that has a limited amount of storage space in which to store inventory. We develop a lower bound as a benchmark for the heuristic solutions and show that near optimal solutions can be obtained in a reasonable amount of time by utilizing information about the amount of storage space in the route selection process.

3 - A Hybrid Grasp-Ga Approach to the Capacitated VRPSPD

Burak Eksioglu, Assistant Professor, Mississippi State University, 808 Red Oak Lane, Starkville, MS, 39759, United States, beksioglu@ise.msstate.edu, Arif Vural

The logistics problem of simultaneous distribution and collection of commodities is studied. Commodities to be distributed are loaded at the depot and delivered to the customers, and items collected from the customers are transported back to the depot. The objective is to minimize total distance traveled. To solve the resulting problem a hybrid genetic algorithm is developed and tested on benchmark problems. The results indicate that the proposed algorithm produces good quality solutions.

4 - Heuristic Approaches for the Multi-period Location Routing Problem

Marco Lam, The University of Alabama, PO Box 870226, Tuscaloosa, AL, United States, mlam@cba.ua.edu, John Mittenthal

The objective of the Multi-Period Location Routing Problem (MP-LRP) is to minimize transportation and warehousing costs by selecting warehouses out of a set of possible warehouses. Because the problem is NP-hard, we propose heuristic approaches to solve it. We develop lower bounds and assess the performance of our heuristic approaches.

■ MB35

C-Room 305

Panel Discussion: Transportation 2030 - Trends and Challenges

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Martin Savelsbergh, Georgia Tech, 765 Ferst Dr, Atlanta, GA, 30332, United States, martin.savelsbergh@isye.gatech.edu

1 - Transportation 2030- Trends and Challenges

Moderator: Martin Savelsbergh, Professor, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Tech, 765 Ferst Dr, Atlanta, GA, 30332-0205, United States, mwps@isye.gatech.edu, Panelist: Brenda Dietrich, Michael Meyer, Chelsea White

The Transportation Science and Logistics Society is including a panel discussion on transportation trends and challenges in its cluster of presentations. Panel members will present their views on this topic followed by a general discussion. Panel members: Brenda Dietrich (Director, Mathematical Sciences, IBM TJ Watson Research Center & INFORMS President), Michael Meyer (Professor, Civil & Environmental Engineering, Georgia Tech), Chelsea White (Chair, Industrial & Systems Engineering, Georgia Tech).

■ MB36

C-Room 306

Homeland Security Problems in Transportation

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Rajan Batta, Professor/Associate Dean, SUNY at Buffalo, 412 Bonner Hall, Buffalo, NY, 14260, United States, batta@eng.buffalo.edu

1 - Analyzing the Sequential Stochastic Multilevel Passenger Screening Problem

Adrian Lee, University of Illinois, Urbana, IL, United States, ajlee4@uiuc.edu, Laura McLay, Sheldon H. Jacobson

The problem of assigning sequentially arriving passengers to a multilevel aviation security screening system in real-time is formulated as a discrete-time set of difference equations. Using feedback linearization, an optimal state feedback control algorithm is developed to achieve desired security class occupancies while maximizing a total system security measure.

2 - Stochastic Routing for Large-scale Emergencies
Zhihong Shen, University of Southern California, 3715 McClintock Avenue, GER-240, Los Angeles, CA, 90089, United States, shenz@usc.edu, Maged Dessouky, Fernando Ordonez

We are interested in routing problems with large demand, insufficient supply, tight deadline and significant uncertainty, which are typically faced in applications like large-scale emergencies. We model the problem into a stochastic vehicle routing problem and propose two different recourse strategies. A tabu search heuristic is presented; experimental results show the merits of the model and compare the performance of the recourse strategies.

3 - A Risk Mitigation Model Concerning Hazardous Materials and Terrorist Threat
Justin Yates, PhD Candidate, SUNY at Buffalo, Dept.. of Industrial and Systems Eng, 418 Lawrence D. Bell Hall, Buffalo, NY, 14260-2050, United States, jtyates@buffalo.edu, Mark Karwan, Rajan Batta, Irene Casas

Models reducing the capability of attackers to use hazardous materials (hazmat) as a terrorist weapon often accept assumptions which limit their applicability. Using a Geographic Information System (GIS) and optimization software, this research incorporates combinatorial and stochastic modeling with spatial referencing and representation tools to develop a more robust OR model for mitigating risk in a geographic area due to the potential, intentional use of hazmat as a weapon of destruction.

■ MB37

C-Room 307

Military Force Sizing

Sponsor: Military Applications
Sponsored Session

Chair: Steven Stoddard, Operations Research Analyst, Office of the Secretary of Defense, PA&E, 1800 Defense Pentagon, Rm 2B256, Washington, DC, 20301-1800, United States, Steven.Stoddard@osd.mil

1 - Joint Force Mix Analysis in OSD(PA&E)
John Duke, Operations Research Analyst, Northrop Grumman Corporation, 713 Fontaine St., Alexandria, VA, 22032, United States, john.duke.ctr@osd.mil

Over the course of the Operational Availability series of studies, the Simulation and Analysis Center (SAC), OSD (PA&E), in collaboration with the Joint Staff, CoComs, and Services, has conducted joint force mix analysis in order to assess how well joint force structure sources the full range of military operations required by the US defense strategy. The purpose of this briefing is to update analysts on the state of the models used to conduct this analysis.

2 - Joint Force Development: Transforming for the Future
Clark Heidelbaugh, Joint Chiefs of Staff, The Joint Staff, 7000 Pentagon, Washington, DC, 20318-7000, United States, clark.heidelbaugh@js.pentagon.mil

Through a multitude of activities, the joint military community provides insights and findings that shape the design of the future force. By looking to the future and designing Joint Operations Concepts, the Joint Experimentation Transformation Concept Division of the Joint Staff J7 introduces new ideas to improve joint operations and capabilities. Through a process known as Joint Experimentation, which is based upon the future Joint Operations Concepts, the military can gain insights designed to produce results to shape Joint Force Development. This is a deliberate, iterative and continuous process of planning and developing that transforms the current force into a future joint force.

3 - Modelling Army Force Generation
Josh Klimas, Operations Research Analyst, Center for Army Analysis, 6001 Goethals Rd, Ft. Belvoir, VA, 22060, United States, joshua.klimas@us.army.mil

The Army manages its force structure through the Army Force Generation process. The Center for Army Analysis first developed the MARATHON simulation to analyze Army Force Generation for the 2005 Quadrennial Defense Review. MARATHON is now used for a wide range of analytical efforts concerning force sizing and management. This presentation describes Army Force Generation, the modeling approach that we employ in MARATHON, and some results from our analyses.

■ MB38

C-Room 308

Market Algorithms and Applications

Cluster: Game Theory
Invited Session

Chair: Amin Saberi, Stanford University, Terman Eng. Center #317, Stanford, CA, United States, saberi@stanford.edu

1 - Bidding Heuristics in Ad Auctions: Convergence to Market Equilibria
Nicole Immorlica, CWI, Amsterdam, Netherlands, 6 Purgatory Road, Mont Vernon, NH, 03057, United States, nickle@eecs.northwestern.edu, Omid Etesami, Mohammad Mahdian, Kamal Jain, Christian Borgs, Jennifer Chayes

We study a bidding heuristic for keyword-advertising auctions in which budget-constrained advertisers attempt to optimize utility by equalizing ROI across all keywords. We show that a perturbed first-price mechanism combined with this bidding heuristic provably converges to the unique market equilibrium. Thus, our results can be alternatively described as a tatonnement process for convergence to market equilibrium in which prices are adjusted on the side of the buyers rather than the sellers.

2 - Proportional Response Dynamics Leads to Market Equilibrium
Li Zhang, HP Labs, 1501 Page Mill Road, Palo Alto, CA, United States, l.zhang@hp.com, Fang Wu

We model the bandwidth allocation in a peer to peer file sharing system as an exchange economy and study the proportional response dynamics in this economy. In a proportional response dynamics each player distributes its good to its neighbors proportional to the utility it received from them in the last period. We show that this dynamics not only converges but converges to a market equilibrium, a standard economic characterization of efficient exchanges in a competitive market.

3 - Market Equilibria and Cell-Breathing for Wireless LAN
Vahab Mirrkoni, Researcher, Microsoft Research, One Microsoft Way, Redmond, WA, United States, mirrokni@microsoft.com

A major issue in wireless LAN is the problem of distributed load balancing. Similar to ideas of market equilibria, we propose Cell Breathing as a load balancing mechanism for power assignment of access points in a wireless LAN. These distributed power assignment algorithms ensure the optimal use of the capacity of the network. We analyze our algorithms both theoretically and empirically, and observe that it outperforms the existing algorithms.

■ MB39

C-Room 309

Resource Allocation in Healthcare

Sponsor: Health Applications Section
Sponsored Session

Chair: Margaret Brandeau, Professor, Stanford University, 407 Terman Engineering Center, Stanford, CA, 94305, United States, brandeau@stanford.edu

1 - Analysis of Optimal Investment in HIV Prevention Programs
Margaret Brandeau, Professor, Stanford University, 407 Terman Engineering Center, Stanford, CA, 94305, United States, brandeau@stanford.edu, Greg Zaric

We present a mathematical/economic framework to address the following question: Given a particular population, a specific HIV prevention program, and a fixed amount of funds that could be invested in the program, how much money should be invested? We illustrate our framework with analysis of several different prevention programs in different populations.

2 - Results of a Decision Analysis of Alternate Modes of Dispensing Medications in LA
Anke Richter, Associate Professor, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Rd, Bldg 234, Monterey, CA, 93943, United States, arichter@nps.edu, Sinan Khan

Mass prophylaxis planning for a large-scale public health emergency is heavily reliant on Points of Dispensing (POD) distribution sites. To assess the relative merits of alternate modes of dispensing in LA County, a decision analysis was conducted. Sensitivity analyses reveal that the choices from the public health point of view are robust. However, examining the problem from the law enforcement angle reveals potential areas of conflict with these fellow first responders.

3 - An Evaluation Strategies to Reduce Waiting Times for Total Joint Replacement in Ontario

Greg Zaric, Associate Professor, Ivey School of Business, University of Western Ontario, London, ON, Canada, gzaric@ivey.uwo.ca, Chris Anderson, Bert Chesworth, Lauren Cipriano

The median waiting time for total joint replacement in Ontario is greater than 6 months and demand is expected to increase over the next 10 years. We developed a simulation model to evaluate the effectiveness of a number of strategies to reduce waiting times including waiting list management strategies, strict clinical prioritization, waiting time guarantees, reductions in demand, and diversion to other jurisdictions.

4 - Cost Effectiveness of Containment Strategies in an Avian Influenza Epidemic

David Hutton, PhD Student, Stanford University, 380 Panama Street, Stanford, CA, 94305, United States, billdave@stanford.edu, Nayer Khazeni

The Asian Influenza A H5N1 virus is one of the primary international public health concerns of the 21st century. Practical, cost-effective strategies for containment at the source of an outbreak are essential to public health preparedness. We present a hybrid decision-analytic and dynamic transmission nmodel to evaluate the cost-effectiveness of strategies for containing influenza A H5N1 in case of an epidemic.

■ MB41

C-Room 3A

Joint Session HAS/ICS: Clinical Applications of Operations Research

Sponsor: Health Applications Section, INFORMS Computing Society
Sponsored Session

Chair: Lisa Maillart, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, lisa.maillart@engr.pitt.edu

1 - Suboptimal Control Policies for Adaptive Radiotherapy

Mustafa Sir, The University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109-2117, United States, msir@umich.edu, Stephen Pollock, Marina A. Epelman

Optimization-based planning for intensity-modulated radiotherapy often produces sharp dose gradients between tumors and healthy tissue. Random shifts can cause significant differences between the optimized plan and actual dose. It is now possible to measure variations in patient setup after each daily fraction of treatment. We exploit the dynamic nature of treatment and information gathering within a DP framework. Adaptive control policies provide considerable improvement over static plans.

2 - Modeling of and Numerical Solution to Optimal Control of Diabetes Mellitus Under Uncertainty

Zhen Liu, Assistant Professor, University of Missouri - Rolla, 1870 Miner Circle, Rolla, MO, 65409, United States, zliu@northwestern.edu, John Birge

We consider the continuous control of insulin for diabetic patients to minimize the cumulative deviations of blood glucose level from basal level. The dynamics we use is the 'minimal model' of Bergman subject to uncertainties. A Hamilton-Jacobi-Bellman (HJB) equation is derived and corresponding numerical methods are discussed.

3 - Optimal Timing for a Paired Organ Exchange

Andrew Schaefer, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, schaefer@ie.pitt.edu, David Kaufman

In March 2007 the Supreme Court ruled that it is legal for transplant recipients with incompatible donors to swap organs. We consider the timing decision faced by two recipient-donor pairs of when to undergo a simultaneous exchange. The decision is modeled as a two-player nonzero-sum game in which recipient health states follow Markov processes. The optimal actions are compared to several alternative policies. Structural results and a numerical study using clinical data for livers are presented.

4 - Robust Control of Treatment Decisions for Type II Diabetes

Murat Kurt, PhD Candidate, Department of Industrial Engineering, University of Pittsburgh, Pittsburgh, PA, 15217, United States, muk7@pitt.edu, Nilay Shah, Andrew Schaefer, Brian Denton

Type II diabetes is one of the major underlying causes of stroke and coronary heart disease (CHD). Several models are available to guide clinicians on the risks of stroke and CHD. However, there are deviations between the probability estimates of these risk models. In this talk we discuss a robust MDP model to control diabetes related treatment decisions under ambiguous transition probabilities and present numerical results illustrating optimal treatment decisions.

■ MB42

C-Room 3B

Data Mining in Bioinformatics and Health Care

Cluster: Operations Research in Medicine and Health Care
Invited Session

Chair: Metin Turkay, Asst. Prof., Koc University, Department of Industrial Engineering, Sariyer, Istanbul, 34450, Turkey, mturkay@ku.edu.tr

1 - Peptide Extraction Using Regular Expressions and Support Vector Machines

Theodore B. Trafalis, Professor, The University of Oklahoma — School of Industrial Engineering, 202 West Boyd room 124, Norman, OK, 73019, United States, ttrafalis@ou.edu, Robin C Gilbert

Short sequences of peptide are often contained only within the published medical literature rather than in databases and thus are not available until located and extracted. Herein we report the efficacy of using regular expressions and support vector machines to differentiate peptide sequences from the text that surrounds them. We have tested the system on over 10,000 journal articles. Our results suggest that this method will help in automated extraction of sequences from large texts.

2 - MILP Based Hyper-box Enclosure Approach for Multi-group Data Classification

Fadime Uney Yuksektepe, PhD Candidate, Koc University, Department of Industrial Engineering, Rumelifeneri Yolu Sariyer, Ystanbul, 34450, Turkey, funey@ku.edu.tr, Metin Turkay

In this talk, a novel mixed-integer programming based hyper-box enclosure method is presented for multi-group data classification problems. In order to overcome computational difficulties, a 3-stage mathematical programming based approach is developed for training part analysis of hyper-box enclosure method. The performance of this method is tested on different benchmark datasets.

3 - QSAR Analysis of 1,4-Dihydropyridine Calcium Channel Antagonists

Metin Turkay, Asst. Prof., Koc University, Department of Industrial Engineering, Sariyer, Istanbul, 34450, Turkey, mturkay@ku.edu.tr, Pinar Kahraman

The early prediction of activity related characteristics of drug candidates is an important problem in drug design. The activities of drug candidates are classified as low or high depending on their IC50 values. We use a novel MILP approach in combination with partial least squares regression to determine the most relevant molecular descriptors of the drug molecules in efficient classification. The results indicate that our approach outperforms the other approaches reported in the literature.

4 - The Role and Impact of the Pharmacy Benefit Manager (PBM) in Prescription Drug Marketing

Ozden Gur Ali, Koc University, Sariyer, Istanbul, Turkey, oali@ku.edu.tr, Murali Mantrala, Burak Cavdaroglu

We model the Pharmacy Benefit Manager (PBM)'s formulary tier assignment decisions in response to rebates, physician detailing activities and direct to consumer advertising by the pharmaceutical companies. We find that not only discount offers, but also pull marketing give incentive to the rebate-maximizing PBM to prefer a drug. These findings run counter to the common assumptions that the PBMs would necessarily favor lower-priced brands with lower detailing and/or DTC advertising spending.

■ MB43

S-Grand Ball. A (Lev. 2)

Real World Applications I

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Mary Crissey, SAS Insitute, 17030 Vista Park Dr, San Antonio, TX, 78247, United States, Mary.Crissey@sas.com

1 - Optimal Army Personnel Distribution Using SAS/OR

Kenneth Clark, Senior Operations Research Analyst, US Army, 200 Stovall Street, Alexandria, VA, 22332, United States, kenneth.d.clark1@us.army.mil

In this talk we describe a flexible mathematical model for optimizing the allocation of Army personnel and its implementation using SAS/OR optimization tools, e.g., proc optmodel. The set manipulation and conditional equation/constraint generation capabilities in proc optmodel facilitate the inclusion of a number of model parameters so that it can be used to perform a range of important feasibility studies related to personnel distribution planning.

2 - Analyzing Discrepancies in the 2004 Presidential Vote in Ohio
Doug Samuelson, President, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States, samuelsondoug@yahoo.com

We analyzed reported discrepancies between exit polls and actual vote totals in Ohio in the 2004 Presidential election, using spreadsheets and a popular statistical package (JMP). While we found indications of problems in the voting and vote counting, we concluded that there was insufficient evidence to call the outcome into serious question.

3 - CPMS - What is this INFORMS Section?
Mary Crissey, SAS Insitute, 17030 Vista Park Dr, San Antonio, TX, 78247, United States, Mary.Crissey@sas.com, Stephen Strauss

Do you have real world case studies to share? I invite you to take a more active role in your profession by nominating best practices for awards. Learn about the volunteer positions available to those eager to share how they apply OR and reap benefits in a variety of areas represented by the practitioners across the Globe. Nominate organizations for Edelman Awards and the INFORMS prize and put yourself in for the wagner prize!

■ MB44

S-Grand Ball. B (Lev. 2)

Tutorial: Designing and Delivering a Better Management Science Course for MBA Students

Sponsor: INFORM-ED
Sponsored Session

1 - Designing and Delivering a Better Management Science Course for MBA Students
Robert Freund, Professor, MIT Sloan School of Mgmt., Building E53-357, 50 Memorial Drive, Cambridge, MA, 02142, United States, rfreund@MIT.EDU

We will share key strategies for designing and delivering a successful management science curriculum for MBA students, based on our successes in the (MIT) Sloan MBA program. We will share how to deliver a curriculum to educate future managers about the value of operations research, and how to develop and use case-like materials that work.

■ MB45

S-Capitol Hill (Lev. 3)

Risk,Technology and Operations in Financial Services

Sponsor: Financial Services
Sponsored Session

Chair: Mei Xue, Boston College, Fulton 350, 140 Commonwealth Ave, Chestnut Hill, MA, United States, mei.xue@bc.edu

1 - Optimal Capacity Investment of a Multiple Channel Service Delivery System
Jun Zhang, Assistant Professor, University of Texas at Dallas, School of Management, Richardson, TX, United States, jun.zhang@utdallas.edu, Mei Xue

We study the optimal capacity investment problem of a multiple channel service delivery system that consists of a physical employee- serviced channel and one substitutable virtual self-serviced channel. The service times of different channels are a critical factor that drives customer's channel choices. We found that, contradictory to the commonly held intuition, the firm should invest more on the virtual-service channel when customers' service requests are more customized.

2 - Operational Risk and TQM in the Services Industries
Michael Pinedo, New York University, Stern School of Business, New York, NY, United States, mpinedo@stern.nyu.edu

We present an overview of the Operational RIsk issues in the various services industries, in particular the transportation, health, financial services, and hospitality industries. We discuss the similarities and differences between the various industries and how the pecularities of each affects its procedures and processes. We furthermore discuss how TQM techniques common in manufacturing also can be applied in the services industries.

3 - Service Technology, Pricing, and Process Economics in Retail Banking Competition
Hosun Rhim, Professor, Korea University Business School, Anam-dong Seongbuk-gu, Seoul, 136-701, Korea, Republic of, hrhim@korea.ac.kr, Uday Karmarkar, David Choi

This paper presents a framework that models service technology, design, access and delivery processes, pricing and competition in information intensive services, in the specific context of retail banking. We analyze two alternative service delivery processes, conventional and electronic, and examine how they affect customer costs, process economics, market segmentation and competition.

4 - Creating an Optimal Negotiation Strategy for Consumer Lending
Frank Bria, Sr. Vice President, Response Analytics, Inc., 7426 E Stetson Dr., Ste 120, Scottsdale, AZ, 85251, United States, frank.bria@responseanalytics.com

Early attempts at price optimization for consumer lending left institutions with no flexibility and average prices for average customers. This approach resulted in lost volume or sub-optimal profits. Recently, new approaches to deal-level optimization that account for individual borrowers' price elasticity and product preferences lead to a three-stage approach to developing optimal product offerings and pricing. A brief introduction to the theory and a case study from auto lending is presented.

■ MB46

S-Ballard (Lev. 3)

Uncertainty in Electric Power Markets

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Jorge Valenzuela, Associate Professor, Auburn University, 211 Dunstan Hall, Auburn, AL, 36849, United States, jvalenz@eng.auburn.edu

1 - Economic Impact of Wind Power Penetration: A Stochastic Programming Approach
Antonio J. Conejo, Professor, Universidad de Castilla - La Mancha, Electrical Engineering, Campus Universitario s/n, Ciudad Real, 13071, Spain, Antonio.Conejo@uclm.es, Juan M. Morales

Wind power constitutes a significant proportion of the generation mix in diverse power systems. Due to the time-dependent nature of wind power, to maintain supply reliability extra reserves are needed to cover those periods with no wind. This presentation describes a stochastic programming framework to appraise rigorously the cost of the required reserves. A detailed operations model spanning one week with hourly steps is considered. Simulation results are reported and conclusions drawn.

2 - A Medium Term Multireservoir Hydrothermal Coordination Model by Stochastic Programming
Andres Ramos, Professor, Universidad Pontificia Comillas, Alberto Aguilera 23, Madrid, 28015, Spain, Andres.Ramos@iit.icai.upcomillas.es, Santiago Cerisola, Jesus M. Latorre, Rafael Bellido, Alejandro Perea

Medium term operation planning of hydrothermal systems is an important task in the context of generation production planning. Its purpose is coordinating the releases of hydro basins along the year and allocating them to hydro reservoirs of each basin. Stochasticity is due to hydro inflows although fuel and electricity market prices and demand can also influence the operation. Non linear water head effects are considered. A realistic case study based in the Spanish electric system is presented.

3 - An Analysis of Some Factors that Affect the Locational Marginal Prices
Lizhi Wang, Industrial Engineering, University of Pittsburgh, Pittsburgh, PA, 15261, United States, liw18@pitt.edu

We analyze the following factors to find out their impact to the locational marginal prices: market power, gas prices, and demand management.

4 - Generation Investments in Competitive and Uncertain Markets
Jorge Valenzuela, Associate Professor, Auburn University, 211 Dunstan Hall, Auburn, AL, 36849, United States, jvalenz@eng.auburn.edu, Pinar Kaymaz, Chan Park

Investments on new capacity of electricity generation involve decisions regarding size and location of new power plants. These decisions are subject to risk due to future conditions of the system. A generation expansion model that explicitly accounts for the stochastic nature of load and fuel costs in power markets is presented. The model is a Cournot competition where decisions are made at the same stage with bilateral contracts.

■ MB47

S-Admiral (Lev. 3)

Forestry VI: Decision Making Under Uncertainty

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Sandor Toth, Assistant Professor of Natural Resource Informatics, College of Forest Resources, University of Washington, Box 352100, Seattle, WA, United States, toths@cfr.washington.edu

1 - Random Distance Parameters; Their Analytic Computation and Application in Airtanker System Analysis

Francis Greulich, Professor, College of Forest Resources, University of Washington, Seattle, WA, 98195, United States, greulich@u.washington.edu

Forest engineers have long had access to innovative analytical procedures for the computation of statistical moments for the random distance from discrete points to random locations on line segments and over polygonal regions. It is now possible to rapidly calculate exact moments for the random distance along and between line segments, and the random distance within and between polygonal regions. Possible applications to airtanker system evaluation and design have motivated these advances.

2 - An Approximate Dynamic Programming Approach to Developing Strategies for a Multi-species Stand

Jules Comeau, Dalhousie University, 37 Braemar Dr., Moncton, NB, E1A3S7, Canada, jcomeau5@dal.ca

In forest stand optimization, most whole stand models use multi-dimensional state descriptors. The discretization of this state space becomes a major issue when using dynamic programming (DP) in developing optimal harvest policies. This paper introduces the application of a modern dynamic programming approach in developing multi-species, even-aged decision policies in a stochastic environment.

3 - Erosion Monitoring and Treatment Under Uncertainty

David Tomberlin, National Marine Fisheries Service, David.Tomberlin@noaa.gov

Managers face a trade-off between monitoring erosion and applying erosion treatments. Deciding upon the optimal allocation of funds between monitoring and treatment is difficult because the management problem is inherently dynamic, the effect of treatment is uncertain, and erosion levels are observed with error. We apply a partially observable Markov decision process (POMDP) approach to erosion management, using a point-based heuristic solver suitable for practical operational decisions.

4 - Integrating Fire and Forest Harvest Planning

Mauricio Acuna, Programme 3 - Harvesting and Operations, CRC for Forestry, Hobart, Australia, mauricio.acuna@utas.edu.au, Wenbin Cui, David Martell, Cristian Palma, Andres Weintraub

FireSmart forest management is based on the assumption that the timing and location of forest access roads, harvesting, and silvicultural treatments can fragment forest landscapes and reduce fire spread potential. We developed a DSS (that includes fire ignition, spread and harvesting sub-models) that can help develop integrated fire/forest management plans to exploit such interactions. We describe our DSS and its application to a forest management unit in the province of Alberta, Canada.

5 - An Approach to Developing Growth and Yield Models for Multi-species Forest Stands

Jules Comeau, Dalhousie University, 37 Braemar Dr., Moncton, NB, E1A3S7, Canada, jcomeau5@dal.ca

Generally speaking, stand level models include variables such as average stand diameter, stand basal area and stand dominant height. Although stand level models are simple and robust, historically the number of species and the number of size distributions in multi-species stands have made them difficult to model using a few stand-level variables. This paper discusses a methodology for growing multi-species stands and shows results of the methodology applied to the Nova Scotia Acadian Forest.

■ MB48

S-Fremont (Lev. 3)

Simulation-based Control

Sponsor: Simulation
Sponsored Session

Chair: Young-Jun Son, Associate Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, son@sie.arizona.edu

1 - Simulation-based Commissioning of Shop Floor Control Systems

Jeff Smith, Professor, Auburn University, 207 Dunstan Hall, Auburn University, AL, 36849, United States, jsmith@auburn.edu, Younchol Cho

Commissioning involves proving/demonstrating that a control system works as designed, and contracted. For complex shop floor control systems, commissioning is a time-consuming and expensive process. However, the commissioning process is critical from the contractual, performance, and safety points of view. This presentation presents an example of applying discrete event simulation to the shop floor control system commissioning process.

2 - Formal Modeling of Affordance Using Finite State Automata (FSA) in Human-involved Systems

Richard Wysk, Professor, The Pennsylvania State University, Industrial and Manufacturing Engineering, University Park, PA, 16802, United States, rwysk@psu.edu, Namhun Kim

This paper presents a noble formalism of human-involved automated systems using finite state automata, which incorporates the ecological concept of affordances. The system complexity of human involved manufacturing systems can be tremendously increased when the human acts as one of system components. Humans have limitations, which come from system affordances. We investigate these limitations and map them to the system affordances, in order to analyze and control via simulation.

3 - DDDAS-based Simulation for the Distributed Manufacturing Enterprise

Young-Jun Son, Associate Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States, son@sie.arizona.edu, Parag Sarfare, Nurcin Koyuncu, Seungho Lee

We intend to augment the validity of simulation models in the most economic way using automated fidelity switching in a multi-fidelity model via incorporating dynamic data into the executing model, which then steers the measurement process for selective data update. Comprehensive architecture is first described, and four algorithms embedded within the real-time simulation model are then discussed. Finally, a prototype system is demonstrated for a distributed manufacturing enterprise.

■ MB49

S-Greenwood (Lev. 3)

Revenue Management in Competitive Environments

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Zhan (James) Pang, PhD Candidate, SE&EM CUHK, R609 M. M. W. Engineering Building, Chinese University of Hong Kong, Hong Kong, HK, Hong Kong - ROC, zpang@se.cuhk.edu.hk,

Co-Chair: Youyi Feng, Associate Professor, The Chinese University of Hong Kong, R609 M.M.W Engineering Building, Sys. Engg. & Engg. Mgmt., Hong Kong, HK, Hong Kong - ROC, yyfeng@se.cuhk.edu.hk

1 - Multiple Supplier Competition with Competing Retailers

Ming Hu, Columbia University, mh2252@columbia.edu

We investigate the equilibrium behavior of two-echelon supply chains with a set of competing suppliers servicing a network of competing retailers under vendor-managed-inventories program. In this Stackelberg game, the sequence of actions is assumed as follows: in the first stage, the suppliers set wholesale prices simultaneously; in the second stage, the retailers set retail prices simultaneously given the wholesale price information from the first-stage available.

2 - Dynamic Pricing for Selling a Fixed Inventory of Perishable Products: Research Overview

Ming Chen, PhD Student, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, chenming@rhsmith.umd.edu, Zhi-Long Chen

We present an overview of dynamic pricing models that consider selling a fixed inventory of perishable products. We particularly focus on models that consider clearance sales of seasonal products in retail industry. Our purpose is to provide a stat-of-the-art review and identify future research directions.

3 - Real Options Analysis of Revenue Management: The Case of Pre-sale Housing Market

Zhan (James) Pang, PhD Candidate, SE&EM CUHK, R609 M. M. W. Engineering Building, Chinese University of Hong Kong, Hong Kong, HK, Hong Kong - ROC, zpang@se.cuhk.edu.hk, Youyi Feng

We consider a house developer who designs an options contract in a presales (sales-before-completion) housing market. The spot price in the existing housing market is assumed to follow a diffusion process. The demand approaches housing systems as a Poisson stream and the arrival rate is sensitive to the premium and affected by spot price. The premium of each house is dynamically adusted. Finally, the optimal contract design issue and the optimal capacity investment strategy are developed.

■ MB50

S-Issaquah A & B (Lev. 3)

Competition in Pricing for Supply Chains

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Elodie Adida, Assistant Professor, University of Illinois at Chicago, 842 W. Taylor St. (MC 251), Room ERF 3025, Chicago, IL, 60607-7022, United States, elodie@uic.edu

1 - Analysis of Lead Time and Inventory Flexibility for Base Stock Inventory Systems

Secil Savasaneril, Assistant Professor, Middle East Technical University, Industrial Engineering Department, Ankara, Turkey, secil@ie.metu.edu.tr, Pinar Keskinocak, Paul Griffin

We study a lead time quotation problem with inventory holding where demand is lead time sensitive and unmet due dates are penalized. We analyze the impact of flexibility on the profits and show that lead time flexibility does not affect profits whereas inventory flexibility significantly does. We develop an exact algorithm for optimal base stock level, show that lead time quotes are shorter in a MTO system, and that increasing the inventory level may increase the number of customers waiting.

2 - A Stochastic Multiple Leader Stackelberg Model of Competition in the Telecommunications Industry

Victor DeMiguel, Assistant Professor, London Business School, Regents Park, London, NW14SA, United Kingdom, avmiguel@london.edu

We study an oligopoly consisting of M leaders and N followers that supply a homogeneous product noncooperatively. Leaders choose their supply levels first, knowing demand only in distribution. Followers make their decisions after observing the leader supply levels and realized demand. We prove existence and uniqueness of equilibrium under mild assumptions, propose a computational approach to find the equilibrium, and apply this framework to model competition in the telecommunication industry.

3 - Designing Reputation Systems

Christina Aperjis, Stanford University, Terman Engineering Center, Room 391, Stanford, CA, United States, caperjis@stanford.edu, Ramesh Johari

In online marketplaces buyers often interact with sellers with whom they have never interacted before. A potential buyer has to decide whether to buy an item and how much to pay for it without being able to observe it and without knowing whether the seller is trustworthy. Reputation systems promote trust by giving information about past transactions. We study how a reputation system affects the seller's decisions and compare various reputation systems in terms of efficiency.

4 - Role of Capacity in a Joint Inventory Management and Pricing Game

Elodie Adida, Assistant Professor, University of Illinois at Chicago, 842 W. Taylor St. (MC 251), Room ERF 3025, Chicago, IL, 60607-7022, United States, elodie@uic.edu, Georgia Perakis

We study a demand-based pricing and inventory control model where two firms compete over a differentiated substitutable product. The firms are symmetric differing only by their production capacity. We consider both the decentralized Nash equilibrium game and a centrally controlled setting. We study the capacity effects on the firms, compare prices, production levels, and loss of efficiency between the firms in the two settings. We design a contract for capacity level decision making.

■ MB51

S-Kirkland (Lev. 3)

Pricing and Revenue Management II

Contributed Session

Chair: Anshu Jalora, Associate Scientist, PROS Revenue Management, 3100 Main St. Suite 900, Houston, TX, 77002, United States, ajalora@prosrm.com

1 - An Axiomatic Approach to Product Variety

Ye Lu, MIT, ORC, MIT, 77 Mass. Ave. Bldg E40-130, Cambridge, MA, 02139, United States, yelu@mit.edu, David Simchi-Levi

We use an axiomatic approach to explore the impact of product variety on customer demand, product price, system revenue and inventory levels. These results are applied to two supply chains. The first is a decentralized multi-retailer system where each retailer sells a single product and retailers compete on price. The second supply chain is a single retailer selling multiple competitive products.

2 - Market Segmentation Based on Clustering of Customer Purchasing Behavior

Jimmy Yang, Director of Analytics Engineering, Rapt Inc., 625 Second Street, San Francisco, CA, 94107, United States, jimmy.yang@rapt.com, Michael Goldbach

Market segmentation is one of the most important subjects in pricing and revenue optimization. However, cluster analysis with customer attributes only may not result in segments that truly differentiate the purchasing behavior. This research develops a segmentation approach that is directly based on clustering of customer purchasing behavior, such as booking pattern and price sensitivity. Numerical examples based on real data are presented to show the effectiveness.

3 - Product Pricing, Lead Time and Capacity Selection in Price and Time Sensitive Markets

Sachin Jayaswal, PhD Student, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, sjayaswa@engmail.uwaterloo.ca, Saibal Ray, Elizabeth Jewkes

We study a firm selling two substitutable products differing only in their prices and delivery times. There is a standard delivery time for the regular product, while the other is an express product for which the firm charges a premium. We model the system as a priority queue, and develop a mathematical model to determine the optimal capacity of the server and delivery time of the express product, and appropriately price the two products while satisfying a minimum service level for both.

4 - Multi-item Capacitated Lot Sizing with Setup Times and Pricing

Mehmet Onal, Research Assistant, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611, United States, monal@ufl.edu, Edwin Romeijn

We study the multi-item capacitated lot sizing problem with setup times and pricing over a finite planning horizon. This problem extends the multi-item capacitated lot sizing problem with setup times by relaxing the assumption that demands are given but, instead, we can use pricing decisions to influence the demand level for each item to satisfy in each period. The objective is then to maximize total profit. We develop a branch-and-price algorithm and discuss computational results.

5 - Retail Pricing and Shelf-space Allocation with Demand Learning

Anshu Jalora, Associate Scientist, PROS Revenue Management, 3100 Main St. Suite 900, Houston, TX, 77002, United States, ajalora@prosrm.com

It has been shown in literature that pricing and shelf space allocation have a strong effect on retail demand. However, these problems have been traditionally studied in isolation of each other. In the current work, we present a model to jointly address these two problems with the objective of maximizing retailer's revenues. We extend our model to incorporate demand learning and discuss numerical results.

■ MB52

S-Leschi (Lev. 3)

European Rail Research

Sponsor: Railway Applications
Sponsored Session

Chair: Michael Gorman, University of Dayton, Dept. of MIS, OM and DSC, 300 College Park, Dayton, OH, 45469, United States, michael.gorman@udayton.edu

1 - Deadhead Selection for Railway Crew Scheduling Applications

Marc Albers, University of Cologne, Albertus-Magnus-Platz, Cologne, de, 50923, Germany, marc.albers@uni-koeln.de, Ulrich Thonemann

Within the railway crew scheduling problem sparsity of connecting trains can lead to extended periods of inactivity. To avoid these inefficient times deadheads can reposition crews to other stations via different modes of transportation. We present an improved deadhead selection scheme that enables us to solve large-scale crew scheduling problems containing millions of potential deadheads.

2 - A Mathematical Model for Optimizing the Management of Empty Railcars

David De Almeida, Research Project Manager, SNCF, 45 Rue de Londres, 75379 Paris Cedex 08, Paris, France, david.de_almeida@sncf.fr, Romain Wlodarczyk, Christian Weber

This presentation describes a mathematical model designed to optimize the management of empty railcars. Available railcars of different types must be allocated to demands and positioned with a minimal travelling cost and a maximum reliability (travel times are not deterministic). In some instances, demands may actually be intermediate stops where railcars need to be charged in order to fulfill final demands.

3 - Solving Rolling Stock Scheduling Problems at SNCF

Nicolas Marcos, Research Project Manager, SNCF, 45 Rue de Londres, 75379 Paris Cedex 08, Paris, 75, France, nicolas.marcos@sncf.fr, Guillaume Bourez, David De Almeida, Christian Weber

We present a generic mathematical modelling approach for solving rolling stock scheduling problems. Our approach is based on a time-space network and a multi-commodity flow model; in order to deal with the various types of rolling stock scheduling problems faced by SNCF planners, it integrates numerous modeling settings and features including maintenance routing requirements which are treated by a heuristic, post-processing procedure.

4 - A New Railway Rolling Stock Planning System

Jesper Hanson, Senior Consultant, Jeppesen, Odinsgatan 9, Gothenburg, SE, 41103, Sweden, Jesper.Hansen@jeppesen.com, Mattias Grönkvist, Tomas Lidén, Erik Hasselberg, Jens Kjerrström

A newly developed rolling stock planning system is presented. The system solves several optimization problems resulting in train compositions, vehicle rotations including local activities and depot planning taking all relevant aspects into account. The system is customizable for any railway operator. Results are presented from the Danish State Railways.

■ MB53

S-Medina (Lev. 3)

Location and Sourcing

Sponsor: Location Analysis
Sponsored Session

Chair: Lian Qi, Assistant Professor, University of Missouri - Rolla, 107-I Fulton Hall, 1870 Miner Circle, Rolla, MO, 65409, United States, lianqi@umr.edu

1 - A Branch-and-price Algorithm for Single-sourcing Stochastic Transportation Problem

Fatma Zeynep Sargut, Sr Operations Researcher, Innovative Scheduling, Inc, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, 32641, United States, zeynep@ufl.edu, Edwin Romeijn

We consider a single period stochastic transportation problem, where the objective is to minimize the expected total transportation costs between facilities and retailers as well as the total expected overage and underage cost at the retailers. We consider the problem with and without single-sourcing constraints and compare them under different cost structures.

2 - Single-sourcing Tradeoffs in a Joint Location-inventory Model

Joseph Geunes, Associate Professor, University of Florida, Department of Industrial and Systems Eng, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu, Semra Agrali

We consider a joint location-inventory problem for locating distribution centers under uncertain demand. While the single-sourcing version of the problem has been addressed in the literature, the problem structure and required solution approaches differ when we relax the single-sourcing requirement. Using a Lagrangian-relaxation approach, we provide a method to quantify the cost of single-sourcing requirements in systems with uncertain demand.

3 - Retailer Location and Customer Demand Allocation Decisions Under Random Supply Disruptions

Lian Qi, Assistant Professor, University of Missouri - Rolla, 107-I Fulton Hall, 1870 Miner Circle, Rolla, MO, 65409, United States, lianqi@umr.edu

We study an integrated supply chain design problem that considers random disruptions at both the supplier and retailer echelons. By analytically studying the integrated model, we discuss the impacts of random supply disruptions at the supplier and retailers on retailer location and customer demand allocation decisions, and provide sufficient and necessary conditions for these decisions under random supply disruptions. Both single sourcing and multiple sourcing are considered in our research.

■ MB54

S-Queen Anne (Lev. 3)

The Applied Probability Society Markov Lecture

Sponsor: Applied Probability
Sponsored Session

Chair: Ger Koole, Professor, VU University Amsterdam, De Boelelaan 1081 a, Amsterdam, 1081 HV, Netherlands, koole@few.vu.nl,

Co-Chair: Otis Jennings, Professor, Duke University, 1 Towerview Dr, Durham, NC, 27705, United States, otisj@duke.edu

1 - Stochastic Networks with Resource Sharing

Ruth J. Williams, Department of Mathematics, University of California, San Diego, CA, williams@stochastic.ucsd.edu

Stochastic networks are used as models for complex systems involving dynamic interactions subject to uncertainty. Application domains include manufacturing, the service industry, telecommunications, and computer systems. Networks arising in modern applications are often highly complex and heterogeneous, with network features that transcend those of conventional queueing models. The control and analysis of such networks present challenging mathematical problems. In this talk, a concrete application will be used to illustrate a general approach to the study of stochastic networks using more tractable approximate models. Specifically, we consider a connection-level model of Internet congestion control that represents the randomly varying number of flows present in a network where bandwidth is shared fairly amongst elastic documents. This model, introduced by Massoulie and Roberts, can be viewed as a stochastic network with simultaneous resource possession. Elegant fluid and diffusion approximations will be used to study the stability and performance of this model. The talk will conclude with a summary of the current status and description of open problems associated with the further development of approximate models for general stochastic networks. This talk is based in part on joint work with W. Kang, F. P. Kelly, and N. H. Lee. Discussiants: Kavita Ramanan and Mark Squillante.

■ MB55

S-Ravenna (Lev. 3)

Reducing Delays in the National Airspace System

Sponsor: Aviation Applications
Sponsored Session

Chair: John Shortle, George Mason University, 4400 University Dr., MS 4A6, Fairfax, VA, 22030, United States, jshortle@gmu.edu

1 - Demand Management at Congested Airports: Finding Metrics to Compare Alternative Policies

Karla Hoffman, Professor, George Mason University, Mail Stop 4A6, 4400 University Drive, Fairfax, VA, 22030, United States, khoffman@gmu.edu, George Donohue, Loan Le

This research seeks to find schedules that reduce delays at congested airports, maintain profitability for the airline, and assure passengers access to currently-served markets at current prices. To determine if such schedules exist, we model a profit-seeking, benevolent airline that uses actual price elasticities estimated through extensive data mining of existing behavior. Our results indicate that upguaging can provide profitable schedules at today's prices and reduce delays by over 70%.

2 - Capacity Analysis of Wake Vortex Hazards

John Shortle, George Mason University, 4400 University Dr., MS 4A6, Fairfax, VA, 22030, United States, jshortle@gmu.edu

A landing airplane that encounters a wake may roll, resulting in a crash. Separation requirements insure that severe wake encounters do not occur. This talk examines potential capacity benefits that can be achieved by reducing separation constraints during periods when crosswinds exist to blow the wakes out of the approach path. The probabilistic analysis combines a direct data feed of flight-track data with simulation of wake-evolution models.

3 - Selecting Representative Weather Days for Air Traffic Analysis

Laura Kang, Boeing, P.O. Box 3707 MC 7L-21, Seattle, WA, 98124, United States, Laura.S.Kang@Boeing.com

This research analyzes alternatives that Boeing Commerical Airlines proposes, where each alternative has different airport capacities. The National Flow Model (NFM) is used to compare annual delay statistics for each alternative. A challenge is to get annualized delay statistics without running the NFM for 365 days. We present a quadratic programming model for selecting representative weather days. We also present annualized delay results from the analysis.

4 - Decision Theory Framework for System Wide Information Management Benefits Case

Fred Wieland, Sensis Corp., 600 Maryland Ave., S.W., Suite 603E, Washington, DC, United States, fred.wieland@sensis.com

System-Wide Information Management (SWIM) is an FAA initiative that proposes to eventually provide more accurate and timelier information to controllers, pilots, dispatchers, and others involved in flight planning and execution. One of the potential benefits to dispatchers is knowing whether Special Use Airspaces (SUAs) are available for civil operations or not. This paper estimates the dollar value of better SUA information using standard techniques from the science of decision theory.

■ MB56

S-Wallingford (Lev. 3)

Combinatorial Auctions

Cluster: Auctions
Invited Session

Chair: Michel Gendreau, Universite de Montreal, Montreal, Canada, michelg@crt.umontreal.ca

1 - Quadratic Rules for Selecting Core Outcomes in Combinatorial Auctions

Robert Day, University of Connecticut, bob.day@business.uconn.edu, Paul Milgrom

Most auctions for one item have the core property, i.e., no mutually profitable renegotiation is available. Using a quadratic core-selection rule in the combinatorial setting, we achieve other beneficial properties, including strict shill-proofness, a unique dual-like payment decomposition, and adjustable auction parameters to account for market asymmetries. Spectrum auction implementations are discussed.

2 - Iterative Combinatorial Auction Designs in the Lab

Martin Bichler, TU Munchen, martin.bichler@in.tum.de, Kemal Guler

Iterative combinatorial auctions (ICAs) are economic mechanisms where bidders submit bundle bids in a sequence and an auctioneer computes allocations and ask prices in each auction round. The literature in this field proposes different auction designs using linear or non-linear personalized prices. In this talk, we will describe the results of laboratory experiments testing different ICA designs, most notably ALPS, the Combinatorial Clock auction, iBundle, and the VCG auction based on different valuation models.

3 - Cost Allocation in Combinatorial Auctions for Bilateral Procurement Markets

Michel Gendreau, Universite de Montreal, Montreal, Canada, michelg@crt.umontreal.ca, Monia Rekik, Jacques Robert, Teodor Gabriel Crainic

We consider a bilateral procurement market where multiple buyers and sellers trade indivisible contracts through a one-sided combinatorial auction where sellers are the only bidders. We propose, evaluate and compare different allocation methods to determine each buyer's portion of the total cost incurred at the end of the auction.

4 - Time Period Unbundling and the Transformation of Auctions

Richard Steinberg, Reader in Operations Management, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, r.steinberg@jbs.cam.ac.uk, Dolores Romero Morales

Consider a firm that satisfies demand over a time period by assigning it to a supplier via the Vickrey auction (the standard auction). The firm is considering breaking demand into smaller time periods and permitting bids for one or more of these sub-periods, either as independent bids or as package bids, via the VCG mechanism (the unbundled auction). One might expect the buyer's cost to always be lower in the unbundled auction, but we show the cost can be higher and provide a bound.

■ MB57

S-Columbia (Lev. 4)

Ad-hoc Wireless Networks

Sponsor: INFORMS Telecommunications Section
Sponsored Session

Chair: Timothy Matis, Assistant Professor, Texas Tech University, Box 43061, Lubbock, TX, 79409, United States, timothy.matis@ttu.edu

1 - Reliability Analysis & Optimization of Cluster Based Ad-hoc Networks

Jose Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Jose.Ramirez-Marquez@stevens.edu, Jason Cook

A method to analyze the reliability of a cluster-based MAWN is presented. The method considers that in such networks, communication among mobile nodes is enabled through one or more backbone sub-networks, which have significant impact on the reliability of the MAWN and thus, are critical for its reliable operation. This method is the basis of an optimization model where the objective is to maximize reliability via the design of backbone networks yet constrained by cost and/or weight.

2 - Small Scale Fading Effects on the Control Overhead of Current Protocols.

Ivan Guardiola, Graduate Student, Texas Tech University, P.O. Box 43061, Lubbock, TX, 79409, United States, ivan.guardiola@ttu.edu, Timothy Matis

This research highlights a new method of mitigating the stochastic nature of the wireless signal in various operating environments. It has been found through simulation that a high amount of control overhead does little to increase the overall performance of the network. We propose a new method of protocol design that is considerate to this stochasticity of the wireless signal and employs GPS technology at the receiver to accept or reject specific protocol communication demands.

3 - On the throughput Capacity of Large Ad-hoc Networks Confined to a Fixed Area

Eugene Perevalov, Assistant Professor, Lehigh University, 200 W Packer Avenue, Mohler Lab, Bethlehem, PA, United States, eup2@Lehigh.EDU, Rick Blum, Danny Safi

It is known that the throughput of large wireless ad hoc networks with fixed node density decreases roughly as the inverse square root of the total number of nodes, making large networks sound impractical. We study the throughput in the scenario of an ad hoc network occupying a fixed size physical region. It is found that the achievable per node throughput increases at first, reaches a maximum and then decreases demonstrating an existence of an optimal network size.

■ MB58

S-Pike (Lev. 4)

Managing the NPD Resources

Cluster: New Product Development
Invited Session

Chair: Stylianos Kavadias, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, NW, Atlanta, GA, 30308-0520, United States, Stylianos.Kavadias@mgt.gatech.edu

1 - Knowledge Management for Product and Process Design Teams

Gulru Ozkan, PhD Candidate in Operations Management, College of Management, Georgia Institute of Technology, 800 W. Peachtree St., NW, Atlanta, GA, 30308-0520, United States, gulru.ozkan@mgt.gatech.edu, Cheryl Gaimon, Stylianos Kavadias

We analyze dynamic knowledge management strategies for NPD product and process design teams. Net revenue earned at the product release is a function of the knowledge embedded in the product and process during the development project. Each team's knowledge increases from learning-by-doing, knowledge transfer, and knowledge acquisition. The rates and directions for knowledge transfer, the rates of knowledge acquisition, and the product release time are optimally determined.

2 - The Effect of Incentives on New Product Development Outcomes and Timing

Jurgen Mihm, Assistant Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, jurgen.mihm@insead.edu

NPD research has largely ignored the importance of incentives to individuals. Through game theoretic models we show that incentives provided by most of current practices endanger project outcomes and impact project timing by favoring late design changes. Individual incentives may help. For many projects, compared to linear contracts or Bayesian mechanisms, component level target costing makes the most efficient use of available information. We thus create an initial map for incentives in NPD.

3 - Market Research and Innovation Strategy

Elie Ofek, Associate Professor, Harvard Business School, Boston, MA, 02163, United States, eofek@hbs.edu

We examine innovation decisions in the face of uncertainty about consumer preferences. Firms determine R&D effort (direction and level) and also decide whether to conduct market research. We characterize equilibria where one firm conducts market research, while its rival undertakes R&D blindly. If consumer preferences are sufficiently heterogeneous, the firm conducting market research may innovate on the less profitable attribute, while its rival innovates on the more profitable attribute.

4 - Dynamic Research Capacity Allocation in a R&D Pipeline
Yi Xu, Assistant Professor, University of Miami, 412B Jenkins Bldg., 5250 University Dr., Coral Gables, FL, 33146, United States, yxu@miami.edu, Yong-Pin Zhou

This paper studies a R&D intensive firm's dynamic capacity allocation policy to maintain an efficient R&D pipeline. The firm needs to allocate its research capacity among a set of project classes. We characterize the optimal policy and explore how factors such as risk aversion, diminishing return, and interactions among different project classes could affect the optimal policy. We also discuss the relationships between our model and R&D and financial portfolio management techniques.

■ MB59

S-Seneca (Lev. 4)

Panel Discussion: Meet the Editors

Cluster: INFORMS Publications
Invited Session

Chair: Terry Harrison, Penn State Univ., 459 Business Building, Smeal College of Business, University Park, PA, 16802, United States, tharrison@psu.edu

1 - Panel Discussion: Meet the Editors
Moderator: Terry Harrison, Penn State Univ., 459 Business Building, Smeal College of Business, University Park, PA, 16802, United States, tharrison@psu.edu

This session is a panel discussion. Editors from several of the INFORMS journals will present short descriptions of their journals both in what they are looking for in articles and how they handle the editorial process. After brief statements by the editors, we will take questions from the audience on publishing in our journals.

■ MB60

S-University (Lev. 4)

Offshoring

Sponsor: Technology Management
Sponsored Session

Chair: Erica Fuchs, Post-Doctoral Fellow, M.I.T., 73 Magazine Street, Apartment 401, Cambridge, MA, 02139, United States, erhf@mit.edu

1 - The Internationalization of Supply Chains and the Location of Innovation Activities
Francisco Veloso, Assistant Professor, Carnegie Mellon, Engineering & Public Policy, Pittsburgh, PA, 15213, United States, fveloso@cmu.edu, Brian Fifarek, Cliff Davidson

We analyze the impact of the movement of rare earth materials production from US to China on US rare earth innovation activities. We show that this movement causes some innovation activities to move away while others remain. We suggest that this relocation of innovation is conditioned by the nature of innovation processes and the role of knowledge spillovers among value chain actors. Using patents and industry observations, we employ regression and modeling techniques to test this relationship.

2 - The Globalization of Science & Engineering Capabilities: A Dynamic Perspective on Next-generation Offshoring
Arie Lewin, Duke University, ayl3@duke.edu, Stephan Manning

The growing shortage of domestic science and engineering (S&E) talent and the increasing availability of talent and supportive infrastructures in emerging economies have led to a new offshoring dynamic: the globalization of S&E capabilities. Using results from the Offshoring Research Network, this paper examines how this trend has resulted from macro-economic developments, domestic and offshore national policies, industry dynamics and the sophistication of firm-level offshoring capabilities.

3 - Modularity and the Geography of Innovation
John Paul MacDuffie, Wharton School, U. Pennsylvania, 3105 Steinberg-Dietrich Hall, 3620 Locust Walk, Philadelphia, PA, 19104, United States, macduffie@wharton.upenn.edu

Some posit inexorable movement of industries from high levels of vertical integration and integral product architectures towards modular architectures and a horizontal structure. I consider this hypothesis using a framework with three dimensions of architecture: product, value chain, and organization. I apply this framework at industry, firm, and jurisdictional (nations/regions) levels to examine consequences of alignment and misalignment among these dimensions for the geography of innovation.

4 - Globalization of Software Innovation
Chris Forman, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, cforman@andrew.cmu.edu, Ashish Arora, Matej Drev

Using patent data from the US, we provide evidence on the geographic distribution of inventive activity in software. We show that at present inventive activity in software remains concentrated in locations within the US and among US firms. Dividing software patenting activity into sectors, we further demonstrate that inventive activity in software outside of the US tends to be concentrated in software that requires less interaction with users.

Interactive Session
Monday, 12:30pm - 1:30pm

Exhibit Hall Entrance

Chair: Archis Ghate, Assistant Professor, University of Washington, Industrial Engineering, BOX 352650, Seattle WA 98195, United States, archis@u.washington.ed

1- Risk Averse Selective Newsvendor with All-or-nothing Orders
Kiran Chahar, PhD Candidate, Clemson University, 110 Freeman Hall, Clemson SC 29634, United States, kchahar@clemson.edu, Kevin Taaffe

Consider a firm offering its product for a single selling season to various unconfirmed demand sources each with unique forecasted demand and revenue. The order may either come in at a predefined level or not come in at all (all-or-nothing), and the firm can choose to pursue the order or not. We propose an order selection approach minimizing the risk of incurring losses below some threshold value. We employ multiple optimization models, including a Conditional Value-at-Risk (CVaR) approach.

2- On the Use of Hidden Markov Models for Animal Speech Recognition
Ivan Guardiola, Graduate Student, Texas Tech University, P.O. Box 43061, Lubbock TX 79409, United States, ivan.guardiola@ttu.edu, Aaron Phillips

This research highlights the use of Hidden Markov Models (HMM) for speaker identification and recognition. A model design is presented that can be applied to Marmot calls. This HMM application facilitates the monitoring and collection of data related to the social analysis of a biological habitat system, where such a capability allows biologists to study animals of interest while reducing human presence due to a deployed sensing network of microphone arrays.

3- Using a Genetic Algorithm and Mixed Integer Program to Solve Concave Cost Supply Scheduling Problem
Xia Wang, Gradudate Student, University of Maryland, College Park, 4307 Mathematics Building, University of Maryland, College Park MD 20742, United States, lilywang@math.umd.edu, Bruce Golden, Edward Wasil

We consider the concave cost supply scheduling problem with multiple manufacturing units and multiple providers. We use a genetic algorithm to select a subset of providers and then solve a mixed integer linear program to determine the quantity to deliver. Our hybrid algorithm is simple in structure and generates near-optimal solutions.

4- Reliability, Failure Characterization, and Intensity Function Estimates of Nanosystems
Geoffrey Okogbaa,University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa FL 33620, okogbaa@admin.usf.edu, Wilkistar Otieno

Nanomanufacturing has emerged as an important area of national and global concern. The role of nanomanufacturing and processing technologies in the promotion of international security, including protection of the public from sabotage activity as well as chemical and biological threats etc. has been widely acknowledged by most experts. This is especially so given the potential contributions of nanosystems in miniaturization in such areas as nanostructured sensors and bioassay devices, drug delivery, protection materials, alarms and safety devices, information technologies, among numerous others. Nanomanufacturing and processing places emphasis on up-scaling, synthetic fabrication of functional structures, devices and systems, through use of particles, structures and processes with nanoscale size or control.

5- Understanding Team Development Through Survival Analysis
Deanna M. Kennedy, Doctoral Student, University of Massachusetts Amherst, 121 Presidents Drive, Amherst MA 01003, United States, dkennedy@som.umass.edu, Sara A. McComb

This paper employs survival analysis to examine the dynamics of team development. Using data collected during team experiments we investigate the development process of computer-mediated and face-to-face teams under varying environmental conditions. Results derive from hazard rates and covariates of team performance.

6- An Ant Colony Based Heuristic for the Vehicle Routing Problem with Simultaneous Pick-up and Delivery

Emrah Cimren, PhD Student, Ohio State University, 115 West Patterson Ave, Columbus OH, United States, cimren.1@osu.edu, Elif Ilke Gokce

In this study, an ant colony based heuristic is proposed for the vehicle routing problem with simultaneous pick-up and delivery. The performance of the heuristic is evaluated with three different objectives: minimizing the total distance traveled, minimizing the number of vehicles used, and minimizing both the total distance traveled and the number of vehicles used.

7- Allocation of Warfighters into Strategic Compact Units: Picking Teams Beyond the Playground

Nicole Scholtz, Undergraduate, Department of Mathematics and Computer Science, Denison University, 7740 Woodlands Trail, Chesterland OH 44026, United States, scholt_n@denison.edu, Nina Fefferman

The completion of any type of special mission requires selecting the best team for the job. Here, we examine the best way to simultaneously compose multiple teams from a limited and shifting population. In doing so, each team must meet certain competency and resiliency requirements, as dictated by the mission. Our aim is to create an efficient algorithm to assign people to teams such that these requirements are met, while minimizing the number of people given assignments.

8- Improving Regularity of Crew Schedules in Ex-urban Public Transit

Leena Suhl, University of Paderborn, Department of Business Information Systems Warburger Str. 100, D-33098, Paderborn, Germany, suhl@upb.de

We discuss timetables in ex-urban bus traffic that consist of many trips serviced every day together with some exceptions that do not repeat daily. We propose new solution methods that improve regularity while partially integrating the vehicle and crew scheduling problems. The methods belong to two groups: First we present novel branching strategies within a set partitioning approach using column generation techniques. Second, we discuss various bi-objective metaheuristics taking operational costs as well as regularity into account.

9- The Financial Costs of Entrepreneurial Errors in Launch Timing

David Croson, Associate Professor, SMU Cox School of Business, 333 Fincher, 6212 Bishop Blvd, Dallas TX 75275, United States, dcroson@smu.edu

I derive optimal timing for venture launch decisions. Calibration with MBA data allows computation of the costs of plausible timing errors (e.g., premature or delayed launches) as NPV shortfalls from perfect decisions. Most launch far too early and can improve lifetime earnings by delaying up to 5 years. The concavity of the NPV gradient in launch time suggests that small unbiased prediction errors favor aggression and early launch, whereas larger errors favor conservatism and later launch.

10- Algorithm of Finding Hereditarily Minimax Matrices and Functions

Vladimir Tsurkov, Dorodnicyn Computing Center of RAS, 40 Vavilov Str., Moscow 119991, Russia, tsur@ccas.ru, Anatoly Mironov

Matrix of a transportation polyhedron is called to be minimax if its biggest element is minimal. Minimax matrix is called hereditarily minimax if each its submatrix is minimax matrix of the corresponding transportation polyhedron. Generalization of these concepts to functional transportation problems is considered. An algoritm for finding hereditarily minimax matrices and fucntions is presented.

11- Optimization of Multi-Echelon Supply Chains Using Piecewise Linear Cost Functions

Metin Turkay, Asst. Prof., Koc University, Department of Industrial Engineering, Sariyer, Istanbul 34450, Turkey, mturkay@ku.edu.tr, Ugur Kaplan

Piecewise linear cost functions are used to model dependence of purchase quantity on price in supply chain management, unit inventory holding cost as a function of inventory quantity, distance and quantity dependent transportation costs. Theoretical characterization of piecewise linear cost models are made. Several algorithms are developed that takes advantage of the theoretical properties of these piecewise linear cost models. The effectiveness of the algorithms is illustrated with some case studies in supply chain management.

12- Data Mining: A Definition of Patient Compliance

Christiana Petrou, University of Louisville, University of Louisville, Louisville, United States, petrouchristiana@hotmail.com, Patricia Cerrito

We define a measure of patient compliance for dental patients. Data-mining with clustering and kernel density assisted in defining compliance. Text-mining and confidence interval estimation were used to develop a measure of conditions severity and allocated patients to compliance levels respectively. The most critical patients had the least compliance level.

13- Generalized Trade Reductions: The Role of Competition in Designing Budget-Balanced Mechanisms

Rica Gonen, Research Scientist, Yahoo!Research, 1257 Lakeside Drive, Sunnyvale, United States, gonenr@yahoo-inc.com, Elam Pavlov

This paper provides a procedure called a Generalized Trade Reduction (GTR), which given an IR and IC mechanism, outputs a mechanism that is IR, IC and BB with a loss of welfare. We bound the welfare achieved by GTR for a wide range of domains. Our results improve on existing solutions for problems such as double-sided auctions, distributed markets and supply chains. Furthermore GTR answers several open problems such as combinatorial markets and distributed markets with strategic transport edges.

14- Revenue Sharing, Disposal Allowance to Coordinate Two Period Newsboy Supply Chain with Mid Disposal

Linh Cao, Student, POSTECH, San 31, Hyoja-Dong, Namgu, Pohang, Korea, Republic of, linhcao@postech.ac.kr, Yu-Shin Hong

The paper examines the performance of revenue sharing (RS), midlife disposal allowance (DA) in two period newsboy supply chain, in which the retail price declines in second period and retailer can dispose part or all of leftover inventory at midlife. RS contract asks retailer to share his revenue with manufacturer. DA requires manufacturer to give a subsidy to retailer for midlife disposal. Under certain condition, both coordination and win-win outcome are guaranteed by combination of RS and DA.

15- Text and Data Mining to Investigate Expenditures of Prescribed Medicines

Guoxin Tang, University of Louisville, Department of Mathematics, Louisville KY 40208, United States, guoxintang05@gmail.com, Patricia Cerrito

We use Text Miner to examine combinations of medications and time series methods to investigate costs in relationship to the patient conditions to examine prescribed medications. By clustering the text strings, we can show the relationship of patient condition to patient self-pay, Medicare, Medicaid and private insurance in total cost.

16- Supply Contracts in Constrained Channels

Navid Sabbaghi, MIT, 77 Massachusetts Avenue, Room 32D-712, Cambridge MA 02139, United States, sabbaghi@mit.edu, Yossi Sheffi, John Tsitsiklis

We demonstrate the enhanced coordination capability of supply contracts in a capacity-constrained channel. Furthermore, we analyze how the contracts influence profits and service levels in a game theoretic setting.

17- New Approaches to Nonlinear Network Design Problems in Supply Chain Optimization

Thomas Sharkey, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville Fl 32611, United States, sharkeyt@ufl.edu, Edwin Romeijn

We consider facility location problems where the cost associated with each location is a nonlinear function of the assignments. We develop approximation methods and exact and heuristic solution approaches for important classes of such problems. This has led us to study several new classes of optimization problems, which are discussed.

18- Emergency Medical Service System Design with Risk Measures

Nilay Noyan, Assistant Professor, SABANCI University, Faculty of Engineering and Natural, Sciences. SABANCI University. Tuzla, Istanbul 34956, Turkey, nnoyan@sabanciuniv.edu

The stochastic nature of emergency service requests is a critical issue in constructing models representing real life emergency medical service (EMS) systems. We consider EMS system design models where the network coverage is quantified using risk measures on random unmet demands. In particular, we describe stochastic optimization models involving integrated chance constraints introduced by Klein Haneveld (1986), and dominance constraints introduced by Dentcheva and Ruszczynski (2003).

19- Two Stage Approach to Decision Making in Radiation Therapy

Minsun Kim, Student, University of Washington, Department of Radiation Oncology, Box 356043, Seattle WA 98195, United States, mk688@u.washington.edu, Mark Phillips

We propose a two-stage approach to structuring decision making in radiation therapy. The first step is to obtain a representation of the Pareto frontier using BOXCQP, an active set quadratic optimization algorithm. This step involves objectives and constraints that are poor surrogates for clinical variables. To amend this, the solutions are filtered in the second stage by an influence diagram incorporating a Bayesian network and patient-specific utilities.

20- RimSim: A Simulation Testbed for Emergency Planning and Response

Suzanne Weghorst, Sr Research Scientist, University of Washington, Box 352142, Seattle WA 98107, United States, weghorst@u.washington.edu

RimSim is a DHS-sponsored multi-participant simulation environment for planning and executing responses to threats to Pacific Rim public health and safety. It incorporates methods for modeling and metrics for analyzing the distributed cognition of players and computer-based agents, and provides a framework for visualizing the GOSIR resource distribution optimization methods.

21 - Incorporating Timber Quality and Carbon in Harvesting Planning Models

Rapeepan Kantavichai, Graduate Student, College of Forest Resources, University of Washington, rapeepan@u.washington.edu, D. Briggs

New technology and improved growth models provide information of the quality associated with customer log specifications include (1) stiffness (2) size of knots (3) ring size. With a developing carbon credit market, the goal of this study is to incorporate both timber quality and carbon into the harvest scheduling and perform sensitivity analyses.

Monday, 1:30pm - 3:00pm

■ MC01

C-Room 602

Supply Chain Management VII

Contributed Session

Chair: Xiaowei Xu, Assistant Professor, Rutgers Business School, 180 University Avenue, Ackerson Hall, Room 208, Newark, NJ, 07102, United States, xiaoweix@andromeda.rutgers.edu

1 - Coordination of Pricing and Production-scheduling Decisions in Supply Chains

Aysegul Toptal, Bilkent University, Department of Industrial Engineering, Ankara, b, Turkey, toptal@bilkent.edu.tr, Mehmet Rustu Taner, Ihsan Sabuncuoglu, Muzaffer Misirci

This study considers a two-stage supply chain consisting of a single manufacturer and multiple retailers operating in a single period stochastic demand environment. A new delivery time-dependent pricing mechanism is proposed to help the manufacturer effectively utilize its limited production capacity. The performance of this mechanism as a term of a contractual agreement is compared to a more traditional model with a fixed wholesale price and tardiness penalties.

2 - Modeling, Optimization & Analysis of a Supplier-manufacturer Network

Uday Nimmala Manikandan, Graduate Student, The Pennsylvania State University, Department of Industrial Engineering, 310 Leonhard Building, University Park, PA, 16802, United States, udaynm@psu.edu, Sridhar Ranganathan

A generalized supply chain model for the Supplier – Manufacturer network is designed taking into considerations the inventory policy, supplier selection, transportation & production planning criterions. The model is a multi-level optimization problem working on a ëmulti-site & multi-supplier' network that allows inter-site transportation of materials. This optimization model forms a base for analysis of various concepts such as Risk Pooling, Price Increase & Shortage of Supply etc.

3 - The Impact of IT Implementation on Supply Chain Performance

Hongjiao Yang, PhD Candidate, Management School of Xi'an Jiaotong University, Xianning West Road 28#, Xi'an, Shann Xi, Xi'an, 710049, China, rechardyoo@gmail.com

Implementation of IT in a firm is becoming very important during managing supply chain under the context of global economy and intensified competition. This study aims to investigate the relationship between IT implementation and supply chain performance. Using the data collected from almost 200 firms in China, we make an empirical study. The results show that IT implementation positively enhances supply chain performance indirectly through information sharing and supply chain integration.

4 - Supply Quality Management and Horizontal Competition

Fouad El Ouardighi, Associate Professor, Essec Busines School, BP 105, Cergy Pontoise, 95021, France, elouardighi@essec.fr

In the setup of a two competing manufacturers and one common supplier network, we investigate how wholesale price and revenue sharing contracts can affect (design) quality competition at the manufacturing level via the way efforts are allocated for quality improvement.

5 - Optimal Pricing, Ordering, and Return Policies

Michael Ketzenberg, MKetzenberg@mays.tamu.edu, Rob Zuidwijk

Our research addresses a firm that sells a product to consumers who are sensitive to both price and return policy. The operational decisions of interest are the selling price, return policy, and quantity of new product to purchase. We conceptually model a single selling season that is split into two periods where the boundary between periods is delineated by the opportunity to recover product returns and resell them.

■ MC02

C-Room 603

Information Flow, Incentives, and Supply Chain Contracts

Cluster: Supply Chain

Invited Session

Chair: Milind Sohoni, Indian School of Business, Gachibowli, Hyderabad, 500032, India, Milind_Sohoni@isb.edu

1 - Optimal Contract Design with Information Sharing and Competition

Aditya Jain, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, AP, 500032, India, Aditya_Jain@isb.edu, Milind Sohoni, Sridhar Seshadri

We consider the case when retailers, engaged in horizontal competition, source from a common supplier. Each retailer privately observes her market signal and chooses to reveal her information to the common supplier. Her information accuracy is common knowledge. The supplier then sets a wholesale price for the retailers. We design an optimal, linear, mechanism that enforces truthful revelation and ensures individual rationality. We also show that the entire supply chain is better off.

2 - Strategic Information Management Under Leakage in a Supply Chain

Manu Goyal, mgoyal@rhsmith.umd.edu, Krishnan Anand

In practical settings, material and information flows are intertwined, calling for their joint optimization to maximize channel efficiency. We analyze one such setting where material and information flows intersect through the mechanism of information leakage (non-consensual sharing of information), and study its effect on the joint determination of material flows (the order quantities) and information flows (acquisition and dissemination of demand information) in a vertical contract.

3 - Threshold Incentives and the Sales Hockey Stick Phenomenon

Sunil Chopra, Kellogg School of Management, Northwestern University, Evanston, IL, 60208, United States, s-chopra@kellogg.northwestern.edu, Achal Bassamboo, Milind Sohoni

We study quota-based sales-force incentives and their impact on a dealer's optimal effort. Often the dealer exerts a large effort towards the end of the incentive period resulting in the hockey stick phenomenon (HSP.) We characterize the form of the HSP and show how to control it using a signal correlated with the underlying demand. We then study the impact of dealer competition on the HSP. We also study the impact such incentives on the overall sales of the manufacturer.

4 - Impacts of Financial Collaboration in a Competitive Three-Party Supply Chain

Jianer Zhou, Simon School of Business, University of Rochester, 4-341 Carol G. Simon Hall, Rochester, NY, 14627, United States, ZHOUJ2@simon.rochester.edu, Harry Groenevelt

We consider a supply chain involving 3 parties: retailer, manufacturer and bank. The mfr sells her products through a channel retailer whose ability to finance inventory is limited. In order to sell more product, the mfr partners with a bank to offer a loan program to the retailer. We formulate the interaction between retailer, mfr and bank as a Stackelberg game, compare the results with open account financing provided by the mfr, and consider contracts to coordinate this 3-party supply chain.

■ MC03

C-Room 604

Risk Management in Operations

Cluster: Supply Chain
Invited Session

Chair: Ravi Anupindi, University of Michigan, 701 Tappan Avenue, Ross School of Business, Ann Arbor, MI, 48105, United States, anupindi@umich.edu

1 - Optimal Operational versus Financial Hedging for a Risk-averse Firm
Wanshan Zhu, Assistant Professor, Singapore Management University, 50 Stamford Road #04-01, Singapore, 178899, adamzhu@smu.edu.sg, Roman Kapuscinski

We examine a Multinational Risk-averse firm who produces and sells goods at home and overseas over multiple periods. The firm faces risks in uncertain exchange rate, as well as uncertain demand. The firm may use financial hedging and operation hedging to reduce these risks. Our paper models these two hedging tools in a make-to-order system and identifies the favorable conditions where one hedging is more beneficial than the other.

2 - Risk Metrics in Supply Chain Management
John Birge, University of Chicago, Chicago, IL, John.Birge@ChicagoGSB.edu

A variety of measures have been proposed for including risk considerations into operational contexts. Each of these measures has merit in different contexts, but care is necessary to ensure that the proposed models are consistent with other principles. This talk will discuss features of various risk measures, their motivation and uses, and how to ensure consistency with basic economic assumptions.

3 - Integrated Optimization of Procurement, Processing and Trade of Commodities
Sripad Devalkar, Ross School of Business, University of Michigan, 701 Tappan Street, E0401, Ann Arbor, MI, 48109, United States, devalkar@bus.umich.edu, Ravi Anupindi, Amitabh Sinha

We consider the integrated optimization for a firm involved in the procurement, processing and trading of commodities. We model risk-aversion using a Value-at-Risk constraint on the total expected profits and derive optimal policies for both risk-neutral and risk-averse firms. We show that the optimal procurement quantity for a risk-averse firm is never greater than that for a risk-neutral firm, while the optimal quantity processed is never lower than that for a risk-neutral firm.

4 - Balancing Risk and Efficiency at a Major Commercial Bank
Erkut Sonmez, PhD Candidate, Carnegie Mellon University, Tepper School of Business, Carnegie, Mellon University, 5000 Forbes Ave., pittsburgh, pa, 15213, United States, esonmez@andrew.cmu.edu, Sunder Kekre, Ken West, Nicola Secomandi

Check-processing institutions are being forced to downsize their workforce to cut cost and improve the efficiency of their operations as a result of continued growth of electronic payments. However with reduction in headcount, the chances of delayed checks increase and the expected costs associated with fraud and float risks escalate. We discuss how a team of executives at a major commercial bank and Carnegie Mellon University students and faculty engaged in conducting a model-based study.

■ MC04

C-Room 606

Tutorial: Approaches to Risk in Optimization Under Uncertainty

Cluster: Tutorials
Invited Session

1 - Coherent Approaches to Risk in Optimization Under Uncertainty
R. Tyrrell Rockafellar, Professor Emeritus, University of Washington, Department of Mathematics, Box 354350, Seattle, WA, 98195-4350, United States, rtr@math.washington.edu

Decisions often need to be made before all the facts are in. Essentially then, the outcomes are random variables which have to be quantified with respect to their inherent risk. Constraints may need to be viewed in a probabilistic manner, perhaps with the introduction of safety margins. This tutorial concerns the methodology for dealing with such issues. Questions of whether a particular approach is coherent or not are addressed, in particular.

■ MC05

C-Room 607

In Memory of Peter L. Hammer

Cluster: History of OR/MS
Invited Session

Chair: Endre Boros, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscawatawy, NJ, 08854, United States, boros@rutcor.rutgers.edu

1 - Peter Hammer as a Mentor, Motivator, and a Friend
Frieda Granot, Professor, UBC, 2053 Main Mall, Sauder School of Business, Vancouver, BC, V6T1Z2, Canada, Frieda.granot@sauder.ubc.ca

I will recall personal memories about Peter.

2 - Peter Hammer and the Roof-duality Adventure
Bruno Simeone, Sapienza University, Rome, Italy, bruno.simeone@uniroma1.it

The theory of Roof-Duality is a unique synthesis of Peter Hammer's three main research interests: binary optimization, Boolean functions, and graphs. Initiated by Hammer, Hansen, and the writer towards the end of the 70's, it has since then been the subject of ramifications and extensions by Hammer himself and many of his students and collaborators. Eight characterizations will be reviewed. Recently, the impressive computational results of G. Tavares have spurred a revival of this theory.

3 - Everything Looks Like Boolean ...
Endre Boros, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscawatawy, NJ, 08854, United States, boros@rutcor.rutgers.edu

I will survey Peter Hammer's main research contributions, and recall episodes from his life.

4 - Why Should You Apply Pseudo-boolean Optimization?
Gabriel Tavares, Consultant, Dash Optimization Inc, 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, gabriel.tavares@dashoptimization.com

The peculiar relation between Professor Peter Hammer and his students will be outlined and illustrated. Peter's research and his teaching methods were determinant to efficiently solve some difficult optimization problems. I will present two types of problems (1-dimensional Ising chains and maximum independent sets of planar Delaunay graphs) that are typically solved in minutes using Hammer's techniques, but which cannot be solved on a time life by using state-of-the-art solvers.

■ MC06

C-Room 608

RFID in Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Fuqiang Zhang, Assistant Professor, University of California, Irvine, CA, United States, fzhang@uci.edu

1 - Inventory Record Inaccuracy and RFID Adoption Incentives in a Supply Chain
Seb Heese, Indiana University, 1309 E 10th St, Bloomington, IN, 47405, United States, hheese@indiana.edu

We study a supply chain with one manufacturer and one retailer, who suffers from inaccurate inventory records. We show that such inaccuracies exacerbate the inefficiencies resulting from double marginalization in the decentralized supply chain. Assuming that RFID technology eliminates the problem of inventory record inaccuracy, we determine the cost thresholds at which RFID adoption becomes profitable and show that RFID adoption improves supply chain coordination.

2 - Inventory Misplacement and RFID
Almula Camdereli, Georgetown University, McDonough School of Business, Georgetown University, 37 & O Streets, Washington, DC, 20057, United States, zac2@georgetown.edu, Jayashankar Swaminathan

We study benefits of RFID implementation on a two stage supply chain experiencing misplaced inventory at the retailer in three settings: a vertically integrated, a decentralized supply chain with a wholesale contract and a supply chain that is coordinated with a revenue sharing contract. We consider both fixed and variable costs for RFID implementation and assume that the fixed cost is shared between the two using an arbitrary proportion while the variable cost could be charged to either party.

3 - Impact of Item-level RFID on Product Availability and Forecasting in Retail

Gary Gaukler, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States, gaukler@tamu.edu

In this talk, we consider a two-stage retail supply chain with a periodic-review, order-up to inventory system with lost sales. In this setting, we explore the impact that item-level RFID has on the availability of products on the retail shelf, as well as on the demand forecasts made by a retailer.

4 - Effects of Inventory Inaccuracy in Joint Marketing and Inventory Decisions

Shaoxuan Liu, UC Irvine, 419 The Paul Merage School of Business, UC Irvine, Irvine, ca, 92697, United States, sliu02@merage.uci.edu, Fuqiang Zhang, Rick So

We develop a mathematic model to study how supply uncertainty due to inventory inaccuracy affects a firm's marketing effort and stocking quantity decisions. We use our model to analyze the value of coordination between marketing and inventory decisions and quantify the benefits of emerging technology such as RFID.

■ MC07

C-Room 609

Applications of Empirical Science in OM

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Aleda Roth, Professor, Clemson University, College of Business & Behavioral Science, Clemson, United States, aroth@clemson.edu

1 - Effect of Manufacturer Rebates in the Automobile Industry - An Empirical Study

Banu Yuksel Ozkaya, Hacettepe University, Department of Industrial Engineering, Ankara, 06800, Turkey, byuksel@hacettepe.edu.tr, Pinar Keskinocak, Julie Swann

We analyze the effect of manufacturer rebates using several sources of data from automotive industry. We investigate how rebates impact the sales for different vehicle types. We differentiate the strategic behavior of several customer segments over time. We also analyze factors to determine the pass-through rates of rebates by dealers.

2 - The Influence of Psychological Safety and Confidence on Employee Knowledge Sharing

Enno Siemsen, Assistant Professor, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States, siemsen@uiuc.edu, Aleda Roth, Sridhar Balasubramanian, Gopesh Anand

This research examines how psychological safety influences knowledge sharing among coworkers. Reconciling conflicting findings in the literature, we demonstrate that while psychological safety is an important antecedent of knowledge sharing, the relationship between these two constructs is moderated by the level of confidence that employees have in what they know. The higher her level of confidence, the less is the importance of psychological safety in facilitating knowledge sharing.

3 - Why are Banks Still Opening More Branches? The Impact of On-line Channel on Offline Channel Capacity

Mei Xue, Assistant Professor, Boston College, Walace E. Carroll School of Management, 140 Commonwealth Ave., Chestnut Hill, MA, 02467, United States, xueme@bc.edu, Lorin Hitt, Jun Zhang

In this paper we study the impact of offering virtual, self-service channel (e.g. Internet banking) on a service firm's capacity investment in the existing physical, employee service channel (e.g. bank branches). In particular, we explore the issue of the missing of channel substitution. We first present a two-channel model and then test the major conclusions from the model using a large data set from retail banking.

4 - From Observation to Theory in OM Empirical Research

Aleda Roth, Professor, Clemson University, College of Business & Behavioral Science, Clemson, United States, aroth@clemson.edu

This paper discusses the need for theory building in OM. It describes the development of Competitive Progression Theory as an example of theory building and testing.

■ MC08

C-Room 611

Managing Risks for Goods in Transit

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Tom Schmitt, Washington University, glennsch@u.washington.edu

1 - Reducing Railroad Hazardous Materials Transportation Risk Through Route Rationalization

Athaphon Kawprasert, University of Illinois at Urbana-Champaign, 1201 Newmark Lab, MC-250, Room B118, 205 North Mathews Avenue, Urbana, IL, 61820, United States, a_kawprasert@hotmail.com, Christopher Barkan

This paper combines a railroad hazardous materials risk analysis with a linear programming model to consider the potential reduction in risk from rationalization of a hazardous materials transportation route structure. An optimal route structure can be developed for the origins and destinations for any particular hazardous material. The set of optimized routes may vary depending on the particular objective function such as minimization of mileage, train accidents, or population exposure.

2 - Optimizing Both Risk and Costs with Multi-objective Metaheuristics for Rich Vehicle Routing Problems

Andreas Reinholz, University of Dortmund, Otto-Hahn-Str. 14, Dortmund, 44227, Germany, andreas.reinholz@gmx.de, Tycho Mönckes

Cost optimized VRP solutions are often close to the infeasible region of the search space and therefore very sensitive to the inherent uncertainty of real world applications. We present a model to quantify risk and flexibility of VRP Solutions and optimize both cost and risk with three Multi-Objective Metaheuristics.

3 - Evaluation of Countermeasures to Secure Cargo at Southwestern Ports of Entry

Niyazi Bakir, Postdoctoral Researcher, University of Southern California, 3710 Mc Clintock Ave, Room 322, Los Angeles, CA, 90034, United States, nbakir@usc.edu

This study examines security issues pertaining to Mexican commercial truck crossings at US borders. We propose a model that examines risks at various phases of container movement beginning with customs processing at the Mexican side of the border and including inspection of cargo at U.S. customs ports. We model container movement using decision tree analysis and explore cost effectiveness of countermeasures given the potential benefits of reduced likelihood of a successful terrorist attack.

■ MC09

C-Room 612

Professionals in Emergency Management

Cluster: Homeland Security
Invited Session

Chair: Deena Disraelly, Research Staff Member, Institute for Defense Analyses, 4850 Mark Center Drive, Alexandria, VA, 22311, United States, ddisrael@ida.org

1 - Emergency Response and The Clinical Approach to Chemical, Biological, and Radiological Agents

Robin McFee, DO, MPH, DABPM, tweetydoctor@aol.com

The Medical community and hospitals, in particular, play a vital role in responding to any large-scale emergency response. As private companies providing public services, hospitals and medical professionals have to make tough decisions regarding preparedness, planning, and response capabilities. While terrorism medicine is slowly finding its way into medical curricula and hospitals are starting to make efforts to prepare, questions remain, not the least of which is how to decide how much time to take away from the day-to-day business of patient care to spend preparing for something that might happen sometime in the future. Failure to respond will not be an option, so hospitals and patient care providers need to begin thinking about their roles in responding to disasters, and the coordination, plans, education and training, and additional actions that will shape their ability to provide the necessary assistance if the need arises.

2 - Taking a Regional Approach to Emergency Management

Eric Holdeman, EHoldeman@icfi.com

There is a system for emergency management for the nation. It has been rigorously tested over the years and some question its ability to function during catastrophic events. The challenge for emergency managers is blending the public-private efforts with the multi-level governmental response. Taking a regional approach is one solution to improving the current system of governance and organizational interaction.

3 - Crisis Preparedness: Who Should Prepare and Why They Aren't
Dale Stewart, CEO, REACTION, 8100 White Horse Rd., Greenville, SC, 29610, United States, dstewart@reactioncompany.com

The survival of a business following a disaster or other crisis event depends on management's ability to minimize the scale and duration of disruption to business functions. Business continuity management is about not making excuses. It's about planning before a crisis event happens. It is a mind set by management that understands great companies never moan they are having problems because of a natural disaster, a terrorist event, a major recall, a fire, or a strike. To do this effectively requires planning and preparation, an understanding of risks and vulnerabilities, training for your employees and their families, and coordination within your own company up and down your supply chain. Great companies do well in spite of the event. Others fade away or worse. Yet, even now, in light of the lessons learned after September 11th and in far more recent events, many companies are not doing what's necessary to ensure their own survival. Business continuity can't be something that's discussed after disaster strikes; rather, business continuity should be a critical part of a company's way of life.

4 - Enlisting the Community in its Own Preparedness
Deena Disraelly, Research Staff Member, Institute for Defense Analyses, 4850 Mark Center Drive, Alexandria, VA, 22311, United States, ddisrael@ida.org

In the past six years, we've seen both man-made and natural disasters. Largely in the news following these events was what the government should have done, before the events to prevent them or after to help the communities. What has received less attention is what these communities could have, should have, and did do to help themselves, both before and after. Amidst the tragedies are success stories, of lives saved, of communities coming together to help each other. There is an opportunity to learn from these communities and to apply those lessons to reach out in other communities, to enlist the communities and the people and organizations within them to be prepared at home and as part of their city or town, not just for their own sakes, but for the safety, security, and future of the communities they live in.

■ MC10

C-Room 613

New Developments In Multi-Echelon Systems

Cluster: Inventory
Invited Session

Chair: Ton de Kok, Technische Universiteit Eindhoven, Dept.. Technology Management, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, a.g.d.kok@tm.tue.nl

1 - A New Old Method for Calculating Order-up-to Levels for Transshipment Problems
Yale Herer, Technion, Haifa, Israel, yale@technion.ac.il

We consider the problem of calculating optimal order-up-to levels for the multi-location periodic stochastic inventory problem with transshipments. In the past, these levels were calculated by differentiating the expected profit function. We demonstrate how an old idea for the single location version of the problem can be used to solve our problem.

2 - Inventory Control in Divergent Supply Chains with Shipment Consolidation
Johan Marklund, Lund University, P.O. Box 118, Lund, SE, SE-22100, Sweden, johan.marklund@iml.lth.se

Balancing inventory and delivery costs is an important issue in many supply chains. This talk focuses on methods for joint evaluation of inventory replenishment and shipment consolidation effects in one-warehouse multiple-retailer systems. The results are applicable for both single-item and multi-item inventory systems with non-identical retailers.

3 - Supply Chain Inventory Optimization Under Multiple Sourcing Options
Stefan Minner, University of Mannheim, Schloss, Mannheim, BW, Germany, minner@bwl.uni-mannheim.de, Steffen Klosterhalfen, Daniel Kaiser

We analyze multi-stage safety stock optimization when multiple sources for replenishment exist. The model extends existing approaches for general networks under the guaranteed service assumption. We show optimality properties of safety stock allocations and discuss optimization algorithms based on dynamic programming and a heuristic estimation of distribution algorithm.

4 - Service Times in Multi-echelon Systems
Ton de Kok, Technische Universiteit Eindhoven, Dept.. Technology Management, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, a.g.d.kok@tm.tue.nl

We consider general multi-echelon systems under synchronized base stock policies. We translate the concept of service times proposed by Simpson a.o. to this situation. We show how to compute optimal service times based on service level constraints for each item and how to use them in MRP systems.

■ MC11

C-Room 614

Flexible and Integrative Strategies for Manufacturing Systems and Distribution Networks

Cluster: Manufacturing
Invited Session

Chair: Douglas Morrice, Professor, The University of Texas at Austin, IROM Dept., McCombs School of Business, 1 University Station, B6500, Austin, TX, 78712-0212, United States, morrice@mail.utexas.edu

1 - Simultaneous Assignment & Sequencing of Product Families to Minimize Sequence-Dependant Setup Costs
Susan Heath, Assistant Professor, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States, skheath@nps.edu, Douglas Morrice, Jonathan Bard

This paper presents a mixed-integer non-linear program (MINLP) as a next-generation solution to a known production scheduling problem. The scheduling problem consists of scheduling multiple product families on parallel, identical production lines so as to minimize complex sequence-dependant setup costs. This problem is represented as a multiple traveling salesman subset-tour problem (MTSSP). We use a greedy randomized adaptive search procedure (GRASP) to generate good quality solutions.

2 - Comparative Assessment of Alternative Approaches to Distribution System Design in Supply Chains
Srinagesh Gavirneni, Assistant Professor, Cornell University, Johnson Graduate School of Management, Ithaca, NY, 14853, United States, sg337@johnson.cornell.edu, Poornachandra Panchalavarapu, Ram Rachamadugu

Conventional methods in designing distribution systems are sequential in nature – strategic design of the distribution network followed by the operational design. We propose an integrative approach which models and makes these decisions simultaneously. Using a large practical data set from industry, we explore how product characteristics such as value density and demand variability impact the sequential approach vis-á-vis the integrative approach.

3 - Managing Capacity Flexibility in Make-to-Order Production Environments
Fehmi Tanrisever, The University of Texas at Austin, IROM Dept., McCombs School of Business, 1 University Station, B6500, Austin, TX, 78712-0212, Fehmi.Tanrisever@PhDmccombs.utexas.edu, Douglas Morrice

We consider a multi-period planning problem in a make-to-order production environment in which multiple product types are produced on multiple flexible production lines. Given the demand distribution, product-to-line assignments are made in the first period. In subsequent periods, capacity allocations are dynamically made, to minimize the operating cost, as the demand is realized. We provide optimal operating policies for real sized problems.

■ MC12

C-Room 615

Game Theory and Applications

Cluster: Scheduling
Invited Session

Chair: Marc Posner, Professor, Ohio State University, Integrated Systems Engineering, Columbus, OH, 43210, United States, posner.1@osu.edu

1 - Randomized Supermodular/Log-supermodular Games and Their Comparative Statics
Jian Yang, Associate Professor, New Jersey Institute of Technology, University Heights, Newark, NJ, 07102, United States, yang@adm.njit.edu, Xiangtong Qi

We study a game with random player types which is in turn generated from an original game involving strategic complementarities. Besides examining the existence and shape of the game's pure equilibrium strategy curves, we determine how each player's strategy curve should change when the game's joint player type distribution varies. We apply our theoretical results to a linear pricing game and obtain many useful insights.

2 - House Allocation with Fractional Endowments
Stergios Athanassoglou, PhD Student, Columbia University, New York, NY, United States, sa2164@columbia.edu, Jay Sethuraman

We examine a generalized version of the house allocation problem in economics, allowing for arbitrary fractional endowments of houses to agents. In this context, we provide an efficient network flow based algorithm that computes an allocation satifying ordinal efficiency, individual rationality and no justified envy. We further discuss impossibility results related to strategyproofness and the core of the associated cooperative game.

3 - Capacity Allocation and Scheduling in Supply Chains
Zhixin Liu, Assistant Professor, University of Michigan-Dearborn, United States, liu.573@osu.edu, Nicholas G. Hall

Consider a multiple product supply chain where a manufacturer allocates capacity to distributors in response to their orders. The distributors may share their allocated capacity, using a cooperative game, and resubmit orders. We estimate the benefit of considering scheduling costs in capacity allocation decisions, the value of capacity sharing by the distributors, and the value of coordination between the manufacturer and the distributors. We provide exact estimates of the value of coordination.

4 - A Cooperative Gaming Model for Vehicle Sharing in Perishable Product Deliveries
Xiaoqiang Cai, Professor, Chinese University of HK, Dept. of SE&EM, Shatin, NT, Hong Kong - ROC, xqcai@se.cuhk.edu.hk, Jun Li

A group of distributors, each requiring to deliver a perishable product from location A to location B, can cooperate in vehicle utilization subject to vehicle capacity and fair cost sharing. The total cost of a distributor is the expenses of using a vehicle and the loss of the product during transportation, which increases exponentially as time grows. We develop a cooperative game model for the problem and derive the characteristics of the solutions.

■ MC13

C-Room 616

Advances in Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu

1 - Computational Advances for Generating Hypergraphic Cutting Planes
Siddhartha Maheshwary, Georgia Institute of Technology, Industrial & Systems Engineering, Center for OR in Medicine, Atlanta, GA, 30332-0205, United States, sid@isye.gatech.edu, Eva K. Lee

New cutting planes are derived from conflict hypergraphs arising out of 0-1 integer programs (every vertex of the conflict hypergraph corresponds to a 0-1 variable, and every edge corresponds to a cover in the constraint matrix). Hypergraphic forms of structures such as odd holes, cliques etc. are identified. Separation heuristics are developed. Applications to MIP instances from brachytherapy cancer treatment are presented.

2 - Generating Multiple Solutions for Mixed Integer Programming Problems
Emilie Danna, ILOG, Inc., 889 Alder Avenue, Suite 200, Incline Village, NV, 89451, United States, edanna@ilog.com, Zonghao Gu, Roland Wunderling, Mary Fenelon

Decision makers like to use subjective criteria in conjunction with optimization software. Applications of this type that use MIP models would benefit from having several different good-quality solutions available, instead of a single optimal solution. We present a modification of the branch-and-bound algorithm available in CPLEX that generates multiple solutions significantly faster than previously known algorithms, while providing an acceptable level of diversity in the solutions produced.

3 - Faster MIP Solutions via Prediction of the Optimum
John Chinneck, Professor, Carleton University, Systems and Computer Engineering, 1125 Colonel By Drive, Ottawa, ON, K1S5B6, Canada, chinneck@sce.carleton.ca, Daniel Wojtaszek

MIP solution effort can be reduced by changing the node selection rules. We predict the depth of the leaf during a depth-first dive and use this information to estimate the optimum objective function value. This aspiration level then triggers backtracking out of dives that are not likely to reach optimality. Empirical results are presented.

■ MC14

C-Room 617

Semidefinite Programming and Its Applications

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Anthony Man-Cho So, Stanford University, 51 Dudley Ln, Apt 404, Stanford, CA, 94305, United States, manchoso@cs.stanford.edu

1 - A Unified Theorem on SDP Rank Reduction
Anthony Man-Cho So, Stanford University, 51 Dudley Ln, Apt 404, Stanford, CA, 94305, United States, manchoso@cs.stanford.edu

We consider the problem of finding a low-rank approximate solution to a system of linear equations in symmetric, positive semidefinite matrices. We show that a simple randomized polynomial-time procedure produces a low-rank solution that has provably good approximation qualities. Our result provides a unified treatment of and generalizes several well-known results in the literature.

2 - A Combinatorial, Primal-dual Approach to Semidefinite Programs
Satyen Kale, Princeton University, 35 Olden St, Princeton, NJ, 08540, United States, satyen@cs.princeton.edu, Sanjeev Arora

Semidefinite programs (SDP) have been used in many recent approximation algorithms. We develop a general primal-dual approach to solve SDPs using a generalization of the well-known multiplicative weights update rule to symmetric matrices. For a number of problems, such as Sparsest Cut and Balanced Separator in undirected and directed weighted graphs, and the Min UnCut problem, this yields combinatorial approximation algorithms that are significantly more efficient than interior point methods.

3- On the Iteration-complexity Results of the Augumented Lagrangian Method for Convex Programming
Guanghui Lan, School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, United States, glan@isye.gatech.edu, Renato Monteiro

In this talk, we discuss the iteration-complexity results for a classic optimization algorithm, the augumented Lagrangian method, for certain convex programs. In particular, we show some promising theoretic results of this method as applied for solving the conic programming and/or its reformulations.

■ MC15

C-Room 618

Algorithms and Computing for Stochastic Integer Programming

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Yongpei Guan, School of Industrial Engineering, University of Oklahoma, 202 West Boyd Street, Norman, OK, United States, yguan@ou.edu

1 - Two-stage Stochastic Hierarchical Multiple Risk Problems
Cole Smith, Associate Professor, University of Florida, The University of Florida, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, j.cole.smith@gmail.com, Hanif Sherali

We consider a class of two-stage stochastic risk management problems with binary first-stage variables. Second-stage variables for each scenario include continuous recourse decisions, and a hierarchy of binary variables that represent whether or not certain risk levels have been incurred. The objective minimizes the cost of the first-stage decisions, plus the expected risk penalties. We adopt an RLT-based procedure to cast the problem into a form that is amenable to Benders decomposition.

2 - Using Computational Grids for Solving Stochastic Programs
Jeff Linderoth, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706-1572, United States, jtl3@lehigh.edu, Udom Janjarassuk, Jierui Shen

The theme of this talk is how to (easily) exploit the massive computing power offered by collections of loosely-federated, nondedicated computational units for solving stochastic programs. Experience with solving two-stage and multi-stage linear recourse problems will be presented.

3 - A Preliminary Study of Binary Quadratic Optimization Under Uncertainty
Nan Kong, Purdue University, 206 S. Intramural Drive, West Lafayette, IN, 47907, United States, kong@eng.usf.edu, Oleg Prokopyev

Many combinatorial optimization programs can be formulated as unconstrained quadratic 0-1 programs (Q01), such as the minimum cut problem. Due to this motivation, many corresponding solution methods are developed. We present several constrained stochastic integer programming (SIP) models to study these

problems under uncertainty. We compare deterministic Q01 and SIP algorithms in this context. We also attempt to generalize the modeling framework to stochastic pseudo-Boolean optimization.

■ MC16

C-Room 619

Distributed Optimization and Learning

Cluster: Optimization (Invited)
Invited Session

Chair: Alfredo Garcia, Associate Professor, University of Virginia, 151 Engineer's Way, Charlottesville, VA, 22904, United States, agarcia@virginia.edu

1 - Rational Swarm Routing for Military Networks
Chenyang Li, PhD Candidate, University of Virginia, Dept. of Systems & Information Engineering, 151 Engineer's Way, Charlottesville, VA, 22903, United States, cl2ha@Virginia.EDU, Fernan Pedraza, Alfredo Garcia

Military networks require quick-response dynamic routing schemes for adequate performance. Unlike most MANET protocols that barely respond to link quality change after a path is established, a novel Rational Swarm Routing algorithm that can deal with highly dynamic topology and link quality changes in military networks is presented. Performances comparison with the existing Ant Colony algorithm obtained from a preliminary MATLAB simulation test bed are very encouraging.

2 - Distributed Optimization of Markov Reward Processes
Enrique Campos-Nañez, Assistant Professor, The George Washington University, 1776 G Street NW, Suite 161, Washington, DC, 20052, United States, ecamposn@gwu.edu

We present a gradient-based policy search technique that exploits the fact that in many applications the state space and control actions are naturally distributed. We introduce a technique in which a set of distributed agents compute an estimate of the partial derivative of a system-wide objective with respect to the parameters under their control. We illustrate the algorithms with an application to energy-efficient coverage in energy harvesting sensors networks, e.g. heliomotes.

3 - Rational Swarms for Distributed On-line Bayesian Search
Alfredo Garcia, Associate Professor, University of Virginia, 151 Engineer's Way, Charlottesville, VA, 22904, United States, agarcia@virginia.edu, Fernan Pedraza, Chenyang Li

We present a novel scheme for distributed search in mobile sensors networks. With non-negligible probabilities for false positives and false negatives, mobile sensors leave two data trails across potential target locations that have been explored. By endowing mobile sensors with a simple trail data processing rule, we show that a form of rational swarm intelligence emerges as sensors successfully coordinate indirectly (i.e. they locate all targets) through active manipulation of the trails.

■ MC17

C-Room 620

New Frontiers in Research on Business Value of Information Technology

Sponsor: Information Systems Society
Sponsored Session

Chair: Sunil Mithas, Assistant Professor, University of Maryland, VMH 4324 RH Smith School of Bus, U. of Maryland, College Park, MD, 20742, United States, smithas@rhsmith.umd.edu

1 - Information Technologies and Supply Chain Process Initiatives: Complementary vs. Independent effect
Pankaj Setia, Michigan State University, N 205 Acc and IS Dept, Eli Broad College, E Lansing, MI, United States, setia@bus.msu.edu, Cornelia Droge, Shawnee Vickery, Vallabhajosyula Sambamurthy

Recent research on IT value has focused on: i. mediation, through specific capabilities; and, ii. complementarities or synergies between IT and other practices. Building upon this research, we examine agility as a mediator between the use of IT and firm performance and empirically test complementarities between the specific IT and supply chain initiatives. Results have implications for how manufacturing firms can position their IT investments to enhance their agility and overall performance.

2 - Conversion and Churn in B2C, Ecommerce: An Analysis of Observed Behavior
Mark Cotteleer, Assistant Professor, Marquette University, P.O. Box 1881, Milwaukee, WI, 53132, United States, mark.cotteleer@marquette.edu

Given a dependence on subscription and advertising revenue, B2C providers must understand factors associated with recruiting and retaining subscribers. This challenge is intensified by high costs of customer acquisition. We draw on observed customer behavior from a major content site to explain factors related to conversion and retention of subscribers, and present analyses of factors that contribute to customer propensity to convert from Trial to Subscription status.

3 - Information Technology, Alliances and Firm Performance
Ali Reza Tafti, PhD Student, University of Michigan, Ross School of Business, E0401 Elec Educ Resources Bldg, Ann Arbor, MI, 48502, United States, atafti@umich.edu, Sunil Mithas, M. S. Krishnan

We study the moderating influence of IT investment and flexible IT infrastructure in the effect of alliance activity on firm performance, distinguishing between collaborative and transactional alliances. We draw from a cross section of over 120 firms that span multiple industries, and that have collectively engaged in more than 8100 alliances over a period of 10 years. Our results indicate that IT enables firms to derive greater value from collaborative alliance activity.

4 - Productivity Effects of Information Diffusion in Email Networks
Sinan Aral, Assistant Professor, NYU / MIT, 44 West 4th Street Room 8-81, New York, NY, 10012, United States, sinana@mit.edu, Erik Brynyjolfsson, Marshall Van Alstyne

We examine the diffusion of different types of information through email networks and the effects of information diffusion on productivity. We ask: What predicts the likelihood of becoming aware of strategic information sooner? Do different types of information diffuse differently? Does better access to information predict productivity? We find that different types of information exhibit different diffusion patterns and that access to information strongly predicts productivity.

■ MC18

C-Room 201

Integer Programming - Applications and Computation

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Karen Aardal, CWI, Kruislaan 413, Amsterdam, 1098 SJ, Netherlands, Karen.Aardal@cwi.nl

1 - Use of Energy Storages to Balance Regenerative Energy Supply and Consumers' Demand
Debora Mahlke, Technical University of Darmstadt, Schlossgartenstr. 7, Darmstadt, 64289, Germany, mahlke@mathematik.tu-darmstadt.de, Alexa Epe, Andrea Zelmer, Alexander Martin, Hermann-Josef Wagner

We deal with the integration of offshore wind parks into power supply networks. As regenerative energy supply and consumers demand strongly fluctuate, energy storages and power plants are used to compensate the imbalance. We present a mixed-integer nonlinear model where nonlinear efficiencies, start-up costs, and switching processes are considered. A piecewise linear approximation of the nonlinearities yields a mixed-integer linear program. For its solution a Branch&Cut algorithm is presented.

2 - Design and Dimensioning of Coupled Energy Carrier Networks
Andrea Zelmer, Technical University of Darmstadt, Schlossgartenstr. 7, Darmstadt, 64289, Germany, zelmer@mathematik.tu-darmstadt.de, Debora Mahlke, Daniel Waniek, Edmund Handschin, Alexander Martin

We consider a coupled network design problem where a gas, heat, and electricity network are coupled by combined heat and power plants. The aim is to determine the topological design and the dimensions of the pipes and cables cost-efficiently in order to meet consumers' demand. Mathematically, this problem results in a hardly solvable mixed-integer nonlinear program. We approximate the nonlinearities by piecewise linear functions and analyze the underlying structure of the mixed-integer problem.

3 - Directed Cuts for the 2-Root-connected Prize-collecting Steiner Network Problem
Maria Kandyba, Dortmund University, Otto-Hahnstr. 14, Dortmund, 44227, Germany, maria.kandyba@cs.uni-dortmund.de, Markus Chimani, Petra Mutzel

We consider the real-world problem of extending a given network in order to connect new customers. This can be formulated as a 2-root-connected prize-collecting Steiner network problem where certain customer nodes require two node-disjoint paths to the root. We present an ILP approach based on directed cuts, which is novel for problems requiring node-disjointness. We show that this formulation is theoretically and practically stronger than the traditional undirected cut approach.

4 - Generating Safe Gomory Mixed Integer Cuts
Ricardo Fukasawa, GeorgiaTech, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, rfukasaw@isye.gatech.edu, William Cook, Marcos Goycoolea

The validity of Gomory Mixed Integer Cuts relies on the correctness of arithmetic calculations, which is not guaranteed in floating point arithmetic used by modern computers. In practice, numerical tolerances and low rank cuts are used to try to overcome this problem. These measures, however, do not guarantee that the resulting cuts will be valid. In this work we propose solutions to always generate valid cuts, and analyze the trade-offs in working harder to generate them.

■ MC19

C-Room 203

Joint Session ICS/ISS: Interdisciplinary and Analytical Approaches to Email Management

Sponsor: INFORMS Computing Society, Information Systems Society
Sponsored Session

Chair: Ashish Gupta, Assisstant Professor, Minnesota State University Moorhead, School of Business, 1104 7th Ave South, Moorhead, MN, 56563, United States, gupta@mnstate.edu

Co-Chair: Ramesh Sharda, Regents Professor of Managemen Science and Information Systems, Conoco Chair of Management of Technology, Oklahoma State University, Spears School of Business, Stillwater, OK, 74078, United States, ramesh.sharda@okstate.edu

1 - Social Networks and Information Flow
Bernardo Huberman, Senior Fellow, HP Labs, 1501 Page Mill Rd, Palo Alto, CA, 94304, United States, bernardo.huberman@hp.com

Given email's ubiquity, it can reveal the hidden patterns of collaboration and leadership as well as the dynamics of information exchange within large social networks. This talk will describe several studies that have revealed the structure of informal communities within an enterprise, and surprising regularities among the millions of messages exchanged within an online social network. Finally, I will show how recommendation cascades within such networks affect the viral propagation of news.

2 - User Interface Support for Group Productivity
Mary Czerwinski, Research Area Manager of the Human-Centered Computing (HCC) groups, Manager of the Visualization and Interaction (VIBE) Research Group, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, marycz@microsoft.com

Current and future technologies, including various wearables and sensing devices, ensure that robust communications and information transmissions can occur almost anywhere, any time, within a workgroup. Our ability to log, collect, and visualize event data has become more sophisticated, allowing us to analyze trends and identify patterns across many areas of individual andgroup behaviors. In this paper, I discuss our research approach to these trends.

3 - Distilling Digital Traces: Images of Behavior in Online Communities
Marc Smith, Senior Research Sociologist, Microsoft Research, Marc.smith@microsoft.com

The behavior of authors and consumers of social media leave traces behind that are recorded in digital records and can, with processing, be visualized in a variety of ways. These images support the study of social roles present in social media spaces, which is consequential for a more ecological conception of social media. The talk will feature examples of several visualization techniques that highlight varying roles and activities in newsgroups, email lists, web boards, and discussions.

4 - Understanding the Performance of Email Processing Strategies in a Network of Knowledge Workers
Ashish Gupta, Assisstant Professor, Minnesota State University Moorhead, School of Business, 1104 7th Ave South, Moorhead, MN, 56563, United States, gupta@mnstate.edu, Ramesh Sharda

While emails have improved the communication effectiveness of knowledge workers, they have also started to negatively impact their productivity due to increased interruptions, overwhelming volumes and inefficient use. This study uses a computational modeling approach to understand how various combinations of timing-based and frequency-based email processing strategies adopted within different types of knowledge networks can influence the performance of entire network of knowledge workers.

■ MC20

C-Room 204

Advances in Decision Analysis - The Book

Sponsor: Decision Analysis
Sponsored Session

Chair: Detlof von Winterfeldt, University of Southern California, Ronald Tutor Hall 316A, University Park, Los Angeles, CA, 90089, winterfe@sppd.usc.edu

Co-Chair: Ralph F. Miles, JPL (Retired), 3608 Canon Blvd., Altadena, CA, 91001, United States, rmiles2@earthlink.com

1 - Advances in Decision Analysis – The Book
Detlof von Winterfeldt, Professor, USC, Ronald Tutor Hall 316A, University Park, Los Angeles, CA, 92651, United States, Detlof@aol.com, Ralph F. Miles

Thirty-five prominent decision analysts contributed chapters to this book, which was published by Cambridge University Press in August of 2007. The editors will provide a brief overview of the book and how it was started and several chapter authors will comment on their chapters and the future of decision analysis.

■ MC21

C-Room 205

DA Arcade I

Sponsor: Decision Analysis
Sponsored Session

Chair: Ivy Li, lingfanl@uci.edu

1 - What is the Cost of Speaking Out? Evidence from eBay
Ivy Li, University of California, Irvine, lingfanl@uci.edu

This paper tries to identify why buyers fail to leave (negative) feedback in eBay. One potential reason is that it takes more time to leave negative feedback, and another reason is fear of retaliation. Empirical results show that the fear of retaliation is an important motivation to keep silent. Thus, a potential rebate mechanism that the market maker can use to induce buyers to leave feedback is to provide an option for sellers to leave automatic feedback contingent on receiving payment.

2 - Cost-effectiveness of Mitigation Against Terrorist Release of a Toxic Industrial Chemical
Anthony Barrett, Graduate Research Assistant, Doctoral Student, Carnegie Mellon University (Department of Engineering and Public Policy), 5000 Forbes Ave, Pittsburgh, PA, 15221, United States, tonybarrett@cmu.edu

Fatalities from terrorist release of a toxic industrial chemical under various conditions in an urban location, as well as reductions in fatalities from selected mitigation measures, are estimated using atmospheric dispersion and human effects models. Mitigation costs are estimated and multi-criteria decision analysis of defense strategies is performed to find Pareto-optimal strategies and associated tradeoffs between mitigation costs and potential fatalities.

3 - On Simpler Procedures for Multi-attribute Choice
Paula Sarabando, Escola Superior de Tecnologia de Viseu, Dep. Matemática Campus Politécnico, Viseu, 3504-510, Portugal, psarabando@mat.estv.ipv.pt, Luis Dias

Building multiattribute value functions requires translating the preferences of a Decision Maker into precise numbers, which is often problematical even in the additive case. Hence, procedures such as SMART and Even Swaps have been proposed. We discuss elicitation of information which, albeit not precise, may facilitate the cognitive burden on the analysis. The incomplete information can then be used to provide guidance on the best choice using tools like simulation or mathematical programming.

4 - Decision Tree Voyeurism — An Unscientific Survey of Real-World DA Models
Chris Dalton, Syncopation Software, 1623 Main Street, Concord, MA, 01742, United States, cdalton@syncopation.com, Lori Carswell

Syncopation's role as vendor of the DPL decision analysis software package puts us in a position to see a large number of real-world decision analysis models — the good, the bad and the ugly. The models working decision analysts produce as they ply their trade are often quite different from the nice ones they select for presentation to their peers. We've surveyed a sample of real models and will make non-judgmental observations about their technical and methodological characteristics.

■ MC22

C-Room 206

An Interactive Panel/Audience Discussion: Research and Publications

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Gal Raz, Associate Professor, Darden Graduate School of Business, University of Virginia, Charlottesville, VA, 22906-6550, United States, razg@darden.virginia.edu

1 - An Interactive Panel/Audience Discussion: Research and Publications

Moderator: Candace Yano, Professor, University of California, Industrial Engineering and OR, Haas School of Business, Berkeley, CA, 94720, United States, yano@ieor.berkeley.edu, Panelist: David Simchi-Levi, Wallace Hopp, Martin Lariviere

In this interactive panel discussion, we will discuss the role of publishing in academia. The panel comprise of the editors of the leading academic journals in the OR/OM field. The Panel members will discuss the importance of academic publishing in different environments such as business schools and engineering departments. A large part of the panel will be dedicated to interactive discussion with the Audience. We plan to: 1) provide an overview of the publication outlets for Engineering and Business School faculty; 2) describe how the publishing process works; 3) present strategies for picking topics for publication; and 4) discuss the research/practice interface.

■ MC23

C-Room 208

Human Behavior on the World Wide Web

Sponsor: Behavioral Process Management (BPM)
Sponsored Session

Chair: Kay-Yut Chen, Principal Scientist, Hewlett-Packard Laboratories, MS 1U-2, HP Labs, 1501 Page Mill Road, Palo Alto, Ca, 94304, United States, kay-yut.chen@hp.com

1 - Novelty and Collective Attention

Fang Wu, HP Labs, 1501 Page Mill Rd, Palo Alto, CA, 94304, United States, fang.wu@hp.com, Bernardo Huberman

To understand how attention to novel items propagates and eventually fades among large populations, we have analyzed the dynamics of collective attention among one million users of an interactive website – digg.com - devoted to thousands of novel news stories. The observations can be described by a dynamical model characterized by a single novelty factor which decays with a stretched-exponential law, suggesting the existence of a natural time scale over which attention fades.

2 - Experimental Study of Market Reputation Mechanisms

Tad Hogg, HP Labs, MS1139, 1501 Page Mill Road, Palo Alto, CA, 94304, United States, tad.hogg@hp.com, Kay-Yut Chen, Cecilia Zentano

We test reputation mechanisms revealing differing amounts of transaction history in a market where people need not fulfill contracts. People favored those with high reputation, and efficiency increased with the amount revealed. Since transaction verification is costly, we also tested a method where people rate transaction quality, analogous to eBay's rating system. Most ratings accurately reflect actual transaction outcome, leading to efficiencies similar to revealing full transaction history.

3 - Deriving Marketing Intelligence from Online Discussion

Natalie Glance, Google, 4720 Forbes Ave., Lower Level, Pittsburgh, PA, 15213, United States, nglance@gmail.com

Weblogs and message boards provide online forums for discussion that record the voice of the public. Woven into this mass of discussion is a wide range of opinion about consumer products, movies and other topics. This presents an opportunity for companies to understand and respond to the consumer by analyzing this unsolicited feedback. Given the volume, format and content of the data, the appropriate approach to understand this data is to use large-scale web and text data mining technologies.

4 - The Role of Trust in Intercompany Supply Chain Projects

Ozalp Ozer, Stanford University, Stanford, CA, 94305, United States, oozer@stanford.edu, Andreas Brinkhoff, Ulrich Thonemann

In recent years the importance of inter-company projects such as VMI or CPFR has strongly increased. There is a large body of literature on influence factors for innercompany projects such as Top-Management Commitment and on supply chain relationships. We combine these two research directions and analyze how the initial relationship between the project partners influences the project's outcome and present empirical evidence of over 100 sc-projects.

■ MC24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - AIMMS by Paragon Decision Technology - AIMMS, How to Enhance and Improve OR Usability

Gertjan de Lange, VP Sales & Marketing, Paragon Decision Technology Inc, 5400 Carillon Point, Kirkland, WA, United States, g.de.lange@aimms.com

AIMMS 3.8 allows you to take another step towards using and deploying OR. The already available sophisticated features are extended with Benders Decomposition techniques, NLP Multi-start and Pre-solve options, and extended GUI capabilities. We introduce the AIMMS Viewer, a freely distributable version of AIMMS. All–again–to enhance and improve the user experience.

2 - ILOG, Inc. - Introducing ILOG CPLEX 11

Irvin Lustig, 889 Alder Ave. Ste. 200, Incline Village, NV, 89451, ilustig@ilog.com

Join us for an overview of the new ILOG CPLEX, which delivers the most significant performance gains to date and leverages the full power of multi-core machines. Learn how CPLEX's algorithmic innovations and parallel search can solve your most challenging MIP problems. Learn how to make the most of the new features. Come and see why CPLEX is better than ever!

■ MC25

C-Room 210

Services Workforce Management II

Sponsor: Service Science
Sponsored Session

Chair: Dagan Gilat, Senior Manager, Business Transformation and Optimization, IBM, IBM Haifa Research Lab, Haifa University, Mount Carmel, Haifa, 31905, Israel, dagang@il.ibm.com

1 - Applying Constraint Programming to Workforce Management of Highly-skilled Employees

Yossi Richter, IBM Research, Haifa University Campus, Haifa, Israel, RICHTER@il.ibm.com, Yehuda Naveh, Donna Gresh, Daniel Connors

Today many companies face the challenge of matching highly-skilled professionals to high-end jobs, while maximizing the number of accomplished jobs. Unlike traditional Workforce Management problems such as shift-scheduling, employees are considered distinguishable and non-interchangeable. We describe a mature tool based on Constraint Programming, and elaborate on its novel infrastructure and unique features. We provide strong experimental results to support its usability.

2 - From Work Practices to Complex Service Systems in Strategic Outsourcing

John Bailey, Research Staff Member, IBM, 650 Harry Rd., San Jose, CA, 95120, United States, baileyj@us.ibm.com, Cheryl Kieliszewski, Jeanette Blomberg

Strategic Outsourcing (SO), where one company runs the ICT or business functions for another, requires many stages, people, technologies, and capabilities. We conducted an ethnographic study of the work of technical solution strategy definition in SO deals. Our results are described in terms of a complex service system, leveraging insights from our analysis in collaboration, creativity, and relationships. We discuss the application of these insights to the enablement of SO service systems.

3 - Competing for Service

Navid Sabbaghi, MIT, 77 Massachusetts Avenue, Room 32D-712, Cambridge, MA, 02139, United States, sabbaghi@mit.edu, Yossi Sheffi, John Tsitsiklis

We model multiple suppliers competing for a retailer's service capacity (e.g., shelf space) and characterize the equilibria of the associated game. We analyze the effects from using different supply contracts on the service levels and profits for the suppliers, retailer, and channel.

■ MC26

C-Room 211

Data Mining Applications in Service Industry

Sponsor: Data Mining (Sponsored)
Sponsored Session

Chair: Rong Duan, AT&T, 180 Park Ave, Florham Park, NJ, United States, rongduan@att.com

1 - Data Quality Assessment by Robust Clustering

Rong Duan, AT&T, 180 Park Ave, Florham Park, NJ, United States, rongduan@att.com, Tom Au, Wei Jiang

Data mining results may be unreliable to represent useful knowledge if data quality is poor. This paper proposed a generic framework for data quality assessment in nonhomogeneous environments based on robust clustering analysis. In particular, trimmed clustering methods are proposed to robustly characterize groups of similar observations and trimmed observations are then evaluated to assess outlying-ness based on their distance with the cluster profiles.

2 - Scenario Maps: Tools for Discovery and Design of Business Scenarios

Yukio Ohsawa, Associate Professor, The University of Tokyo, ohsawa@q.t.u-tokyo.ac.jp

Awareness of possible future scenarios is essential for business decisions, where creating new values and reducing risks are desired. Scenario maps visualized based on business data are presented, as tools for creating values and managing risks on rare/novel events. The methods have been utilized for managing credit risks and for designing products/markets in real companies since our team started the project chance discovery in 2000.

3 - Using Behavioural Scores and Economic Variables to Build Credit Risk Models of Consumer Loan Portfolios

Lyn Thomas, Professor, University of Southampton, School of Management, Faculty of Law, Arts and Social Sciences, United Kingdom, L.Thomas@soton.ac.uk

The changes in banking regulations in 2007 mean credit scoring models need to be extended to help build credit risk models of portfolios of consumer loans. In particular there is a need to include the impact of macro economic conditions on the default risks of borrowers, which would allow stress testing of the models. This paper outlines one approach to this problem based on survival analysis ideas. It is applied to the data from four years performance of over 50,000 loans.

4 - Computational Issues in the Analysis of Call Center Arrivals

Refik Soyer, George Washington University, Decision Sciences Dept. Funger Hall 415, School of Business, Washington, DC, 20052, United States, soyer@gwu.edu, Murat Tarimcilar, Fabrizio Ruggeri

In this talk we consider analysis of call center arrivals that are mostly linked to individual advertisements. We discuss the problem of prediction for aggregate arrivals based on advertisement specific data and illustrate how these predictions can be developed in a Bayesian analysis. We also address the issue of how to deal with call arrival data that are not 100% linked to ads. We consider this as a missing data problem and develop a data augmentation algorithm for the Bayesian analysis.

■ MC27

C-Room 212

Data Mining Models and Applications

Cluster: Data Mining (Invited)
Invited Session

Chair: Jacob Zahavi, Tel Aviv University, jacobz@tauex.tau.ac.il

1 - Informational Decision Trees

Irad Ben-Gal, Dept.. of Industrial Engineering, Tel-Aviv University, Tel-Aviv, 69978, Israel, bengal@eng.tau.ac.il, Evgeni Kagan, Niv Shkolni

We will discuss the Informational Decision Trees that locally optimizes the gain of information over a given set of selected features and can be used for Classification. We use a revised version of the LRTA*, a known artificial intelligence algorithm that was proposed for learning. Our model generalizes a wide range of classification algorithms. It enables to directly address the tradeoff between complexity and optimality.

2 - Incremental Data Mining

Ziv Pollack, Faculty of Management, Tel Aviv University, Tel Aviv, 69978, Israel, ziv-pollak@hotmail.com, Jacob Zahavi, Israel Spiegler

Incremental data mining is the process of updating data mining models in light of new observations. We offer cube-based approach for storing data that allows one to update knowledge without increasing the storage requirements to accommodate the new data. We implemented this approach on five different data mining algorithms: linear regression, logistic regression, classification, clustering, and rule induction, obtaining results which are not much different than those obtained with the original dataset.

3 - Forecasting Demand in the Presence of Promotions, Which Tool to Use When

Ozden Gur Ali, Koc University, Sariyer, Istanbul, Turkey, oali@ku.edu.tr, Aysegul Tuncelli, Serpil Sayin

Forecasting demand in the presence of promotions is a critical but difficult task. Our objective is to evaluate the performance of different data mining strategies, including the type of tool (regression, regression trees, and SVR), the data content (length of history, and competitor information) and the model content (SKU by SKU, and all SKUs collectively) for different types of SKUs. We generate the data using a simulation based on a consumer choice model from the marketing literature, with calibrated parameters; and conclude useful strategies for different situations.

4 - And the Winner is...StepWise Regression

Ronen Meiri, Faculty of Management, Tel Aviv University, Tel Aviv, 69978, Israel, ronen-meiri@gmail.com, Jacob Zahavi

We explore three classes of methods for solving the feature selection problem in linear regression – statistical methods, stochastic search methods and feature extraction methods. Our objective is to find the model that yields the best fit, yet exhibits no overfitting. We have applied these models on three realistic marketing datasets. The results indicate that the leading approach for selecting variables is still the commonly used and widely known stepwise regression method.

■ MC28

C-Room 213

Integrating CP and OR

Sponsor: INFORMS Computing Society / Constraint Programming and Optimization
Sponsored Session

Chair: Tallys Yunes, University of Miami, Department of Management Science, Coral Gables, FL, United States, tallys@miami.edu

1 - Best-first and/or Search vs Dept.h-first Branch-and-bound for 0/1 Integer Programming

Rina Dechter, University of California, Irvine, dechter@ics.uci.edu, Radu Marinescu

Graphical models, including constraint networks, propositional CNF formulas, and Bayesian networks are knowledge representation schemes that capture independence in the knowledge base and support efficient algorithms for a variety of reasoning tasks, including scheduling, planning, diagnosis and situation assessment. The paper shows that general AND/OR search schemes, recently introduced for graphical models, can be applied to integer programming yielding substantial computational saving.

2 - Formal Languages for Integer Programming Modeling

Louis-Martin Rousseau, Associate Professor, École Polytechnique de Montréal, CP 6079 Succ Centre Ville, Montréal, QC, H3C 3A7, Canada, louis-martin.rousseau@polymtl.ca, Marie-Claude Coté, Claude-Guy Quimper, Bernard Gendron

This paper approaches the problem of modeling optimisation problems containing constraints on sequences of decision variables. We suggest an approach inspired by CP global constraints that use deterministic finite automata (DFA) and grammars to formulate constraints on sequences of variables in a MIP model. Experimental results on both approaches show that they can not only facilitate the modeling, but also give models easier to solve by LP solvers compared to classical MIP formulations.

3 - Logical Bender's Cuts Guided Local Search and a Greedy Heuristic for the Traveling Umpire Problem

Hakan Yildiz, PhD Candidate, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, hakanyil@andrew.cmu.edu, Michael Trick

This paper introduces the use of Logic-Based Bender's Cuts to guide a Large Neighborhood Search to solve the Traveling Umpire Problem, a sports scheduling problem inspired by the real-life needs of the officials of a sports league. At each time slot, a Greedy Matching heuristic is used to construct a schedule. When an infeasibility is recognized Bender's cuts are generated, which guides a Large Neighborhood Search to ensure feasibility and to improve the solution.

4 - The Circuit Polytope

John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu, Latife Genc Kaya

The circuit constraint is useful for the formulation of sequencing problems in constraint programming models. We analyze the circuit polytope as an alternative to the traveling salesman polytope as a means of obtaining a linear relaxation, which can be used in conjunction with filtering algorithms. Proper choice of the relaxation allows one to exploit structure in the objective function.

■ MC29

C-Room 214

Joint Session OS/ICS: Modeling and Computation in Cone Programming

Cluster: Optimization /Computational Optimization and Software, INFORMS Computing Society
Invited Session

Chair: Samuel Burer, University of Iowa, S346 Pappajohn Business Building, Henry B. Tippie College of Business, Iowa City, IA, 52242-1994, United States, samuel-burer@uiowa.edu

1 - P-order Cone Programming in Portfolio Optimization
Paul Krokhmal, Assistant Professor, University of Iowa, 2403 Seamans Center, Iowa City, IA, 52242, United States, krokhmal@engineering.uiowa.edu, Policarpio Soberanis

We discuss a class of risk-reward optimization models that reduce to convex programming problems with p-order cone constraints. As an illustration, a portfolio optimization case study is considered. We propose LP approximation schemes and decomposition algorithms that allow for implementing the formulated p-order cone programming problems with off-the-shelf solvers.

2 - Full Regularization Path for Sparse Principal Component Analysis
Alexandre d'Aspremont, Princeton University, E-Quad E424, Princeton, NJ, United States, aspremon@princeton.edu, Francis Bach, Laurent El Ghaoui

Given a sample covariance matrix, we examine the problem of maximizing the variance explained by a linear combination of the variables while constraining the number of nonzero coefficients in this combination. We formulate a greedy algorithm to compute a full set of good solutions in O (n3). We then derive sufficient conditions for global optimality, which can be tested in O(n3). We detail applications to subset selection and compressed sensing.

3 - On the Copositive Representation of Binary and Continuous Nonconvex Quadratic Programs
Samuel Burer, University of Iowa, S346 Pappajohn Business Building, Henry B. Tippie College of Business, Iowa City, IA, 52242-1994, United States, samuel-burer@uiowa.edu

We show that any nonconvex quadratic program having a mix of binary and continuous variables can be represented as a linear program over the dual of the cone of copositive matrices. This result can be viewed as an extension of earlier separate results, which have established the copositive representation of a small collection of NP-hard problems.

■ MC30

C-Room 2A

Panel Session: Reliability - Research Directions and Curriculum Needs

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yong Chen, University of Iowa, Iowa City, IA, United States, yongchen@engineering.uiowa.edu

1 - Reliability - Research Directions and Curriculum Needs
Moderator: Yong Chen, University of Iowa, Iowa City, IA, United States, yongchen@engineering.uiowa.edu, Panelist: Elsayed Elsayed, Marlin Thomas, Kailash Kapur, Way Kuo

The panelists will first present their own visions on promising directions and crucial needs in reliability research and education. A Q&A session and open discussion with the audience will be held following the presentations.

■ MC31

C-Room 2B

Control Charting with Complex Data Structures

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Dan Apley, Associate Professor, Northwestern University, Dept.. of Industrial Engineering, 2145 Sheridan Rd., Evanston, IL, 60208-3119, United States, apley@northwestern.edu

1 - Dimension Reduction of Multivariate Auto-correlated Process Data
Soren Bisgaard, University of Massachusetts - Amherst, 121 Presidents Drive, Amherst, MA, 01003, United States, bisgaard@som.umass.edu, Xuan Huang

The data used for statistical quality control increasingly are multivariate and sampled individually in time at a high sampling rate. Hence the data will typically be cross- and auto-correlated high-dimensional vector time series. Although the observed dimension may be high, the underlying variability can often be reduced to a few canonical variables. In this presentation, we will compare two methods for dimension reduction of multivariate data for process control and motivate a better method.

2 - A Cusum Control Chart for Detecting a Varying Shift in the Proportion of Failures
Jonghyun Ryu, Purdue University, 315 N. Grant st., West lafayette, IN, 47907, United States, ryuj@purdue.edu, Hong Wan, Sujin Kim

A new cumulative sum (CUSUM) chart is developed for unknown future shifts in the proportion of failures. The chart is based on counts between failures which can be modeled by a geometric distribution. A geometric based model is widely used for monitoring healthcare procedures. To detect a varying shift, we estimate the current failure rate and update the CUSUM statistic continuously. The simulation results show its potential to perform more effectively than other well-established methods.

3 - A Class of Markov Chain Models for Average Run Length Computation for Autocorrelated Processes
Xuan Huang, PhD Candidate, University of Massachusetts - Amherst, 345 Lincoln Ave., Apt 113, Amherst, MA, 01002, United States, xuan@som.umass.edu, Soren Bisgaard

The Average Run Length (ARL) is an important measure used to evaluate the performance of statistical control charts. Unfortunately, for multivariate autocorrelated processes, there does not exist a numerical way for ARL computation and literature was heavily based on simulations. In this presentation, a general class of Markov chain models is developed for ARL computations for multivariate autocorrelated processes represented by linear time series models.

4 - Linear Control Chart Filters: Performance Optimization and Robustness
Dan Apley, Associate Professor, Northwestern University, Dept.. of Industrial Engineering, 2145 Sheridan Rd., Evanston, IL, 60208-3119, United States, apley@northwestern.edu

Many control charts can be viewed as charting the output of a linear filter applied to a sequence of observations. We generalize this concept by considering a general linear filter as a control chart, with no restrictions on the number of filter parameters. We discuss how to tune the filter parameters with objectives such as: i) optimizing performance in detecting process shifts and ii) ensuring reasonable robustness to errors in process parameters that must be estimated in Phase I.

■ MC32

C-Room 302

Shipping, Maritime, and Supply Chain

Contributed Session

Chair: Matthew Petering, Assistant Professor, University of Wisconsin—Milwaukee, 7229 North Santa Monica Boulevard, Fox Point, WI, 53217, United States, mattpete@uwm.edu

1 - The Raw Material Unloading Problem of a Steelworks: A Solution Approach
Juneho Chang, Postech, San31, Hyoja-Dong, Namgu, Pohang, Korea, Republic of, junho@postech.ac.kr, Jeongin Koo, Jaejoon Shin, Byung-In Kim, Soo Y. Chang, Sangwon Jeong

We consider the scheduling problem of unloading raw material from ships at the seaport of a steelworks. The scheduling problem is very complicated due to several factors. In this talk, we present our solution approach for the problem. The solution approach has been implemented as a prototype system and tested with the real world cases at one of the largest steel works in the world located in South Korea. Our solution approach significantly outperformed the actual practice of the steelworks.

2 - Collaborative Container-vessel Scheduling
Min Shi, Cal Poly Pomona, 3801 West Temple Avenue, Pomona, CA, 91768, United States, jackmshi@gmail.com, Lei Lei

We propose an optimization-based simulation approach to investigate the cost saving achieved by ocean carriers' collaboration efforts, such as slot-sharing and total-sharing policies. A MIP model is used to derive the initial vessel schedules, which are later heuristically modified upon real time dynamics during the simulation. The results under various shipping conditions are reported.

3 - Optimization of a Navigation and Logistic Company's Routes by Minimization of the Operational Cost

Eduardo Silva, student, USP, Av. Prof. Almeida Prado, 128, S„o Paulo, SP, 05508-900, Brazil, eduardo.sa.silva@poli.usp.br, Rafael Madureira, Celso Hino, Hernani Brinat

This work studies the particularitities of the routes of a Navigation Company. The objective is to find chances of reduction of the operational costs, maintainning the service level, obeying the rules and restrictions imposed for the routes and ports and always attendding amount demand. The result searched in the study is to develop a procedure which program the schedule of a ship fleet which work in the market of container regular maritime transport in European and South American ports.

4 - A Tabu Search Heuristic for Tramp Ship Routing Problems

Kjetil Fagerholt, Norwegian University of Science and Technology, Trondheim, 7491, Norway, kjetil.fagerholt@iot.ntnu.no, Jarl E. Korsvik, Gilbert Laporte

We present a planning problem faced by many tramp shipping companies dealing with transport of bulk products. These shipping companies typically have a certain amount of contract cargoes that they are committed to carry, while trying to maximize the profit from optional spot cargoes. We propose an efficient tabu search heuristic to solve the underlying routing and scheduling problem, and results were the heuristic is tested on real-life instances of the problem will be reported.

5 - Real-time Container Storage Location Assignment at a Seaport Container Transshipment Terminal

Matthew Petering, Assistant Professor, University of Wisconsin—Milwaukee, 7229 North Santa Monica Boulevard, Fox Point, WI, 53217, United States, mattpete@uwm.edu

We present several new results on real-time container storage location assignment at a container terminal. Several alternatives are evaluated by a fully-dynamic simulation model that considers the detailed movement of every container passing through a terminal over a several week period. The model, based on the author's extended on-site experience at a major container terminal, directly connects the storage policy to the overall productivity (i.e. long-run gross crane rate) of the facility.

■ MC33

C-Room 303

Containerization Mini Cluster: Container Terminal Operations

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Rommert Dekker, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, ZH, 3000 DR, Netherlands, rdekker@few.eur.nl

1 - OR in Action for Rotterdam's Automated Container Terminals

Rommert Dekker, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, ZH, 3000 DR, Netherlands, rdekker@few.eur.nl

In this presentation we give an overview of the Operations Research work done for the world's first automated container terminals at ECT in the Port of Rotterdam. We tackle both AGV and ASC planning, scheduling and routing. Other topics covered are stacking, terminal transport planning and rail / barge interfaces. Next we show the evolution of the terminal concepts in time and compare them with another automated terminal, HHLA in Hamburg. Finally we sketch a number of open OR problems.

2 - Scheduling Ship Operations in Container Terminals

Kap Hwan Kim, kapkim@pusan.ac.kr, Dong Won Jang, Da Hun Jung

For the efficient operation of container terminals, it is essential to synchronize all the operations of quay cranes, transporters, and yard cranes. This study addresses scheduling of ship operations by considering both the quay side operation and the yard side operation. A mathematical formulation is provided and a solution method is suggested.

3 - Dispatching and Routing Automated Transporters in Port Container Terminals

Kap Hwan Kim, kapkim@pusan.ac.kr, Soo Min Jeon, Vu Duc Nguyen

This study is to provide a method for dispatching and routing automated transporters in container terminals considering container delivery requirements. The objectives of this problem are to satisfy delivery requirements and to minimize the travel time considering not only the moving time on guide paths but also the waiting time at intersections, merging positions, and transfer points.

■ MC34

C-Room 304

Distribution and Inventory Applications

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Leyla Ozsen, Purdue University, 315 Grant St, West Lafayette, IN, 47907, United States, lozsen@purdue.edu

1 - Production/Distribution Network Design with Inventory Decisions

Burcu Keskin, Assistant Professor, University of Alabama, Culverhouse Business School, Tuscaloosa, AL, United States, bkeskin@cba.ua.edu, Halit Uster

We consider a three-stage production/distribution network in which facility location and inventory decisions are integrated. We model the problem as a nonlinear mixed integer program, and develop efficient approaches for its solution. We also present computational results that illustrate the benefits of the integrated decision making.

2 - Minimax Flow Tree Problems

Hui Chen, The University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242-1000, United States, hui-chen@uiowa.edu, Barrett Thomas, Arie Tamir, Ann Campbell

Delivery companies want to design delivery networks that are both low cost and meet the service requirements of their customers. With this in mind, we will examine many different variants in assumptions and objective function for designing tree-structured delivery networks. We will examine their complexity and introduce new polynomial algorithms for efficiently solving certain variants.

3 - Service and Day-differentiated Load Planning for the LTL Industry

Mike Hewitt, Georgia Institue of Technology, 765 Ferst Dr, Atlanta, GA, 30332, United States, mhewitt@isye.gatech.edu, Martin Savelsbergh, Alan Erera

We consider extensions of the traditional load planning problem faced by LTL carriers, namely the generation of service-level and day-of-week differentiated load plans, which are necessary to remain competitive in the current market. We investigate integer programming based approaches augmented with local improvement heuristics.

4 - Two-echelon Location Heuristic (TELH) for LRP

Abdulrahman Alenezi, Purdue University, 3230 Mendel Dr., West Lafayette, IN, 47906, United States, aalenezi@purdue.edu, Leyla Ozsen

In this study, we present a general heuristic solution procedure for the Location Routing Problem (LRP). The LRP aims to determine the optimal depots locations, the assignment of customers to open depots, and the optimal sequence of visiting customers for each vehicle. The LRP is formulated as Two-echelon Location Problem (TELP) with route cost approximation. The performance of proposed heuristic is compared with other recent LRP heuristics.

■ MC35

C-Room 305

Methods and Models for Congestion Pricing I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yafeng Yin, Assistant Professor, University of Florida, 3 65 Weil Hall, Box 116580, Gainesville, FL, 32611, United States, yafeng@ce.ufl.edu

1 - Day-to-day Dynamic Congestion Pricing Strategies under Elastic Travel Demand

Fan Yang, Assistant Professor, City University of New York, 140th St and Convent Ave, New York, NY, 10031, United States, fyang@ccny.cuny.edu, Jiangang Lu

Day-to-day dynamic tolls were proposed to guide the day-to-day dynamic traffic flow moving towards system optimal under the fixed travel demand. In this talk, we investigate the social efficiency of day-to-day dynamic tolls under the elastic demand and a general driver's rational behavior adjustment process.

2 - Optimal Dynamic Pricing Strategies for High-occupancy/ Toll Lanes

Yingyan Lou, Graduate Research Assistant, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States, yingyan@ufl.edu, Jorge Laval, Yafeng Yin

A self-learning approach is proposed to determine optimal pricing strategies for high-occupancy/toll lane operations. The approach learns recursively motorists' willingness to pay and specifies tolls to maximize the freeway's throughput while ensuring a superior travel service on the toll lanes. The impacts of the lane-changing behaviors on the flows are explicitly modeled by a multi-lane hybrid traffic flow theory. Insights on when to convert high-occupancy lanes to toll lanes are provided.

3 - A Variational Inequality Model for Road Pricing with Environmental Constraints

Henry Liu, University of Minnesota, Department of Civil Engineering, Minneapolis, MN, United States, henryliu@umn.edu, Xiao-Zheng He

In this talk, we consider a road pricing problem with environmental capacity constraints, which has been proposed for a decade without appropriate model and solution methods due to the requirement of explicit functional information and high computational cost. We formulate this problem as a constrained Inverse Variational Inequality (IVI) that has been applied to link-based toll pricing problems recently. A revised proximal-point algorithm is adopted as the solution method.

4 - Congestion Pricing for Scheduled-based Transit Networks

Siriphong Lawphongpanich, University of Florida, Industrial & Systems Engineering, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, lawphong@ise.ufl.edu, Younes Hamdouch

We describe techniques for adjusting or setting fares on transit networks to encourage passengers to choose travel strategies that lead to the least system delay. Our techniques rely on scheduled-based transit assignment models that handle vehicle capacities explicitly and account for priorities in loading passengers. Traditional tolling schemes such as marginal cost pricing are not applicable because delay in transit networks is due to factors different from those in traffic networks.

■ MC36

C-Room 306

Urban Transportation Planning Models V: Transit

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Luca Quadrifoglio, Assistant Professor, Texas A&M University, CE/TTI Bldg., Room 301I, College Station, TX, 77843, United States, lquadrifoglio@civil.tamu.edu

1 - Barriers to Relocating Intercity Bus Stations in Chinese Mega-cities

Elenna Dugundji, Universiteit van Amsterdam, Faculty of Social & Behavioral Sciences, Nieuwe Prinsengracht 130, 1018 VZ, Amsterdam, Netherlands, E.R.Dugundji@uva.nl

Several mega-cities in China are faced with relocating their intercity bus stations due to problems caused by the mismatch between transport and land use systems. This paper takes Wuhan as an example to illustrate requirements for relocating the stations; to analyze the major barriers in the decision-making process for the relocation; and to propose likely information solutions to remove the barriers.

2 - Revisiting Dynamic Transit Assignment

Mark Hickman, Associate Professor, University of Arizona, P.O. Box 210072, Tucson, AZ, 85721-0072, United States, mhickman@engr.arizona.edu

Recent research on dynamic transit assignment has suggested models that could be quite different than existing static transit assignment methods. We investigate a dynamic, strategy-based model for transit assignment. This model describes both sequential passenger behavior at a stop as well as sequential behavior through the transit network. Characteristics of this model are discussed and are compared with existing assignment models.

3 - GIS-based Approach to Determine Feasible Locations for Urban Multimodal Interchanges

Grisselle Centeno, Associate Professor, University of South Florida, Industrial & Mgmt Systems Engineering, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States, gcenteno@eng.usf.edu

Multimodal interchanges allow users to transfer between various transportation networks. This work combines mathematical programming with sources of geographic information to select feasible sites for the location of such interchanges. The discrete nature of location problems and the decisions to be made lead to computationally intensive algorithms to solve the resulting mathematical programming problem.

4 - A Methodology to Select Between Fixed and DRT Services: Critical Demand Density

Luca Quadrifoglio, Assistant Professor, Texas A&M University, CE/TTI Bldg., Room 301I, College Station, TX, 77843, United States, lquadrifoglio@civil.tamu.edu

In the transit business, planners often struggle when having to decide what type of transit service to put in place in a given area. This is because the balance between operating costs and service quality is frequently hard to evaluate and so is the choice between a fixed-route or demand responsive type of service, especially within residential areas with lower and sparser demand. We are proposing a simulation analysis to address the problem.

■ MC37

C-Room 307

Street to Fleet: Using Simulation and Optimization to Manage the Navy's Manpower and Personnel Business

Sponsor: Military Applications
Sponsored Session

Chair: Tanja Blackstone, Economist, Navy Personnel Research Studies and Technology, 5720 Integrity Drive, Millington, TN, 38055-1000, United States, tanja.blackstone@navy.mil

1 - Simulation Modeling of the Street-to-fleet Supply Chain for the Builder Community

Mehdi Amini, Professor, University of Memphis, mamini@memphis.edu, Mike Racer, David Cashbaugh, Tanja Blackstone

Traditional supply chain analysis focuses on tangible products. To date, there has been surprising little research that has examined supply chains where the products are people. This study focuses on simulation modeling and analysis of the Navy's street-to-fleet supply chain for the builder community. This supply chain is in charge of recruiting, training, and placement of sailors.

2 - A Surrogate Model Approximating the Performance of the Compass Model

Gary Kochenberger, University of Colorado at Denver, Denver, CO, gary.kochenberger@cudenver.edu, Manuel Laguna, Candy Brinkman, Jim Kelly

COMPASS is an agent-based model designed to simulate the flow of sailors through the sequence of career decisions. While COMPASS holds great promise as a policy evaluation tool, it is, by its very nature, computationally cumbersome. To address these computational issues, we are developing a surrogate model to approximate COMPASS with enough accuracy to provide good starting points for policy variables.

3 - Enlisted Community Manager (ECM) Digital Dashboard: Inventory Tracking of Military Personnel

Thomas Jones, Commander, USN, thomas.jones4@navy.mil

The ECM Digital Dashboard has been responsible for unprecedented transformational change affecting the processes and methodologies used to manage enlisted communities across the entire Active Component (AC) and Reserve Component (RC – FTS) Navy. The ECM DD offers Senior Navy Leadership, as well as all ECMs, unprecedented visibility into 214 enlisted ratings with intuitive displays of data for 15 top-level metrics critical to community management.

■ MC38

C-Room 308

Algorithmic Mechanism Design I

Cluster: Game Theory
Invited Session

Chair: Moshe Babaioff, Researcher, Microsoft Research, 1065 La Avenida St., Mountain View, CA, 94043, United States, moshe@microsoft.com

1 - On Best-response Bidding in Ad Auctions

Anna Karlin, Professor, University of Washington, Box 352350, PGA 594, Seattle, WA, 98195, United States, karlin@cs.washington.edu

How should players bid in keyword auctions such as those used by Google, Yahoo! and MSN? We consider best-response bidding strategies for a repeated auction on a single keyword, where in each round, each player chooses some optimal bid for the next round, assuming that the other players merely repeat their previous bids. We study the convergence and robustness properties of such strategies. Most interesting among these is a best-repsonse strategy with the property that if all players use it, the bids converge to a fixed point that coincides with the equilibrium of a static game, with payments identical to those of the VCG mechanism. We prove that convergence occurs with probability 1, and we establish bounds on the speed of convergence. This shows that there exist natural bidding strategies in the dynamic game that lead to the equilibrium of the static game.

2 - Online Pricing and Prophet Inequalities
Robert Kleinberg, Assistant Professor, Cornell University, 4138 Upson Hall, Cornell University, Ithaca, NY, 14853, United States, rdk@cs.cornell.edu, Mohammad Taghi Hajiaghayi, Ymir Vigfusson, Tuomas Sandholm

In probability theory, a prophet inequality is a theorem which compares the expected payoff obtained by two parties each selecting k elements from the same sequence of random numbers: a prophet, who has foreknowledge of all the numbers in the sequence and may select any k of them, versus a gambler, who knows only the distribution from which the sequence is sampled and must make selections online. This talk will explore a relation between prophet inequalities and the analysis of optimal online pricing mechanisms for digital goods. We will present some new (and nearly optimal) multi-choice prophet inequalities, and we will apply them to understand the effect of different temporal incentive constraints on the expected revenue of the optimal dominant-strategy incentive-compatible online mechanism.

3 - Best-Reply Mechanisms
Michael Schapira, The Hebrew University, Jerusalem, Israel, mikesch@cs.huji.ac.il, Aviv Zohar, Noam Nisan

In many setting strategic agents are instructed to follow the best reply dynamics (economic markets, Internet protocols). This gives rise to many questions: Is best-reply dynamics guaranteed to converge to a stable state? What happens in asynchronous settings in which the communication between agents can be delayed or dropped? Is it in the best interest of the agents to follow best-reply dynamics? We characterize a subclass of games, which contains all dominance-solvable ones. For this subclass we prove that the best-reply dynamics converges within polynomial time to a pure Nash equilibrium. Moreover, we show that convergence is assured even in asynchronous settings in which communication between players may be delayed or lost. We then study best-replies strategies in the context of mechanism design. We characterize a narrower subclass of games for which we prove that best-reply strategies are ex-post-Nash incentive-compatible. We provide several examples: stable-roommate problems, network-routing games, and first-price auctions.

4 - Truthful and Near-Optimal Mechanism Design via Linear Programming
Chaitanya Swamy, Assistant Professor, University of Waterloo, Dept.. of C&O, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, cswamy@math.uwaterloo.ca, Ron Lavi

We consider the problem of designing efficient truthful mechanisms that compute near-optimal solutions to the social-welfare-maximization algorithmic problem. We show that for packing problems (e.g., combinatorial auctions), any c-approximation algorithm that also bounds the integrality gap of the LP relaxation of the problem by c can be used to construct a c-approximation, truthful-in-expectation mechanism. This yields a variety of new and significantly improved results.

■ MC39

C-Room 309

Panel Discussion: Improving Healthcare Supply Chains and Logistics

Sponsor: Health Applications Section
Sponsored Session

Chair: Ronald Rardin, White Chair and Distinguished Professor, University of Arkansas, Ctr for Innov in Healthcare Logistics, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, rrardin@uark.edu

1 - Improving Healthcare Supply Chains and Logistics (Panel)
Moderator: Ronald Rardin, White Chair and Distinguished Professor, University of Arkansas, Ctr for Innov in Healthcare Logistics, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, rrardin@uark.edu, Panelist: Russell Meller, Bill Hardgrave

Huge unnecessary costs in healthcare supply chain and logistic systems result from overlapping providers, duplication, and under-investment in IT. As important, confusion in logistic systems has direct implications for safety and quality of patient care. The new Center for Innovation in Healthcare Logistics (CIHL) is a university-industrial partnership to catalyze solutions to these challenges. This panel of key CIHL personnel will discuss opportunities and future directions.

■ MC40

C-Room 310

Innovations in Models for Healthcare Operations and Policy

Sponsor: Health Applications Section
Sponsored Session

Chair: Chris P. Lee, Assistant Professor, The Wharton School, Univ. of Pennsylvania, 3730 Walnut St., Suite 500, Philadelphia, PA, 19104, United States, cpclee@wharton.upenn.edu

1 - Nurse Staffing: Patients or Patience?
Natalia Yankovic, Columbia University, Graduate School of Business, New York, NY, 10027, United States, natalia.yankovic@columbia.edu, Linda Green

Nurse staffing in hospitals is traditionally based on target ratios of patients to nurses. However, varying needs for care based on age, diagnosis, case severity, and medical complexity, as well as emerging evidence relating nursing levels to quality of care have led to the search for better staffing models. This talk will describe a newly developed queueing model for nurse staffing and an on-going hospital-based project to implement it to assure timely nursing responses to patients' needs.

2 - How Often Should Liver Transplant Patients Update Their MELD Scores?
Andrew Schaefer, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, schaefer@engr.pitt.edu, Lisa Maillart, Atul Bhandari

UNOS requires liver transplant patients to update their MELD scores at least as often as a predetermined frequency associated with their last recorded scores. We consider a time cost of updating and determine the policy that maximizes the expected net lifetime. The policy prescribes when to check or report scores, and which liver types to accept in each state. We model the problem as a partially observable MDP, establish structural properties, and conduct numerical studies using clinical data.

3 - Cost-effectiveness of Alternative HIV Vaccination Strategies Among U.S. Risk Groups
Elisa Long, PhD Candidate, Stanford University, 467 Terman Engineering Center, Stanford, CA, 94305, United States, elisa46@stanford.edu, Douglas Owens, Margaret Brandeau

Efforts to develop an HIV vaccine have become an increasing priority, and several questions exist regarding the efficient distribution of vaccination programs. We examined the effects of alternative HIV vaccination strategies among different US risk groups, including injection drug users, men who have sex with men, and the general population. We present a dynamic compartmental model of HIV transmission and progression and calculate health and economic outcomes of different vaccination policies.

4 - Do it Right the First Time or Revisit and Rework? An Empirical Study of ICU Performance
Diwas Kc, PhD Candidate, The Wharton School, 3730 Walnut St., Suite 500, Philadelphia, PA, 19104, United States, diwas@wharton.upenn.edu, Christian Terwiesch

We find that the discharge decision in a cardiac ICU is not only medical, but also operational. A capacity constrained ICU discharges patients early and this decision has eventual capacity and quality implications. In some cases, an early discharged patient develops further complications leading to a longer ICU revisit. In this paper, we explore the quality-capacity tradeoff to determine if a hospital should do it right the first time or revisit and rework.

■ MC41

C-Room 3A

Joint Session HAS/ICS: Medical Decision Making

Sponsor: Health Applications Section, INFORMS Computing Society
Sponsored Session

Chair: Dionne Aleman, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, daleman1@ufl.edu

1 - A New Model for Incorporating Interfraction Motion in Radiation Therapy Treatment Plan Optimization
Chunhua Men, PhD Student, University of Florida, Department of Industrial and Systems Engineering, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, chhmen@ufl.edu, Edwin Romeijn, James Dempsey

We present a new stochastic programming model for IMRT treatment plan optimization to account for the interfraction motion due to set-up errors. In contrast with the traditional approaches, which employ a margin around the clinical target, our optimization is based on a finite number of generated scenarios, where each daily treatment (fraction) can be viewed as a realization. We test the efficacy and efficiency of our model, as well as the effect of the number of scenarios, using clinical data.

2 - An Exact Algorithm for the Minimum Cardinality Leaf Sequence Problem in IMRT

Zeki Caner Taskin, PhD Student, University of Florida, University of Florida, ISE Department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, taskin@ufl.edu, Edwin Romeijn, James Dempsey, J. Cole Smith

Intensity modulated radiotherapy (IMRT) is a powerful technique for radiotherapy treatment delivery. We discuss the problem of efficiently delivering a given beam intensity profile. In particular, we need to decompose the intensity profile into a set of beam shapes and associated intensities. We propose an exact algorithm to solve this problem under different efficiency criteria. Our results indicate that several clinical instances can be solved to optimality within a few minutes.

3 - The Trade-off Between Pregnancy Rate and OHSS Risk in In Vitro Fertilization-embryo Transfer

Miao He, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, hem03@mails.tsinghua.edu.cn, Lei Zhao, Yue Zhang

During the hyperstimulation process in In Vitro Fertilization-Embryo Transfer (IVF-ET), doctors need to decide on gonadotropin doses to balance the tradeoff between pregnancy rate and the risk of ovarian hyperstimulation syndrome (OHSS). Supported by clinical data, we use approximate dynamic programming models to capture the dynamic nature of the process and the variability of individual responses. Our goal is to provide doctors with decision supporting tools to balance the tradeoff.

4 - Therapeutic Optimization Considering Medical Research and Development

Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, Steven.Shechter@sauder.ubc.ca, Oguzhan Alagoz

Most patient-level decision models do not consider the downstream availability of new treatment options coming out of the research and development pipeline. We present a Markov Decision Process model for patient treatment, which incorporates uncertainty around the development of new therapies, and show how optimal values and policies compare between models that do and do not consider the R&D dynamic. We present structural properties as well as results from a numerical example for treating HIV.

■ MC42

C-Room 3B

Computational Challenges in Radiotherapy Design

Cluster: Operations Research in Medicine and Health Care
Invited Session

Chair: Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, TX, United States, aholder@trinity.edu

1 - Software Architecture, Algorithms, and Data Models for Radiotherapy optimAl Design (RAD) - Part II

Paul Uhlig, Associate Professor of Mathematics, St. Mary's University, One Camino Santa Maria, Dept.. of Mathematics, San Antonio, TX, 78228-8560, United States, puhlig@stmarytx.edu, Allen Holder, Arthur Hanna

Radiotherapy optimAl Design (RAD) is an academic radiotherapy treatment planning system. RAD uses a database which stores the necessary anatomical data in RTOG format. That data is processed into a computer model that is used in the design and optimization stage. This processing includes curve fitting for boundaries of tissues of varying types, labeling of regions, and efficient storage of the model. This presentation outlines these processes that create the model.

2 - Software Architecture, Algorithms, and Data Models for Radiotherapy Design I

Arthur Hanna, Associate Professor of CS, St. Mary's University, One Camino Santa Maria, Computer Science Department, San Antonio, TX, 78228, United States, AHanna@StMaryTX.edu

Radiotherapy optimAl Design (RAD) is an academic radiotherapy treatment planning system. RAD uses a Web interface that allows researchers immediate access to case descriptions and corresponding treatments. We will discuss the software architecture, algorithms, and data models for RAD, paying particular attention on how C++, SWIG, HTML, Linux, AMPL, and MySQL, are glued together with PHP, to build a seamless, efficient, flexible, and highly interactive system.

3 - Dose Calculations: Where and How to Measure Dose

Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, TX, United States, aholder@trinity.edu, Paul Uhlig, Arthur Hanna

The accuracy of treatment design depends on appropriate estimations of delivered dose. However, the size of the underlying optimization problem increases with the accuracy of dose, often leading to problems of unusual size. So, limiting the dose model is important but needs to be accomplished to reduce the loss of accuracy. We discuss a new technique to measure dose and the supporting data structures.

■ MC43

S-Grand Ball. A (Lev. 2)

Real World Applications II

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Mary Crissey, SAS Insitute, 17030 Vista Park Dr, San Antonio, TX, 78247, United States, Mary.Crissey@sas.com

1 - Real Time Integer Programming to Improve Ambulance Response Time at San Francisco Fire Department

Jodi Blomberg, Technical Architect, SAS, 6501 S Fiddler's Green Circle, Greenwood Village, CO, 80111, United States, jodi.blomberg@sas.com, Bill Storti

The San Francisco Fire Department positions ambulances for emergency response. An integer programming model places ambulances to minimize the distance to call volume. As ambulances go out on calls, using the original model to reposition all remaining ambulances is an impractical solution. Rather, additional constraints were added to the model to determine the best way to reposition a limited number of ambulances. This real time information can be fed to the dispatcher to improve response times.

2 - Global Operational Logistics Decision Support System

Paul Grant, Systems Engineer, SAS Institute, Boston, MA, United States, Paul.Grant@sas.com, Jodi Blomberg

Applying this crisis action planning tool, military analysts optimize their supply chains incorporating complexities of combat operations. Pentagon decision makers can create, change, and compare optimization scenarios in a point-and-click environment. This optimization model runs on the newest solvers available in SAS/ORÆ and can be deployed as a BI environment via an easy to use interface so military planners can explore results with embedded GIS capabilities and OLAP cubes.

3 - Building a Supply Chain Model for Strategic Demand Planning Model at a Pharmaceutical Company

Michael Berliner, Operations Research specialist, SAS Denmark, Köbmagergade 7-9, Copenhagen K, 1150, Denmark, michael.berliner@sdk.sas.com

During this talk a model for strategic supply chain optimization for pharmaceutical finished goods will be presented. The talk will include a description of the modelling process which was focused on finding an appropriate balance of complexity to allow for fast deployment while ensuring applicability. The talk will also present how the model was implemented using SAS/OR and SAS' BI environment for result reporting and exploration.

■ MC44

S-Grand Ball. B (Lev. 2)

Joint Session INFORMS-ED/ICS: Modeling Languages in the Classroom

Sponsor: INFORM-ED, INFORMS Computing Society
Sponsored Session

Chair: Ted Ralphs, Associate Professor, LehighUniversity, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, tkralphs@lehigh.edu

1 - Using an Algebraic Modeling Language for Optimization Class Projects

Robert Fourer, Professor, Northwestern University, Dept. of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States, 4er@iems.northwestern.edu

The operations research literature, particularly the journal Interfaces, is full of realistic mixed-integer programming models that have considerable pedagogical value. This talk describes challenges of adapting MIP formulations to multi-week team projects. The AMPL algebraic modeling language allows students to send challenging formulations to solvers. Data tables in spreadsheets also play a key role, though actual data values must often be reconstructed from limited information in the paper.

2 - Teaching Set-based Modeling in the Introductory Linear Programming Course

Leo Lopes, University of Arizona, University of Arizona - SIE, Tucson, AZ, United States, leo@sie.arizona.edu, Simge Kucukyavuz

In this talk, we analyze data acquired from incorporating set-based modeling into the introductory Linear Programming course in the Systems and Industrial Engineering curriculum. We document aspects of student's background that had to be strengthened, testing and teaching materials, and outcomes. We end with recommendations for faculty interested in taking this approach and for textbook authors.

3 - Teaching Practical Optimization Using GLPK

Paul Brooks, VCU, Dept.. of Stat. Sci. and O.R., P.O. Box 843083, Richmond, VA, 23284, United States, JPBrooks@vcu.edu

This talk describes experiences teaching a master's-level course on Practical Optimization using GLPK, an open source optimization package. A survey of some of the resources available and the resources that are not available is given. Examples of assignments and projects and their use in illustrating real-world optimization problems are presented.

4 - Teaching Computational Discrete Optimization

Andreas Alpers, Visiting Assistant Professor, School of ORIE, Cornell University, Ithaca, NY, 14853, United States, alpers@orie.cornell.edu, Leslie E. Trotter

In this talk I will share my personal experience in teaching an advanced undergraduate level course in computational discrete optimization at Cornell. Freely available software is used throughout the course to illustrate various aspects of current branch-and-cut technology. In particular, I will discuss the classroom use of CONCORDE, the current world record holder for solving Traveling Salesman problem instances.

■ MC45

S-Capitol Hill (Lev. 3)

Optimization Based Methods in Finance

Sponsor: Financial Services
Sponsored Session

Chair: James Primbs, Assistant Professor, Stanford University, 444 Terman Engr. Ctr., Mail Code 4026, Stanford, CA, 94305, United States, japrimbs@stanford.edu

1 - Multi-period Optimization Model for a Household and Optimal Insurance Design

Norio Hibiki, Associate Professor, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, 223-8522, Japan, hibiki@ae.keio.ac.jp

We discuss optimization models to obtain an optimal investment and insurance strategy for a household. In this paper, the optimization model is formulated with term life insurance which variable insurance money is received. Next, we propose a model to decide optimal life and medical insurance money at each time. We examine the models to illustrate optimal financial plans with some practical examples.

2 - Semi-definite Programming Based Receding Horizon Methods for Dynamic Hedging

James Primbs, Assistant Professor, Stanford University, 444 Terman Engr. Ctr., Mail Code 4026, Stanford, CA, 94305, United States, japrimbs@stanford.edu

In this talk we present a receding horizon approach to dynamic hedging of high dimensional options using semi-definite programming methods. The receding horizon approach solves on-line optimization problems at each time in order to construct a policy. We show that the dynamic hedging problem for various options can be formulated so that the on-line optimizations are semi-definite programs. Thus, we are able to effectively hedge high dimensional options. Examples illustrate the approach.

3 - A Conservative Approximation Approach to the Value-at-risk Minimization

Jun-ya Gotoh, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, 112-8551, Japan, jgoto@indsys.chuo-u.ac.jp, Yuichi Takano

We consider a conservative approximation approach to the VaR minimization problem when the underlying loss distribution is given by a finite number of scenarios. The proposed approach is formulated as a D.C. optimization problem, and a branch-and-bound global optimization algorithm is presented. Some comparative computational results are given, showing characteristics of the algorithms.

4 - Simultaneous Optimization of P/L and Payoff Functions for Wind Derivatives Using Prediction Errors

Yuji Yamada, University of Tsukuba, Tokyo, Japan, yuji@gssm.otsuka.tsukuba.ac.jp

We propose a new type of weather derivatives based on the prediction error of wind speed, and estimate its hedge effect on the wind power energy businesses. First, we investigate the correlation between power output and wind speed prediction errors at a wind farm. Then we will develop a methodology that optimally constructs a wind derivative based on the prediction errors. Finally, a simultaneous optimization technique of the P/L and payoff functions for wind derivatives is demonstrated.

■ MC46

S-Ballard (Lev. 3)

Power and Energy Market Modeling I

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Benjamin Hobbs, JHU, 313 Ames DoGEE, Baltimore, MD, 21218, United States, bhobbs@jhu.edu

1 - Asymmetric Supply Function Equilibria with Forward Contracts

Eddie Anderson, Professor of Operations Management, Australian School of Business, University of New South Wales, Sydney, NSW 2052, Australia, eddiea@agsm.edu.au, Xinmin Hu

Recent work has characterized the behaviour of supply function equilibria for asymmetric firms. This paper extends this work by exploring the nature of such equilibria when there are forward swap contracts, which are common in electricity markets. There are surprisingly far reaching effects: e.g there is no longer a natural ordering between different equilibria. We show uniqueness with three firms, even without capacity constraints. On the other hand duopoly solutions are not unique.

2 - Transmission Expansion and Nash Equilibria

Andy Philpott, Professor, The University of Auckland, Private Bag 92019, Auckland, AK, 1025, New Zealand, a.philpott@auckland.ac.nz, Golbon Zakeri, Tony Downward

We consider a system operator expanding the capacity of an electricity transmission system so as to yield a network with enough capacity so that generators in a nodal electricity pool market have no incentive to game transmission constraints. For networks without loops or losses, these capacities can be represented by a convex polyhedral set, which can be incorporated into a multi-stage stochastic programming model. The difficulties of extending this to more general settings will be discussed.

3 - Parameterized Supply Function Bidding: Equilibrium and Welfare

Ramesh Johari, Stanford University, Terman Engineering Center, Room 319, Stanford, CA, United States, ramesh.johari@stanford.edu, John Tsitsiklis

We investigate a model where the market operator can *restrict* the supply functions available for use in bidding by generators. Such an approach has the benefit of controlling the exercise of market power, but the potential for a loss of market efficiency. We show that with an appropriately chosen class of supply functions, both the loss of efficiency and the price markup above competitive levels can be bounded at equilibrium.

4 - A Bivariate Garch Analysis of Real-time and Day-ahead Electricity Prices

Nathan Wilson, University of Michigan, nathanew@bus.umich.edu, Shanshan Hu

This paper examines the relationship between the real-time and day-ahead electricity markets operated by the New England Independent Service Operator (ISO). Using time series econometric methods, we examine whether or not the relationship between the conditional means and volatilities of the two price series vary over the course of a day. Finding that they do, we then attempt to determine whether trading strategies based on multivariate GARCH techniques perform better than simpler ones.

■ MC47

S-Admiral (Lev. 3)

Mining Applications: Open Pit Sequencing

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Alexandra Newman, Associate Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, anewman@mines.edu

1 - Effeciently Sequencing the Extraction of Ore From an Open Pit Mine

Marty Gaupp, PhD Candidate, CO School of Mines (USAF sponsored), 7152 Prairie Wind Dr, Colorado Springs, CO, 80923, United States, mgaupp@mines.edu, Alexandra Newman

The goal in surface mining is to extract material from an open pit so as to maximize NPV of the usable ore in the pit. Doing this is limited by constraints that: prevent the hole from filling in on itself, limit production and processing capabilities, and ensure the mine is profitable. We describe the complexities involved in efficiently sequencing this ore removal process and examine some possible methodologies to expedite the solution time for this difficult mixed integer program.

2 - Open Pit Optimization and the Gap Problem

Conor Meagher, PhD Candidate, McGill University, 2282 Marie Anne E., Montreal, QC, H2H1N3, Canada, cmeagh1@cs.mcgill.ca, Roussos Dimitrakopoulos, David Avis

Open pit optimization typically involves two phases: designing the ultimate pit, then breaking up the pit into smaller more manageable pieces know as pushbacks. Existing methods for designing pushbacks suffer from large size differences between pushbacks. Some computational complexity results related to finding an optimal pushback design in terms of net present value will be discussed. Algorithmic approaches that can be used to achieve near optimal pushback designs will also be presented.

3 - Aggregation Approaches for Mine Planning

Andres Weintraub, Professor, University of Chile, Department of Industrial Engineering, Santiago, Chile, aweintra@dii.uchile.cl, Ximena Schultz, Marianela Pereira

Large scale, detailed MIP models support long range planning in Chilean copper mines. To compact these models for use in corporate strategic decisions or to incorporate stochastic elements, we use cluster analysis. One method, a priori, aggregates the mine blocks before defining the MIP; the second, a posteriori, aggregates columns of the LP. Results with data from a large underground copper mine show reductions in CPU times and error bounds.

■ MC48

S-Fremont (Lev. 3)

Simulation I

Contributed Session

Chair: Pamela Williams, Sandia National Laboratories, P.O. Box 969, MS 9159, Livermore, CA, 94551, United States, pwillia@sandia.gov

1 - On the Generation of Random Test Networks

Douglas Shier, Professor, Clemson University, Mathematical Sciences Dept., O-120 Martin Hall, Clemson, SC, 29634, United States, shierd@clemson.edu, Dennis Adams-Smith

One of the pillars of empirical testing of network flow algorithms is that of generating a large number of random instances having fixed characteristics. We examine a number of methods used in computational studies for random network generation and we illustrate the tradeoff between their computational efficiency and usability. Both analytic and simulation results demonstrate that some seemingly reasonable methods can produce highly biased results, while other methods are much more satisfactory.

2 - Approximating Event Probability from a Qualitative Discrete Event Simulation Output

Yen-Ping Leow-Sehwail, Oklahoma State University, P.O. Box 2133, Stillwater, OK, 74076, United States, yenl@okstate.edu, Ricki Ingalls

Qualitative Discrete Event Simulation (QDES) uses time intervals as input representation to generate execution threads that characterize all possible ordering of event sequences. This paper presents a methodology to analyze output from a QDES model by assuming Uniform distribution on the delay intervals in order to approximate the probability of occurrence for each event.

3 - SimMan – A Simulation Model for Workforce Capacity Planning with Uncertain Demands

Huei-Chuen Huang, Associate Professor, National University of Singapore, ISE Dept., 1 Engineering Drive 2, Singapore, 117576, isehhc@nus.edu.sg, Brian Eck, Loo-Hay Lee, Haiqing Song

Predicting actual performance of workforce planning policies, within professional services firms, is a difficult challenge. In this research, we develop a simulator, to evaluate the effectiveness and robustness of different workforce capacity planning policies. Numerous practical policies are examined using this tool, which provides comparisons to identify the likely best-performing strategies over future periods.

4 - Multi-objective Computing Budget Allocation Algorithm

Loo-Hay Lee, Associate Professor, National University of Singapore, ISE Dept.. 1 Engineering Drive 2, Singapore, 117576, Singapore, iseleelh@nus.edu.sg

Multi-Objective Computing Budget Allocation Algorithm (MOCBA) is an algorithm which determines how to allocate simulation replications to designs so that the non-dominated set of designs can be found with high confidence at the least expense in terms of simulation replications. In this talk, we will present some of the extension work that we have made on the algorithm.

5 - Developing a Data Extraction Toolkit for Optimization, Uncertainty Quantification, and Validation

Pamela Williams, Sandia National Laboratories, P.O. Box 969, MS 9159, Livermore, CA, 94551, United States, pwillia@sandia.gov, Brian Adams, Genetha Gray

The extraction of signal characteristics from time series data is a critical step in the analysis of model-based simulations and comparison of model with experimental data for optimization, uncertainty quantification (UQ), etc. However, many optimization and UQ toolkits leave the onus on users to setup simulations and post-process results, which results in customized data extraction solutions. We will describe the development of a toolkit to analyze and compare model and experimental data.

■ MC49

S-Greenwood (Lev. 3)

Panel Discussion: Revenue Management Research That is Used in Practice: Past, Present and Future

Sponsor: Revenue Management & Pricing- Invited/Sponsored

Sponsored Session

Chair: Garrett van Ryzin, Columbia University, 412 Uris Hall, New York, NY, 10027, United States, gjv1@columbia.edu

1 - Revenue Management Research That is Used in Practice: Past, Present and Future

Moderator: Garrett van Ryzin, Columbia University, 412 Uris Hall, New York, NY, 10027, United States, gjv1@columbia.edu, Panelist: Robert Phillips, Andy Boyd, Jeff McGill, Richard Ratliff

Revenue management research has grown rapidly over the past decade. So has revenue management practice. But which research ideas have had the most influence on industry practice and why? What accounts for the success of these ideas? What lessons can we learn from these examples about doing research that has real impact? The panel will address these questions in an open discussion format.

■ MC50

S-Issaquah A & B (Lev. 3)

Price Optimization and Price Elasticity Estimation

Sponsor: Revenue Management & Pricing- Invited/Sponsored

Sponsored Session

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

Co-Chair: Zhi-Long Chen, Associate Professor, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu

1 - Coordinating Inventory Control and Pricing Strategies with Concave Ordering Cost

Xin Chen, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States, xinchen@uiuc.edu, Yuhan Zhang

We analyze a finite horizon, single product, periodic review model where pricing and production/inventory decisions are made jointly. Demand in each period is additive. Pricing and ordering decisions are made at the beginning of each period and all shortages are backlogged. Ordering cost is a concave function of the amount ordered. We show that under certain conditions that the generalized (s,S) inventory policy maximizing expected profit over the finite horizon.

2 - Capacitated Procurement Planning with Price-sensitive Demand and General Concave Revenue Functions

Joseph Geunes, Associate Professor, University of Florida, Department of Industrial and Systems Eng, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, geunes@ise.ufl.edu, Yasemin Merzifonluoglu, Edwin Romeijn

We provide solution methods for discrete-time, finite-horizon procurement planning problems with economies of scale in procurement, price-sensitive demand, and time-invariant capacities. We assume general concave revenue functions in each period, and maximize total net revenue. We consider the case where prices vary dynamically, as well as when a constant price is required. Under mild conditions on revenue functions, we provide polynomial-time solution methods for this problem class.

3 - An Empirical Study for Estimating Price Elasticities in the Travel Industry

Pelin Pekgun, Georgia Institute of Technology, School of Industrial and Systems Engng, 765 Ferst Drive, Atlanta, GA, 30332, United States, ppekgun@isye.gatech.edu, Paul Griffin, Pinar Keskinocak

We address the challenges in estimating price sensitivity of customers in passenger travel industry through an empirical study. We show the improvement when endogeneity is accounted for, which arises as a result of simultaneous determination of supply and demand leading to high demand-high price and low demand-low price pairs in the observed data.

4 - Robust Pricing to Minimize Maximum Regret

Zhi-Long Chen, Associate Professor, University of Maryland, R.H. Smith School of Business, College Park, MD, 20742, United States, zchen@rhsmith.umd.edu, Nicholas G. Hall

We consider a robust pricing model where the objective is to minimize the maximum regret. We consider several problems that involve both production and pricing decisions and derive solution algorithms for them. We will also discuss related managerial insights.

■ MC51

S-Kirkland (Lev. 3)

Pricing in Services

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Gad Allon, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu

Co-Chair: Achal Bassamboo, Northwestern University
a-bassamboo@northwestern.edu

1 - The Role of Services: Pricing, Product Line, and Durability

Gad Allon, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu, Achal Bassamboo

In recent times, due to the commoditization of goods, many firms often offer services along with the product. We study the role of these services apart from being another revenue source and understand how to manage services. We first explore their role in pricing of the underlying good. Next we study the impact of services on good variety offered by the firm. Lastly, we demonstrate the impact of services on markets of durable goods.

2 - Optimization of Product Placement in a Retail Environment

Wei Ke, Columbia University, wke10@gsb.columbia.edu, Garrett van Ryzin

We consider the impact of physical locations on the sales of a product assortment. Specifically, we hypothesize that the demand of every retail product has two components—intrinsic and impulse. Products with a dominant impulse demand component tend to be strongly influenced by their locations in the store. We propose some heuristics to solve the NP-hard placement optimization problem and consider the design of an in-store experiment to effectively tease out the placement effect.

3 - Estimating and Benchmarking Less Than Truckload (LTL) Market Rates

Evren Ozkaya, PhD Student, Georgia Institute of Technology, 251 10th Street NW A-702, Atlanta, GA, 30318, United States, evren@gatech.edu, Pinar Keskinocak, Ryan Weight

In this study we propose a robust methodology to estimate Less-than-Truckload (LTL) market rates and a process to benchmark LTL shipments based on historical data. We implemented the process using SAS with MS Access user interface and tested with real world data. Study reveals interesting patterns of the realized market rates.

4 - Robust Newsvendor Competition

Houyuan Jiang, Dr, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, Ca, CB2 1AG, United Kingdom, h.jiang@jbs.cam.ac.uk, Serguei Netessine, Sergei Savin

We generalize the analysis of newsvendor competition to the setting in which the competitors only possess information about support of demand distribution. We analyze and compare several approaches relying on regret minimization or the worst-case criterion instead of minimizing the expected profit. We find the unique and closed-form Nash equilibrium under suitable assumptions. Numerical analysis indicates that the absolute regret minimization offers the most sensible alternative.

■ MC52

S-Leschi (Lev. 3)

Fleet Sizing

Sponsor: Railway Applications
Sponsored Session

Chair: Moncef Sellami, Manager Fleet Planning & Analysis, TTX Company, 101 N. Wacker Dr., 8th Flour, Chicago, IL, 60606, United States, Moncef_Sellami@ttx.com

1 - Reconciling Strategic and Tactical Fleet Inventory Targets with Cyclical Demand

Michael Gorman, Associate Professor, University of Dayton, School of Business, Dayton, OH, United States, Michael.Gorman@notes.udayton.edu

Rolling stock fleets must be managed on an on-going basis so that they are positioned where they provide the greatest value for the fleet owner. We evaluate models for the optimal strategic and tactical strategies for establishing target fleet inventory levels in the face of highly cyclical weekly demand. We observe that strategic and tactical targets may not always agree. We further develop an approach for the estimating the cost of deviaiton from optimal fleet targets.

2 - Locomotive and Freight Car Planning: Predicting the Future

Evan Bell, CSXT, 500 Water Street, Jacksonville, FL, 32202, United States, Evan_Bell@CSX.com

Locomotive and freight car planning is a process that has three key drivers. - Supply -Demand -Utilization Each one of these drivers has many components that need to be forecasted into the future. This presentation will address the issues and possible solutions of the driver components and how the changing world around us affects our view going forward.

3 - Intermodal Fleet Sizing

Maia Pykina, Manager Forecasting and Planning, TTX Company, 101 N Wacker Drive, Chicago, IL, 60606, United States, Maia_Pykina@ttx.com

The railroad industry faces a challenge of investing in an intermodal railcar (a fifty-year asset) a purpose of which is to carry a trailer/container (a ten-to-fifteen year asset). How many intermodal railcars and of what configuration should the industry invest in? In this presentation we show how TTX uses its intermodal fleet sizing process to recommend future investments in intermodal capacity.

4 - Introduction to the Reload Fleet Size Model

Moncef Sellami, Manager Fleet Planning & Analysis, TTX Company, 101 N. Wacker Dr., 8th Flour, Chicago, IL, 60606, United States, Moncef_Sellami@ttx.com

In this presentation we show how to calculate a recommended Fleet Size using the Reload methodology. Reload, a fleet management team within TTX Company, handles fleet sizing and daily distribution of empty multi-level auto-racks for railroads serving 17 automotive shippers. The Reload methodology is based on static and dynamic fleet-sizing models along with appropriate correction factors to recommend the number of railcars of each car type that should be acquired for any model year.

5 - Strategic Railcar Fleet Planning at Norfolk Southern

Stephanie Jernigan, Operations Research Specialist, Norfolk Southern Corporation, 1200 Peachtree St. NW, MS 12-117, Atlanta, GA, 30309, United States, stephanie.jernigan@nscorp.com, Clark Cheng

NS has recently developed a strategic fleet planning model to be able to better account for long-term demand trends and global budget constraints in the fleet planning process. The application uses simulation to estimate the demand for each type of rail car, and then models 30 years of decision-making as a mixed-integer program. In this talk we will discuss the impacts of the fleet planning model on the business process, and we will summarize the lessons learned in developing such a model.

■ MC53

S-Medina (Lev. 3)

Recent Advances in Location Analysis and New Applications Session

Sponsor: Location Analysis
Sponsored Session

Chair: Rakesh Nagi, Professor and Chair, University at Buffalo, 438 Bell Hall, Department of Industrial and Systems Eng, Buffalo, NY, 14260, United States, nagi@buffalo.edu

1 - Solving the Ordered One-median Problem

Zvi Drezner, Fullerton University, zdrezner@fullerton.edu, Stefan Nickel

We propose a general approach solution method for the single facility ordered median problem in the plane. All types of weights (non-negative, non-positive, and mixed) are considered. The big triangle small triangle approach is used for the solution. Rigorous and heuristic algorithms are proposed and extensively tested on eight different problems with excellent results.

2 - A New Modeling of the Gateway Airport Location Problem
Mihiro Sasaki, Associate Professor, Nanzan University, 27 Seirei, Seto, 489-0863, Japan, mihiro@nanzan-u.ac.jp, Takehiro Furuta, Atsuo Suzuki

We present a new model to find the optimal gateway airport in a region. To establish a suitable airline network in a region such as Asia, we should take into account the interregional demand, i.e. the number of outgoing and inbound passengers from/to the region. The problem can be regarded as a hierarchical location problem. We show numerical results of the Asian gateway airport using OD data between Asia and Europe or North America evaluated by IATA in 2005.

3 - Optimizing School District Lines and Bus Routes Using GIS: The Case of Sweet Home School
Irene Casas, University at Buffalo, 125 Wilkeson Quad, Buffalo, NY, 14260-2050, United States, icasas@buffalo.edu, Rakesh Nagi, Deelesh Mandloi, Rajan Batta, Robert Garrity

We consider redistricting four elementary schools and designing bus routes with the support of an integrated geographic information system (GIS) and optimization environment. The objective is to minimize travel distances/transportation cost, but also balancing socio-economic factors (diversity) under school and bus capacity constraints. A western NY case will be discussed.

4 - The Chance-constrained Stochastic P-hub Center Problem
Thaddeus Sim, Assistant Professor, Le Moyne College, 1419 Salt Springs Road, Syracuse, NY, 13214, United States, simtk@lemoyne.edu, Barrett Thomas, Timothy Lowe

Small package delivery companies offer services where packages are guaranteed to be delivered within a given time-frame. With variability in travel time, the configuration on the hub-and-spoke delivery network is vital in ensuring a high probability of meeting the service-level guarantee. We present the stochastic p-hub center problem with chance constraints, which we use to model the service-level guarantees. We discuss results and propose a heuristic for solving the problem.

■ MC54

S-Queen Anne (Lev. 3)

Queueing Applications in Computing

Sponsor: Applied Probability
Sponsored Session

Chair: Robert Hampshire, Professor, Carnegie Mellon University, Pittsburgh, PA, United States, hamp@andrew.cmu.edu

1 - A Modified Fluid Delay Model for the Optimal Design of a Dynamic Call Center
William Massey, Professor, Princeton University, ORFE Department, Princeton, NJ, United States, wmassey@Princeton.EDU, Robert Hampshire, Otis Jennings

A call center queueing model is analyzed using dynamic optimization to estimate a profit optimal staffing and provisioning schedule consisting of three optimal operation modes. Combining this with the modified offered load approximation for dynamical loss systems, we can estimate the blocking and abandonment probabilities plus the profit for the original call center delay model.

2 - Dynamic Priority Optimization for the Management of an E-commerce Web Service
Robert Hampshire, Professor, Carnegie Mellon University, Pittsburgh, PA, United States, hamp@andrew.cmu.edu

We consider a dynamic optimization arising in the management of an e-commerce web site. We investigate a profit maximizing dynamic priority scheme for an e-commerce web site in the presence of fluctuating customer arrivals. An e-commerce web site is constrained by the number of available web servers, hence service capacity. Customers share that service capacity simultaneously via the processor sharing discipline. If customers are allocated server capacity according to their expected purchase amount, then a dynamic priority scheme can be developed to maximize the amount of profit generated by such an e-commerce web site. This work proposes such a dynamic scheme and exams its properties.

3 - A Risk Management Approach to Business Process Design
Xue Bai, CMU, The Heinz School, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, xb@cmu.edu, Ramayya Krishnan, Rema Padman

Using a graph-theoretic model of business processes, we develop a decision-theoretic methodology to characterize the risk that the information flows in a business process containing errors by taking into account the structural aspects of a process with respect to error propagation and mitigation. It finds cost-effective ways of embedding controls into specific steps in the business process to meet desired risk thresholds.

■ MC55

S-Ravenna (Lev. 3)

Performance and Productivity of the NAS: Domain Analyses

Sponsor: Aviation Applications
Sponsored Session

Chair: Dipasis Bhadra, MITRE/CAASD, 7515 Colshire Avenue, McLean, VA, 22102, United States, dbhadra@mitre.org

1 - Investments in Aviation Infrastructure and Productivity Growth
Katherine(Kate) Harback, Senior Economist/Business Analyst, CAASD/MITRE, 7515 Colshire Avenue, McLean, VA, 22102, United States, kharback@mitre.org, Thea Graham

In this paper, we examine the effects of publicly financed infrastructure in aviation and the impact on private sector productivity. Using a methodology introduced by Nadiri and Mamuneas (1996), the direct and indirect effects of an increase in aviation infrastructure investment on total and industry output and productivity growth are estimated on the private sector of the U.S. economy.

2 - Learning Air Carrier Preferences in Traffic Flow Management Programs: A Data-Driven Approach
Brendan Hogan, Sr. Simulation Modeling Engineer, MITRE/CAASD and U. of Virginia, 7515 Colshire Drive, McLean, VA, 22102, United States, bhogan@mitre.org, Dipasis Bhadra

In the future Air Traffic Control system, users will likely have more flexibility to adapt their operations and prioritize which flights get access to constrained resources. The objective of this work is in learning about the relative value users of the ATC system place on access to landing slots in a reduced capacity environment. Knowledge of this preference structure will help designers of new ATC/Traffic Flow Management procedures better align system goals and user needs.

3 - Calculation of En Route Delay Due to Vectoring and Holding
Ken Wright, Lead Simulation Modeling Engineer, CAASD/MITRE, 7515 Colshire Avenue, McLean, VA, 22102, United States, kwright@mitre.org

CAASD has developed an algorithm that measures the delay flights accrue from vectoring and holding and has created a detailed archive going back five years. For many major airports delay from vectoring is higher than delay from airborne holding. Vectoring delay is an important metric for assessing new technologies and procedures that are designed to generate fuel savings and reduce workload for controllers. This paper describes the math behind CAASD's vectoring algorithm and explores trends.

4 - The Changing Structure of the Air Carrier Network and Its Impact on System Performance
Michael Wells, Economist, FAA / ATO, Portals Building, 800 Independence Avenue, SW, Washington DC, DC, 20591, United States, michael.wells@faa.gov

This presentation examines how the route system used by passenger air carriers has changed since the year 2000, and what impact it has had on travel times, delays, and cancellations. Total flights in U.S. airspace are down from their levels in 2000, yet total system-wide delay is back to its level in 2000. This paper looks at how changes in the overall distribution of traffic have helped to bring this about.

■ MC56

S-Wallingford (Lev. 3)

Complex Dynamic Mechanisms

Cluster: Auctions
Invited Session

Chair: Kevin Leyton-Brown, University of British Columbia, 201-2366 Main Mall, Vancouver, BC, V6T1Z4, Canada, kevinlb@cs.ubc.ca

1 - Mechanism Design for Stochastic Optimization Problems
Samuel Ieong, Stanford University, 353 Serra Mall, Rm 120, Stanford, CA, 94305, United States, sieong@cs.stanford.edu, Mukund Sundararajan, Anthony Man-Cho So

We design economic mechanisms for eliciting optimization parameters privately known to selfish agents in two-stage stochastic optimization problems. We show that the expected welfare maximizer can be implemented in perfect Bayesian equilibrium. We study algorithmic issues that arise in implementation, and demonstrate a tradeoff between computational efficiency and incentive guarantee.

2 - Activity Rules for Ascending Price Combinatorial Auctions
Pavithra Harsha, Student, MIT, 77 Massachusetts Ave, Bldg E40-149, Cambridge, MA, 02139, United States, pavithra@mit.edu, David Parkes, Cynthia Barnhart

Activity rules help in suppressing strategic behavior and achieving theoretical efficiency bounds in real world scenarios such as the spectrum and the landing slot auctions. They ensure consistent straightforward bidding. We enhance the commonly used revealed preference activity rules (RPAR) to address quasi-linear and budget constrained bidders. We derive the activity rules in these two settings and provide computational discussion.

3 - Iterative Combinatorial Exchanges: An Experimental Analysis
Benjamin Lubin, Harvard School of Engineering and Applied Sciences, Maxwell Dworkin 217, 33 Oxford Street, Cambridge, MA, 02138, United States, blubin@eecs.harvard.edu, David Parkes

Expressive two-sided exchanges can increase efficiency in important markets. Our Iterative Combinatorial Exchange enables gradual value revelation directed by linear prices and using an expressive bidding language. A VCG-based rule determines the final outcome. Experiments show computational scalability, limited agent computational requirements, and the utility of price feedback.

4 - Bidding Optimally Across Multiple Simultaneous Vickrey Auctions
Enrico Gerding, University of Southampton, Southampton, S017 1BJ, United Kingdom, eg@ecs.soton.ac.uk, Rajdeep Dash, Nicholas Jennings

We consider optimal best response strategies for bidding in simultaneous Vickrey auctions with perfect substitutes. We prove that it is optimal to place non-zero bids in all available auctions, and we characterise the optimal strategy with and without budget constraints.

■ MC57

S-Columbia (Lev. 4)

Network Design and Management

Sponsor: INFORMS Telecommunications Section
Sponsored Session

Chair: Abdullah Konak, Penn State Berks, Tulpehocken Road, Reading, PA, 19609, United States, konak@psu.edu

1 - Network Design with Relay Stations
Sadan Kulturel-Konak, Penn State Berks, Tulpehocken Rd, Reading, 19609, United States, sadan@psu.edu, Abdullah Konak, Alice E. Smith

The network design problem with relay stations arises in telecommunications and logistic systems. The design problem involves selecting network links and determining the location of the relay stations to minimize the design cost. A constraint is imposed on the distance of a signal can travel without being regenerated by a relay station. An efficient local search based heuristic is presented to solve large sized problems.

2 - Managing Telecommunications as a Business
Steven Powell, Professor, California State Polytechnic University, Pomona, srpowell@csupomona.edu

It has been suggested that the telecommunications unit should be managed as a business. This paper describes what it means to run telecommunications as a business, why it is important, how it can be achieved, and what organizations have been doing about it.

3 - The Insatiable Demand for Bandwidth and the Effect on Competition
Joseph Bailey, Research Associate Professor, University of Maryland, Smith School of Business, 4315 Van Munching Hall, College Park, MD, 20742-1815, United States, joepbailey@gmail.com, Justin Biegel

Is there monopolization in the Internet bandwidth market? While there are many tendencies towards monopolization, there are unique aspects of the Internet bandwidth market that may prevent full monopolization. Our data shows movement towards increased concentration in the Internet bandwidth market. We describe its impact on adjacent telecommunication markets.

4 - Designing Wireless Local Area Networks with Security Considerations
Frederick Kaefer, Associate Professor, Loyola University Chicago, Loyola University Chicago, 1 E. Pearson Room 372, Chicago, IL, 60611, United States, fkaefer@luc.edu

Designers of Wireless Local Area Networks (WLANs) use access points to provide areas of coverage for their wireless users. At the same time, security considerations often cause designers of WLANs to limit coverage of areas that are outside of their organizations physical boundaries. Incorporating restrictions on areas of coverage increases the complexity of design. This research develops a multi-objective model for designing WLANs that address security considerations.

■ MC58

S-Pike (Lev. 4)

Software Evolution and Organization Dynamics

Cluster: New Product Development
Invited Session

Chair: Jurgen Mihm, Assistant Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, jurgen.mihm@insead.edu

1 - Organizational Influences on Product Architecture and Their Performance Impact
Alan MacCormack, Harvard Business School, Soldiers Field Park, Boston, MA, 02163, United States, amaccormack@hbs.edu, Carliss Baldwin, John Rusnak

Much work posits a relationship between the design of organizations and the products they produce. Yet little evidence confirms this link or explores its impact. We examine these issues in software. We show that software developed by open source teams is more modular than similar products from commercial firms; and modular software is more evolvable. Our results suggest a product design is driven by factors other than function, with long term and unintended consequences for performance.

2 - Social Networks and Individual Performance in Open Source Software Communities
Il-Horn Hann, Marshall School of Business, USC, 3670 Trousdale Parkway, Los Angeles, CA, 90089, United States, hann@marshall.usc.edu, Jeffrey Roberts, Sandra Slaughter

We examine social network dynamics and participation in several projects of the Apache open source community. Understanding how open source developers communicate and interact, and how this social interaction affects their participation is interesting and important, given the geographic distribution of the developers and the unstructured process of software development in the open source context.

3 - Studying the Dynamics of Software Architectures
Manuel Sosa, Assistant Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu, Jurgen Mihm, Tyson Browning

We report the results of an exploratory study to investigate how the architecture of software products evolves over time. We illustrate our approach by examining the evolution over several versions of an open source product. Implications for research are discussed.

4 - Hierarchies and Decision Making Dynamics
Jurgen Mihm, Assistant Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, jurgen.mihm@insead.edu, Christoph Loch, Bernardo Huberman, Dennis Wilkinson

Through a series of analytic models as well as extensive simulations we explore the effect of different hierarchical setups and different decision making cultures on task outcomes and task completion timing.

■ MC59

S-Seneca (Lev. 4)

Management of Technology

Contributed Session

Chair: Shekhar Jayanthi, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, jayans@rpi.edu

1 - Product and Industry Life Cycle in Aircraft
Jorge Niosi, Professor, Université du Quebec, PO Box 8888 Statin Centre Ville, Montreal, Qc, H3C 3P8, Canada, niosi.jorge@uqam.ca, Majlinda Zhegu

Patent, company and product record over the last century shows that some dimensions of the PLC and ILC theory are confirmed (dominant designs and economic concentration occurred) but others are not: geographic delocalisation, knowledge diffusion did not occur and innovation proceeds at higher rates today than at the beginnings of the industry. We suggest that government support, complex product and operation technology are obstacles to the international diffusion of this industry.

2 - Association Between Rare Operational Failures and Performance
Manpreet Hora, Ivey Business School, UWO, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, mhora@ivey.uwo.ca

This study argues that firms that there is a negative association between rare operational failures and performance. Moreover, the impact on performance may be higher for smaller firms and for firms with high informational intensity.

I investigate this association in the context of ERP systems. Developing a dataset of operational failures occurring during post-implementation stage of ERP systems, I use event study methodology and ordinary least squares regression to verify the association.

3 - An Integer Programming Model for the Timely Completion of College Graduation Requirements

Avi Dechter, California State University, Northridge, College of Business and Economics, 18111 Nordhoff Street, Northridge, CA, 91330-8378, United States, adechter@csun.edu

Students who pursue baccalaureate degrees in so-called four-year universities often take far longer than four years to complete their degrees. This is due, in large part, to the complexity of graduation requirements and rules. We present an ILP model for finding an academic plan that would satisfy a set of graduation requirements in the shortest possible time. Such a model can enhance existing academic advising tools designed to help students in planning for timely completion of their degrees.

4 - Dynamics of Industrial Innovations

Shekhar Jayanthi, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States, jayans@rpi.edu, Shu Han

Capturing and modeling the locus of innovations is critical to their successful development. Using longitudinal panel data from the information technology industry, we identify dynamic innovation types and their distinguishing characteristics. Theoretically, this study extends our understanding of the dynamic interplay between development and use of multiple ongoing industrial innovations.

■ MC60

S-University (Lev. 4)

Panel Discussion: Innovation and Product Development: Engineering, Organizational and Technology Perspectives

Sponsor: Technology Management
Sponsored Session

Chair: Riitta Katila, Stanford University, Terman Engineering Center, MS&E dpt, Stanford, CA, 94305, United States, rkatila@stanford.edu

1 - Panel Discussion: Innovation and Product Development: Engineering, Organizational and Technology Perspectives

Moderator: Riitta Katila, Stanford University, Terman Engineering Center, MS&E dpt, Stanford, CA, 94305, United States, rkatila@stanford.edu, Panelist: Linda Argote, Wallace Hopp, Suresh Kotha, Christoph Loch, James Utterback

In this panel session, leading scholars of technology and innovation discuss current topics in the intersection of engineering, innovation and technology. The panel will examine current trends in product innovation research and outline fruitful future research directions.

Monday, 4:30pm - 6:00pm

■ MD01

C-Room 602

Supply Chain Optimization I

Contributed Session

Chair: Syed Shahabuddin, Professor, Central Michigan University, 203C Smith Hall, Mt Pleasant, MI, 48858, United States, shaha1s@cmich.edu

1 - Integrated Scheduling in a Customer Driven Supply Chain

Tadeusz Sawik, Professor, AGH University of Science & Technology, Al. Mickiewicza 30, Krakow, 30059, Poland, ghsawik@cyf-kr.edu.pl

A mixed integer programming approach is proposed for the integrated scheduling of manufacturing and supply of parts and assembly of products in a customer driven supply chain. The problem objective is to coordinate manufacturing, supply and assembly such that the total system inventory holding, manufacturing set up and part shipment costs are minimized. Numerical examples modeled after a real-world integrated scheduling in the electronics industry are presented.

2 - A Multi-objective Approach for Supply Chain Design Considering Risk

Amir Azaron, Postdoctoral Fellow, Department of Industrial Engineering, Dalhousie University, P.O. Box 1000, 5269 Morris Street, Halifax, NS, B3J 2X4, Canada, a.azaron@dal.ca, S. Armagan Tarim, Kenneth N. Brown

We develop a multi-objective stochastic programming approach for supply chain design under uncertainty. Demands, supplies, processing, transportation and shortage costs are considered as uncertain parameters. Our multi-objective model includes the minimizations of (i) expected total costs, (ii) variance of the total costs, and (iii) financial risk. Finally, we use goal attainment technique to obtain the Pareto-optimal solutions.

3 - Assessing the Maturity Level of Environmental Business Processes

Kelly Cowan, Doctoral Student, Portland State University, P.O. Box 751, Portland, OR, 97207, United States, kcowan@pdx.edu, Robert Harmon

Green Supply Chain Management (GSCM) is an emerging field of ecological business practice that needs to be examined with the latest citation analysis tools to help categorize recent literature and assist both academicians and practitioners.

4 - Supply Chain and Its Effectiveness

Syed Shahabuddin, Professor, Central Michigan University, 203C Smith Hall, Mt Pleasant, MI, 48858, United States, shaha1s@cmich.edu

Supply chain is a set of activities needed to manage the flow of products from the source to the users. The competitive market has forced companies to become efficient and respond quickly to market. Many companies believe that supply chain reduces cost and serves customers efficiently. The question is: are companies with supply chain more profitable than companies without. My paper will compare the performance of companies using supply chain with companies not using supply chain.

■ MD02

C-Room 603

Auctions and Mechanism Design in Supply Chain Management

Cluster: Supply Chain
Invited Session

Chair: Rachel Zhang, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, United States, rzhang@ust.hk,

Co-Chair: Rachel Chen, University of California at Davis, Graduate School of Management, Davis, CA, United States, rachen@ucdavis.edu

1 - Optimal and Approximate Supplier Selection Mechanisms

Mahesh Nagarajan, Asst. Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, v6t 1z2, Canada, mahesh.nagarajan@sauder.ubc.ca

We consider a class of supplier selection problems with non contractible attributes. We pose these problems as infinite dimensional L.P.s. Direct applications of duality fail in giving insights and solutions to these problems. We use techniques that are variants of inner approximations to solve for the optimal trading mechanism as well as to analyze the performance of heuristic methods. We prove convergence properties of such problems as well as insights that may be of practical relevance.

2 - Mitigating Cost Shocks Through Supply Base Design

Zhixi Wan, PhD Candidate, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, wanzhixi@umich.edu, Damian Beil

A buyer must select a set of suppliers to maintain as a supply base. Contracts are auctioned periodically and the buyer seeks to minimize long-term expected costs. Suppliers in the same region have correlated costs, and the buyer can mitigate the influence of correlated costs by choosing suppliers from different regions. We find that full diversification - choosing suppliers from as many different regions as possible - is not always optimal, as similar costs can enhance auction competition.

3 - Truthful Bundle/Multi-unit Double Auction Mechanism Design

Leon Chu, Marshall School of Business, University of Southern California, Bridge Hall 401, Los Angeles, CA, 90089, United States, leonyzhu@usc.edu

We address the mechanism design problem for an exchange market with multiple buyers and sellers. Each buyer asks for a bundle of various commodities, and each seller provides multiple units of one commodity. We implement a novel padding technique to design the truthful double auction mechanisms under the multi-stage design approach. To the best of our knowledge, these are the first strategy-proof, individually rational, budget-balanced mechanisms for the specified exchange environment.

4 - Group Buying Mechanisms for Business-to-business Exchanges
Rachel Chen, University of California at Davis, Graduate School of Management, Davis, CA, United States, rachen@ucdavis.edu, Rachel Zhang, Cuihong Li

In group buying, quantity discounts are offered based on the buyers' aggregated purchasing quantity. We consider group buying mechanisms in business-to-business exchanges with one seller and multiple buyers. Each buyer has private information regarding his valuation of the product, which varies with the number of units he acquires. We study the buyers' bidding behavior, and compare the buyers' surplus, the seller's revenue, and the social welfare under several group-buying mechanisms.

■ MD03

C-Room 604

Behavioral Operations

Cluster: Supply Chain
Invited Session

Chair: Xuanming Su, University of California, Haas School of Business, Berkeley, 94720, United States, xuanming@haas.berkeley.edu

1 - Do Principal-agent Contracts Work in Real Life?
Kay-Yut Chen, Principal Scientist, Hewlett-Packard Laboratories, MS 1U-2, HP Labs, 1501 Page Mill Road, Palo Alto, Ca, 94304, United States, kay-yut.chen@hp.com, Bernardo Huberman, Basak Kalkanci

We study the agency problem experimentally focusing on two issues. The first tests whether an incentive compatible mechanism performs well. The second addresses the issue of the principal's lack of knowledge as to how types and effort levels relate to the final outcome. Our results reveal several behavioral effects that reduce the efficiency of the principal-agent mechanism. These behavioral issues may explain why contract designed by principal-agent modeling are seldom used in practice.

2 - Service Dynamics Under Repeated Interactions
Sam Aflaki, INSEAD, Blvd de Constance, Fontainebleau, 77300, France, sam.aflaki@insead.edu, Ioana Popescu

We model the dynamics of a service relationship where the provider can adjust the service level offered to customers in each period. Customers periodically decide to renew the service contract based on previous experiences and future expectations. We characterize the firm's optimal service strategies under various models of consumer behavior. In particular, we identify what behavioral patterns and properties of the firm's cost structure lead to oscillating vs. monotone service paths.

3 - An Experimental Study on Social Preferences and Supply Chain Performance
Yaozhong Wu, Assistant Professor, NUS Business School, BIZ2 #03-08, 1 Business Link, National University of Singapore, Singapore, 117592, Singapore, bizwyz@nus.edu.sg, Christoph Loch

Supply chain contracting literature traditionally has focused on aligning incentives for economically rational players. We provide experimental evidence that social preferences for relationship and status systematically affect economic decision making in supply chain transactions, such that relationship preference promotes cooperation, individual performance, and high system efficiency, whereas status preference induces tough actions and reduces both system efficiency and individual performance.

4 - Bounded Rationality in Newsvendor Models
Xuanming Su, University of California, Haas School of Business, Berkeley, 94720, United States, xuanming@haas.berkeley.edu

We propose a decision framework of bounded rationality. While the best decision need not always be made, better decisions are made more often. We identify systematic over-ording and under-ordering biases, and we analyze a data-set of newsvendor-type decisions made by individual subjects in a laboratory setting. We also investigate the impact of these biases on other inventory settings, such as supply chain contracting, the bullwhip effect, and inventory pooling.

■ MD04

C-Room 606

Tutorial: The Coordination of Pricing and Production Decisions

Cluster: Tutorials
Invited Session

1 - The Coordination of Pricing and Production Decisions
Nicholas G. Hall, Professor, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States, hall_33@cob.osu.edu

We review the literature on deterministic models for the coordination of pricing and production decisions. We present recent research results on the coordination of pricing and job-by-job scheduling decisions. We also discuss a competitive, multiple player environment where available capacity is auctioned and resulting schedules are thus determined. Promising directions for future research are identified.

■ MD05

C-Room 607

OR History

Cluster: History of OR/MS
Invited Session

Chair: Ernest Koenigsberg, University of California at Berkeley, W A Haas School of Business, Berkeley, CA, 94115, United States, ekoenigsb@aol.com

1 - Maintenance Modelling: Tony Christer
Maurice Kirby, Professor, The Management School, Lancaster University, Lancaster, La, LA1 4YX, United Kingdom, m.kirby@lancaster.ac.uk

This paper assesses the contribution of Tony Christer as a significant OR researcher in the area of maintenance modelling. A leading figure within the British Operational Research Society, he received international acclaim for his work on the random nature of failures and the stochastical growth of hidden defects.

2 - The Researcher and the Manager, Revisited – A Historical Perspective
Heiner Müller-Merbach, Technische Universität Kaiserslautern, Wirtschaftsinformatik & OR,Postfach 30 49, Erwin-Schrödinger-Strafle, Geb. 42-420, D-67653 Kaiserslautern, Deutschland, Germany, hmm@bior.de

In 1965 Churchman and Schainblatt pleaded for mutual understanding between the (operations) researcher and the manager (Mgmt Sci., Feb. 1965, Oct. 1965). Other bridges with a related purpose were suggested by Ackoff, Boothroyd, Checkland, Cook, Little, Mintzberg, Miser, Rivett and others. A historical survey shall be given, results and reactions included.

3 - Charles Bartlett McGuire: An Appreciation
Roy Radner, Stern School of Business, New York University, rradner@stern.nyu.edu

The research, writing, and teaching of Charles Bartlett McGuire (1926-2006) spanned a diverse set of topics in microeconomic theory and operations research. Although most widely known for his pioneering book (with M. Beckmann and C. Winsten), Studies in the Economics of Transportation (1956), he also worked on the prevention of accidental nuclear war, team theory, the economic value of information, leasing of federal land for coal exploration, decentralization of electricity grids, auctions for electric power plants, markets for ozone-depleting pollution permits, and general sorting theory. In this paper I shall describe some of this work, both published and unpublished.

4 - Foster Weldon's Contributions in OR
Lloyd Yates, Consultant, 200 Molino Avenue, Mill Valley, CA, 94941, United States, macyates1@mac.com

He joined a group of scientists at the Naval Ordnance Laboratory who were developing an advanced naval mine in 1942 and then worked as an Operations Analyst with military forces in the Pacific in implementing the mining attack on maritime traffic in Japanese waters and elsewhere. In 1950 he joined the Weapons System Evaluation Group, an OR group for the Joint Chiefs of Staff. He then joined the Operations Research Office of the US Army and worked on a variety of OR projects in the US and overseas. In late 1956 he joined Matson Navigation to build the first Research Department in a steamship company. OR studies of Matson's shipping operations led to pioneering the implementation of a complete system concept for containerization in steamship operations.

■ MD06

C-Room 608

MSOM FELLOWS Presentations

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Gerard Cachon, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu

Co-Chair: Martin Lariviere, Professor, Kellogg School of Management, Northwestern Univeristy, 2001 Sheridan Rd, Evanston, IL, 60091, United States, m-lariviere@kellogg.northwestern.edu

1 - Reflections on the Field of Revenue Management
Garrett van Ryzin, Columbia University, 412 Uris Hall, New York, NY, 10027, United States, gjv1@columbia.edu

I will offer some personal reflections on my experience in the field of revenue management and why, after many years, it still continues to interest me. I'll also try to draw lessons learned from various successes and failures along the way, both in terms of my direct project experience and my observations of the field overall.

■ MD07

C-Room 609

Joint Session MSOM/Managing Disruptions: Supply Chain Disruption Management

Sponsor: Manufacturing & Service Oper Mgmt, Managing Disruptions
Sponsored Session

Chair: Max Shen, Associate Professor, University of California, Department of IEOR, Berkeley, CA, 94720-1777, United States, shen@ieor.berkeley.edu

Co-Chair: Lawrence Snyder, Assistant Professor, Department of Industrial and Systems Engineering, Lehigh University, 200 West Packer Avenue, Mohler Lab, Bethlehem, PA, 18015, United States, larry.snyder@lehigh.edu

1 - Strategic Risk Mitigation of Supply Chain Disruptions
Zigeng Yin, Northwestern University, Department of IE/MS, Evanston, IL, United States, z-yin@northwestern.edu, Wallace Hopp, Seyed Iravani

Supply chains are vulnerable to disruption from a variety of sources. These can result in both short-term loss of revenue and long-term shifts in market share. We present a model that captures both tactical and strategic consequences of business continuity disruptions of supply chains in competitive environments. We use our analytic and numerical results to highlight the conditions that magnify the consequences of supply chain disruptions and to identify policies for minimizing resulting risks.

2 - A Model of Facility Hardening in the Presence of Disruptions
Michael Lim, Northwestern University, Department of IE/MS, Northwestern University, Evanston, IL, 60208, United States, m-lim2@northwestern.edu, Mark Daskin, Sunil Chopra, Achal Bassamboo

We formulate a location problem incorporating facility hardening in the presence of random disruptions. We show the presence of two regimes: one using only hardened facilities and one using hardened and non-hardened sites. We examine the impact of misestimating the failure probability and derive managerial policies to mitigate facility disruptions.

3 - Risk-averse Policies in a One-Warehouse Multiple-Retailer System with Demand and Supply Uncertainty
Amanda Schmitt, PhD Candidate, Lehigh University ISE Dept., 200 W. Packer Ave., Bethlehem, PA, 18015, United States, amanda@lehigh.edu, Max Shen, Lawrence Snyder

We examine demand and supply uncertainty in a One-Warehouse Multiple-Retailer system and compare centralized and decentralized inventory strategies. We show that while risk pooling generates lower expected costs in a centralized strategy, risk diversification generates lower risk in a decentralized strategy. We demonstrate that under certain risk-averse objectives, decentralizing inventory is the optimal policy for the OWMR system.

4 - Manufacturing Disruption Management with Cross Pricing and Cross Production
Tieming Liu, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, tieming.liu@okstate.edu, Max Shen, Ho-Yin Mak

We study the optimal capacity investment portfolio of a firm by considering responsive pricing and partial manufacturing flexibility. The firm produces two substitutable products and invest in resources that can be used for both products but with different efficiencies. We characterize the structure of the optimal pricing and allocation policies and derive managerial insights on the benefits of production and pricing flexibilities.

■ MD08

C-Room 611

Supply Chain Coordination and Risk Sharing for Managing Disruptions

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Samar Mukhopadhyay, Associate Professor, University of Wisconsin-Milwaukee, University of Wisconsin-Milwaukee, 3202 N. Maryland Ave, S493, Milwaukee, WI, 53201, United States, samar@uwm.edu

1 - Random Yield Risk Sharing in a Two-level Supply Chain
Jiang Zhang, Assistant Professor, Adelphi University, School of Business, Garden City, NY, 11530, United States, zhang@adelphi.edu, Yuanjie He

We study a simple supply chain with one manufacturer and one retailer where there are random yield production and uncertain demands. We propose several risk sharing contracts that distribute the random yield risk among parties and evaluate the supply chain performances. We also compare the results of proposed contracts and find that under certain conditions, yield randomness might enhance the supply chain performance and decrease the double marginalization effect.

2 - Dynamic Constraint Formulation for Supply Chain Disruptions
Julie Drzymalski, PhD Candidate, Lehigh University, Mohler Laboratory, 200 W. Packer Ave, Bethlehem, PA, 18015, United States, jud204@lehigh.edu, Nicholas Odrey

A hierarchical Petri net (PN) approach is taken to model a multi-echelon Supply Chain (SC) using a modular approach for the process steps and performance measures. Our modeling is extracted from the SCOR 8.0 model. Strategic and operational policies are considered dynamic. In response to a disruption, these policies are optimized and enforced on the system as dynamic constraints. These constraints, combined with the place invariants of the PN, yield a supervisory net for control of the SC.

3 - Joint Procurement and Production Decisions in Remanufacturing with Uncertainty in Quality and Demand
Huafan Ma, University of Wisconsin-Milwaukee, 3202 N. Maryland Ave, S333, Milwaukee, WI, 53201, United States, mahuafan@uwm.edu, Samar Mukhopadhyay

We address the uncertainty issue due to the random yield and demand in a remanufacturing system where both used and new parts can serve as inputs in the production process to satisfy the demand. We determine the optimal procurement and production quantity for the firm. Three different cases are presented depending on the amount of information the firm has on the yield rate. We also investigate how the degree of availability of information about yield rate affects the firm's decision making.

■ MD09

C-Room 612

Judgment and Decision Models for Threat Intervention and Consequence Mitigation

Cluster: Homeland Security
Invited Session

Chair: Michael Samsa, Decision Support and Risk Management Group Leader, Argonne National Laboratory, 9700 South Cass Avenue, Building 900, Argonne, IL, 60439, United States, msamsa@anl.gov

1 - Modeling Aviation Passenger Security Processes: A Judgment and Dynamic Decision-Making Approach
Ignacio J. Martinez-Moyano, Computational Scientist, Argonne National Laboratory, 9700 South Cass Avenue, Building 900, Argonne, IL, 60439, United States, imartinez@anl.gov, Andrew Cox, Chris Krahe, Stephen Conrad

A model of airport passenger security checkpoint operations using system dynamics and social judgment theory is presented. We model screening operations as a detection-selection problem of judgment embedded in a dynamic decision-making environment with multiple competing goals and strong socio-technical interactions. The model aims to capture a feedback-rich representation of the security checkpoint process in order to identify leverage points, leading to increased efficiency and effectiveness.

2 - Decision Support for Assessing Vulnerability Among Interdependent Critical Infrastructure Systems

Earl Rusty Lee, Assistant Professor, University of Delaware, Dept. of Civil and Env Engr, 360G Dupont Hall, Newark, DE, 19716, United States, elee@udel.edu, William Wallace, John E. Mitchell

A system of systems model has been built which takes into account vulnerability due to interdependency. MUNICIPAL (the MUlti-Network Interdependent Critical Infrastructure Program for Analysis of Lifelines) consists of an interdependent layered network model, its supporting algorithms and the necessary linkages to databases and GIS displays. The system can be used to check the existing network for vulnerability due to interconnectedness and for the design of truly redundant, independent paths.

3 - Chasing Shadows: Assessing the Terrorist Threat

Gary Ackerman, Research Director, National Consortium for the Study of Terrorism and Responses to Terrorism, 3300 Symons Hall, College Park, MD, 20742, United States, gackerman@start.umd.edu

Of the three main legs of terrorist risk assessment - threat, vulnerability and consequence - threat aspects are often underdeveloped in homeland security analysis tools based on traditional risk analysis. This presentation will introduce several types of threat assessment tools in order to illustrate how threat assessment can be integrated into the larger task of comprehensive risk assessment and how novel insights from the social sciences can inform analyses of terrorism risk.

4 - CIPMA: Enhancing the Protection of Australia's National Critical Infrastructure

Greg Scott, Leader, Critical Infrastructure Project, Geoscience Australia, Risk & Impact Analysis Group, Canberra, Australia, greg.scott@ga.gov.au

The CIP Modelling and Analysis (CIPMA) Program will provide Australian governments and industry with a quantitative understanding of the vulnerability or resilience of national CI systems and networks across a number of priority industry sectors (including energy, communications, water, etc.). CIPMA integrates the geospatial analysis and visualisation of CI networks, with system dynamic models that simulate system behaviour and business rules that are applied to network disruptions.

■ MD10

C-Room 613

Primal-dual Algorithms for Inventory Management Problems

Cluster: Inventory
Invited Session

Chair: Retsef Levi, Robert N. Noyce Career Development Professor, Assitant Professor of Management, MIT, Sloan School of Management, 50 Memorial Drive, E53-389, Cambridge, MA, 02142, United States, retsef@mit.edu

1 - A Primal-dual 2-Approximation Algorithm for the Joint Replenishment Problem

David Shmoys, Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States, shmoys@cs.cornell.edu, Retsef Levi, Robin Roundy

We give a primal-dual 2-approximation algorithm (finding a solution of cost twice optimal) for the classical NP-hard joint replenishment problem over a discrete time-horizon with deterministic time-dependent demand. In each time period we are given demand for each item and can order any subset of items paying a joint fixed cost and a fixed cost for each item ordered. On-hand inventory incurs item-dependent holding costs. We must satisfy all demand on time to minimize the fixed and holding costs.

2 - Primal-dual Algorithms for Inventory Problems with General Concave Costs

Dan Stratila, MIT, dstrat@mit.edu, Thomas Magnanti

Recently, we introduced a general technique for obtaining primal-dual algorithms for concave cost problems based on such algorithms for fixed charge problems. By applying our technique together with existing primal-dual algorithms for deterministic inventory models, we obtain a new algorithm for the lot-sizing problem with concave ordering costs, and a new 2-approximation algorithm for the joint replenishment problem with concave ordering costs. We also discuss more general inventory models.

3 - Prima-dual Online Algorithms for Make-to-order Inventory Control Models

Retsef Levi, Robert N. Noyce Career Development Professor, Assitant Professor of Management, MIT, Sloan School of Management, 50 Memorial Drive, E53-389, Cambridge, MA, 02142, United States, retsef@mit.edu, Konstantin Makarychev, Maxim Sviridenko, Niv Buchbinder, Tracy Kimbrel

Consider an online make-to-order inventory model under the cost structure of the joint replenishment problem. The goal is to minimize overall joint and item fixed ordering costs and delay penalty costs due to customers waiting. Future demands are not known, assumed to be generated by a worst-case adversary. We propose a novel 3-competitive primal-dual online algorithm, which cost is guaranteed to be at most 3 times the optimal offline cost, knowing the complete sequence of demands upfront.

■ MD11

C-Room 614

Supply Chain Competition, Risk, and Asymmetric Information

Cluster: Manufacturing
Invited Session

Chair: Hui Zhao, Purdue University, Krannert School of Management, West Lafayette, IN, 47906, United States, zhaoh@purdue.edu

1 - Collaboration in Contingent Capacities with Information Asymmetry

Jun Zhang, Assistant Professor, University of Texas at Dallas, School of Management, Richardson, TX, United States, jun.zhang@utdallas.edu, Amiya Chakravarty

We study the optimal contracting problem between two firms collaborating on capacity investment with information asymmetry. Our analysis shows that system efficiency can always be improved by the optimal contract and the improvement in system efficiency is due to two factors. While the optimal contract may bring the system's capacity level closer to the first-best capacity level, it prevents the higher-margin firm from overinvesting and aligns the capacity-investment decisions of the two firms.

2 - Vertical De-Integration in the Supply Chain: Selling the Retailer's Factory

Candace Yano, Professor, University of California, Industrial Engineering and OR, Haas School of Business, Berkeley, CA, 94720, United States, yano@ieor.berkeley.edu, Elizabeth Durango-Cohen

Many large grocery chains own factories that produce their store-brand products, and they often wonder whether they should sell the factories to a third party that would operate the factories for them. We investigate this issue in situations where store-brand and national-brand products compete at the retail level. We discuss the impact on equilibrium prices, as well as on the retailer's profit, and the impact of capacity constraints on the nature of competition in this context.

3 - Quality-based Supplier Selection with Asymmetric Information

Hui Zhao, Purdue University, Krannert School of Management, West Lafayette, IN, 47906, United States, zhaoh@purdue.edu, Kwei Tang, Xinghao Yan

We explore quality-based supplier selection when quality is suppliers' private information and quality itself also exhibits uncertainty. We analyze quality promise scenario (QP), a signaling game, and quality requirement scenario (QP), a screening game. We find that under certain conditions, both QP and QR may achieve the ideal outcome to the buyer due to the competition among suppliers. Surprisingly, simple requirement strategy with no screening may outperform both QP and QR with screening.

4 - Risk-sensitive Supply Chain Coordination

Danko Turcic, Dept.. of Operations, Case Western Reserve University, Weatherhead School of Management, 330 Peter B Lewis Building, Cleveland, OH, 44106, United States, danko.turcic@case.edu, Matthew Sobel

People are significantly sensitive to risk, but the definition of supply chain coordination presumes risk neutrality. With an extended definition we show that there is a coordinating contract even if the parties are not risk neutral. Also, a systematic bias results from a widely invoked misspecification of time/risk preferences.

■ MD12

C-Room 615

Project Scheduling

Cluster: Scheduling
Invited Session

Chair: Erik Demeulemeester, Professor, Catholic University Leuven, FETEW, KBI, Naamsestraat 69, Leuven, BE-3000, Belgium, Erik.Demeulemeester@econ.kuleuven.be

1 - Heuristics for Order Acceptance and Capacity Planning

Jade Herbots, Katholieke Universiteit Leuven, FETEW, KBI, Naamsestraat 69, Leuven, BE-3000, Belgium, jade.herbots@econ.kuleuven.be, Willy Herroelen, Roel Leus, Erik Demeulemeester

We investigate order acceptance and capacity planning under limited regular and non-regular resources. Our goal is to maximize the expected profits of the accepted projects within a finite planning horizon. The way in which projects are planned affects their payout time and as a consequence, the reinvestment revenues, as well as the available capacity for future arriving projects. Simulation experiments compare the performance of our procedures to a baseline heuristic, commonly used in practice.

2 - A Heuristic Methodology for Solving Spatial Resource-constrained Project Scheduling Problems

Eline De Frene, Catholic University Leuven, FETEW, KBI, Naamsestraat 69, Leuven, BE-3000, Belgium, eline.defrene@econ.kuleuven.be, Stijn Vandevonder, Damien Schatteman, Willy Herroelen

Our review of standard project scheduling problems revealed that the present methodologies in project scheduling fail to manage spatial resources, and as result give unrealistic schedules. Spatial resources have characteristics of both renewable and non-renewable resources. When scheduling spatial resources, deadlocks can occur. We present a new solution method for generating feasible baseline schedules based on the application of a schedule generation scheme on a priority list of activities.

3 - The Robust Resource Availability Cost Problem

Olivier Lambrechts, Catholic University Leuven, FETEW, KBI, Naamsestraat 69, Leuven, BE-3000, Belgium, Olivier.lambrechts@econ.kuleuven.be, Erik Demeulemeester, Willy Herroelen

Most of the research on robust project scheduling focuses on the scheduling phase assuming a given due-date and resource availability. We extend this work by assuming that a specific project content needs to be delivered by a certain deadline with minimal costs while respecting activity precedence relations and resource capacity constraints that result from resource allocation decisions. Total costs consist of regular resource costs, overtime costs and stability costs.

4 - Reactive Scheduling in the MRCPSP Through Optimal Search Techniques

Filip Deblaere, Catholic University Leuven, FETEW, KBI, Naamsestraat 69, Leuven, BE-3000, Belgium, filip.deblaere@econ.kuleuven.be, Willy Herroelen, Erik Demeulemeester

The multi-mode resource-constrained project scheduling problem (MRCPSP) involves the determination of a baseline schedule of the project activities, which can be executed in multiple modes, satisfying the precedence relations and resource constraints while minimizing the project duration. During the execution of the project, the baseline schedule may become unfeasible due to numerous types of disruptions. We propose an optimal reactive scheduling procedure for repairing a disrupted schedule.

■ MD13

C-Room 616

Group Theoretic Approaches in Mixed Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Jean-Philippe Richard, Assistant Professor, Purdue University, 315 North Grant Street, West Lafayette, IN, 47907, United States, jprichar@ecn.purdue.edu

1 - On a Generalization of the Master Cyclic Group Polyhedron

Ricardo Fukasawa, GeorgiaTech, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, rfukasaw@isye.gatech.edu, Sanjeeb Dash, Oktay Gunluk

We study the Master Equality Polyhedron (MEP) which generalizes the Master Cyclic Group Polyhedron (MCGP) and the Master Knapsack Polyhedron (MKP) and present a characterization of its nontrivial facet-defining inequalities. In addition, we analyze how to lift facet-defining inequalities for the MCGP to obtain facet-defining inequalities for the MEP. Finally, we present a mixed-integer extension of the MEP and show how to obtain valid inequalities for general MIPs using facets of the MEP.

2 - Sequential-merge Inequalities for Infinite Group Problems

Santanu Dey, Purdue University, 105 East Oak Street, West Lafayette, IN, United States, sdey@purdue.edu, Jean-Philippe Richard

In this talk, we present relations between facet-defining inequalities of infinite group problems with different dimensions. We show that these relations explains all known non-aggregation based facet-defining inequalities of high-dimensional group problems. We show in an example that these new inequalities generate cuts that are not in the rank-1 split closure of an IP. This procedure also shows how facets of two-dimensional group problems generate a subfamily of the two-step MIR inequalities.

3 - Some New T-space Facets

K. Chen, Georgia Tech, School of Mathematics, Atlanta, GA, 30332, United States, kchen@math.gatech.edu, Ellis Johnson, William Cook

We discuss the infinite group master polyedron and its connection to the generation of cutting planes for general mixed-integer programming. In 2003, Gomory and Johnson gave two different three-slope T-space facet constructions, both of which shared a slope with the corresponding Gomory mixed-integer cut. We give a new three-slope facet which is independent of the GMIC. We also give the first four-slope T-space facet construction.

■ MD14

C-Room 617

Portfolio Selection via NLP

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Victor DeMiguel, Assistant Professor, London Business School, Regents Park, London, NW14SA, United Kingdom, avmiguel@london.edu

1 - Sparse Mean Reverting Portfolios

Alexandre d'Aspremont, Princeton University, E-Quad E424, Princeton, NJ, United States, aspremon@princeton.edu

We study the problem of extracting a sparse portfolio with maximum mean reversion given historical prices time series on a given set of assets. We derive a semidefinite relaxation for this problem and study its performance on numerical examples.

2 - Portfolio Selection with Robust Estimation

Francisco J. Nogales, Assistant Professor, Universidad Carlos III de Madrid, Spain, FcoJavier.Nogales@uc3m.es, Victor DeMiguel

It is well-known that traditional portfolios have unstable weights that fluctuate substantially over time. We propose a class of portfolios with better stability properties. These portfolios are constructed using certain robust estimators and can be computed by solving a single nonlinear program, where robust estimation and portfolio optimization are performed in a single step. The new portfolios are more stable and have better out-of-sample performance than the traditional ones.

3 - Improving Portfolio Performance by Constraining the Portfolio Norm

Victor DeMiguel, Assistant Professor, London Business School, Regents Park, London, NW14SA, United Kingdom, avmiguel@london.edu, Francisco J. Nogales

To reduce the impact of estimation error on portfolio performance, we propose computing the portfolios that minimize the sample variance subject to the additional constraint that the norm of the portfolio-weight vector must be smaller than a certain threshold. We show that these portfolios generalize several policies from the literature. Our empirical results show that the proposed portfolios perform very well out-of-sample.

■ MD15

C-Room 618

Stochastic Programming and Applications

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Lewis Ntaimo, Assistant Professor, Industrial and Systems Engineering, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, ntaimo@tamu.edu

1 - A Scenario-based Branch-and-cut Algorithm for Stochastic Programs with Probabilistic Constraints

Matthew Tanner, Texas A&M University, Zachry Hall, College Station, TX, 77842, United States, mtanner@tamu.edu, Lewis Ntaimo

We present reformulations of deterministic equivalents to stochastic programs with discretely distributed probabilistic constraints. We derive new cuts for this problem based upon irreducibly infeasible subsets of the constraint set. Finally, we present a scenario-based branch-and-cut implementation that includes these cuts and others from prior research. We give computational results using test instances from optimal vaccine allocation.

2 - Computational Comparisons of Stopping Rules for Stochastic Decomposition (SD)

Guzin Bayraksan, Assistant Professor, University of Arizona, P.O. Box 210020, Tucson, AZ, 85721, United States, guzinb@sie.arizona.edu, Binyuan Chen, Suvrajeet Sen

Stochastic decomposition (SD) incorporates sampling-based approximations within the L-shaped method. Current implementations of SD use stopping rules that are guided by bootstrapped (in-sample) duality gap estimates. We develop several other stopping rules using out-of-sample estimates, and compare their performance on several test problems.

3 - A Stochastic Integer Program for Prioritization

David Morton, Associate Professor, The University of Texas at Austin, Graduate Program in Operations Research, Austin, TX, United States, morton@mail.utexas.edu, Ali Koc, Dennis Michalopolous

Priority lists are common in industry and government. In contrast, a combinatorial optimization problem with a knapsack constraint takes as input a budget and binary activity costs. Such models provide a prioritization only in that an activity is selected or not. If the budget or activity costs are uncertain when selecting the activities then it is sensible to create a partially-ordered priority list. We describe a stochastic integer program to do so in the context of motivating applications.

4 - A Real-time Model for the Stochastic Vehicle Routing Problem

Clara Novoa, Assistant Professor, Texas State University, Engineering and Technology Department, 601 University Drive, San Marcos, TX, 78666, United States, cn17@txstate.edu

We develop a stochastic integer programming model for solving the vehicle routing problem with random customer demands in real-time. Every time a vehicle arrives to a new customer, we compare the actual demand against the range of predicted demands for which a current route plan remains valid and decide if it is necessary to solve the model again. We compare our solutions to ones from an approximate dynamic programming approach.

■ MD16

C-Room 619

Decentralized Optimization

Cluster: Optimization (Invited)
Invited Session

Chair: Shih-Fen Cheng, Assistant Professor, Singapore Management University, 80 Stamford Road, Singapore, 178902, sfcheng@smu.edu.sg

1 - Modeling the Contract Manufacturers' Strategic Crossroad

David Wu, Dean of Engineering, Lehigh University, 19 Memorial Drive West, Bethlehem, PA, 18017, United States, sdw1@lehigh.edu, Chung-Yee Lee, Banu Gemici

Contract Manufacturer (CM) often faces the strategic options of devoting its capacity entirely to a brand-carrying customer (BC), or leveraging its capabilities to develop its own market presence. We propose an analytical model that analyzes market demand dynamics, process and resource synergies, as well as market-entry timing.

2 - Combinatorial Auction for Multi-period Distributed Resource Allocation

Shih-Fen Cheng, Assistant Professor, Singapore Management University, 80 Stamford Road, Singapore, 178902, sfcheng@smu.edu.sg, Hoong Chuin Lau, Thin Yin Leong

In this talk, we consider the problem of resource allocation where information and optimization decisions are decentralized. Our goal is to find an efficient mechanism that allows resources from a central pool to be allocated to selfish decision makers (agents). We propose a generic combinatorial auction mechanism for this type of problems, and show how agents can design optimal bidding strategies. We also demonstrate how we can extend our approach to handle cases with stochastic demands.

3 - Game-theoretic Approaches to Parallel Machine Scheduling

Carlos Paternina-Arboleda, Chairman, Department of Industrial Engineering, Universidad del Norte, Km 5 Via a Puerto Colombia, Barranquilla, AT, Colombia, cpaterni@uninorte.edu.co, Diana Ramìrez

A problem of scheduling jobs on two identical parallel machines is considered, minimizing two criteria. A mechanism is proposed to solve this problem as a 2-player non-cooperative game, under the framework of a 2x2 non-sum zero matrix. Each job behaves selfishly attempting to move to a previous position in the machine, generating a cost for its agent, minimizing total flow time. At the same time, a controlling agent allows movements of jobs between machines, minimizing maximum completion time.

■ MD17

C-Room 620

Digital and Social Interactions

Sponsor: Information Systems Society
Sponsored Session

Chair: Animesh Animesh, PhD Student, University of Maryland, 1308 Van Munching Hall, College Park, MD, 20742, United States, animesh@umd.edu

1 - The Interaction Between Knowledge Codification and Knowledge Sharing Networks

Gautam Ray, University of Minnesota, Carlson School of Management, 321 Nineteenth Avenue South, Minneapolis, MN, 55455, United States, gautam.ray@mccombs.utexas.edu, De Liu, Andrew Whinston

Current knowledge management strategies advocate two different approaches: codification and knowledge sharing networks. However, limited attention has been paid to the interaction between them. This research draws upon the literature on formal modeling of networks to examine the interaction between codification and knowledge sharing networks. We find that despite the tension between codification and the knowledge sharing network, a firm may still benefit from combining the two approaches.

2 - Examining the Relationship Between Reviews & Sales: The Role of Social Information in E-Markets

Anindya Ghose, NYU Stern, aghose@stern.nyu.edu, Batia Wiesenfeld, Chris Forman

User-generated product reviews have proliferated online, driven by the notion that consumers' purchsing decision is based on the positive or negative information about that product. Using research on information processing, we show evidence that in online markets, the social information reviewers provide about themselves is used to supplement or replace product information in shaping community members' purchase decisions and the value they attribute to reviews.

3 - Social Interactions and The Digital Divide: Explaining Variations in Internet Use

Ritu Agarwal, University of Maryland, ragarwal@rhsmith.umd.edu, Animesh Animesh, Kislaya Prasad

The presence of large variations in Internet use in the U.S. is widely acknowledged. Prior research suggests that individual, household, and regional differences are responsible for this disparity. We argue for an alternative explanation: that individual choice is subject to social influence that emanates from geographical proximity, and that such peer effects are the cause of the excess variation. We test this assertion with empirical analysis of a data set of over 21,000 households.

■ MD18

C-Room 201

Panel Discussion: ICS 10th Anniversary Celebration and Quiz Show

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Steven Dirkse, GAMS Development Corp., 1217 Potomac St NW, Washington, DC, 20007, United States, sdirkse@gams.com

1 - Panel Discussion: ICS 10th Anniversary Celebration and Quiz Show

Moderator: Steven Dirkse, GAMS Development Corp., 1217 Potomac St NW, Washington, DC, 20007, United States, sdirkse@gams.com

This is your chance to test your ICS-IQ against our panelists and learn what's fact and fiction in the process. The panel will be quizzed on topics from Java to JCL, from TQM to TSP, from ANALYZE to ZOOM. Who'll come out an top, and how will you compare? Join us to find out.

■ MD19

C-Room 203

Joint Session ICS/ISS: New Approaches to Email Management

Sponsor: INFORMS Computing Society, Information Systems Society
Sponsored Session

Chair: Ashish Gupta, Assisstant Professor, Minnesota State University Moorhead, School of Business, 1104 7th Ave South, Moorhead, MN, 56563, United States, gupta@mnstate.edu

Co-Chair: Ramesh Sharda, Regents Professor of Managemen Science and Information Systems, Conoco Chair of Management of Technology, Oklahoma State University, Spears School of Business, Stillwater, OK, 74078, United States, ramesh.sharda@okstate.edu

1 - Reconceptualizing Electronic Mail Overload
Cynthia (Cindy) King, Assistant Professor, Management Communication; Associate Director, Center for Defense Management Reform, Naval Postgraduate School, 555 Dyer Road, Monterey, CA, 93943, United States, clking@nps.edu, Gail Fann Thomas

In this study, e-mail interactions from a government organization were closely analyzed. Drawing on the Sproull & Kiesler's (1991) first and second order effects of communication technologies and Boden's (1994) theory of lamination, results suggest three characteristics that contribute to e-mail overload: unstable and unchanging requests, pressure to respond, and delegation and shifting interactants. We conclude that e-mail talk, as social interaction, may both create and affect overload.

2 - A Solution for Addressing E-mail Overload Using Automatic Document Clustering
David Schuff, Assistant Professor of MIS, Temple University, David.Schuff@temple.edu, Ozgur Turetken

E-mail has become the dominant tool for communications, but its volume is often overwhelming. To address the issue of e-mail overload, we describe a study that applies automatic document clustering to a message collection. This study provides evidence that clustering e-mail, including the assignment of weights to message attributes, improves users' ability to locate messages (over an ordered list). Consequently, we suggest directions for developing solutions for managing e-mail overload.

3 - Personal Information for a World as We Want it to Be, Part 1
William Jones, Associate Research Professor, University of Washington, Suite 400 Roosevelt Commons, Seattle, WA, 98195-2840, United States, williamj@u.washington.edu

Imagine a car with an enormous rear-view mirror and only a tiny windshield. Not practical. Possibly dangerous. But do our tools promote an analogous imbalance of perspective with respect to our information and its management? The vision of an all-inclusive recording of a person's past experiences now seems attainable with few economic or technical barriers standing in the way.

4 - Personal Information for a World as We Want it to Be, Part II
William Jones, Associate Research Professor, University of Washington, Suite 400 Roosevelt Commons, Seattle, WA, 98195-2840, United States, williamj@u.washington.edu

But do advances in devices of data capture and storage place undue focus on recording information relating to past events? What about planning and the use of the information to impact the future? Tools we might actually use for support in this direction are either ad hoc and rudimentary or prohibitively complex and demanding. But better help many be on the way. This talk will consider ways in which tool support might help us to manage our information for a world as we want it to be.

■ MD20

C-Room 204

Decision Analysis Society Awards

Sponsor: Decision Analysis
Sponsored Session

Chair: Craig Kirkwood, Arizona State University, Department of Supply Chain Management, W. P. Carey School of Business, Tempe, AZ, 85287-4706, United States, Craig.Kirkwood@asu.edu

1 - Practice Award
Karen Jenni, Insight Decisions LLC, 2200 Quitman Street, Denver, CO, 80212-1116, kjenni@insightdecisions.com

The Decision Analysis Society Practice Award competition is to recognize, promote, and publicize good decision analysis practice. We will recognize the winner and finalists for the 2007 Practice Award.

2 - Student Paper Award
Eva Regnier, Naval Postgraduate School, DRMI 699 Dyer Road, Monterey, CA, 93943, eregnier@nps.edu, Kimberly Thompson

The Decision Analysis Student Paper Award is given annually to the best decision analysis paper by a student author, as judged by a panel of the INFORMS Decision Analysis Society. Students who did not complete their PhD prior to May 1, 2006 are eligible for this year's competition.

3 - Decision Analysis Publication Award
Vicki Bier, University of Wisconsin-Madison, Dept.. of Industrial and Systems Eng., 1513 University Avenue, Madison, WI, 53706, bier@engr.wisc.edu

The Decision Analysis Publication Award is given annually to the best decision analysis article or book published two years earlier. To be considered for this year's award, a work must have been published during 2005. The intent of the award is to recognize the best publication in decision analysis, broadly defined — including theoretical work on decision analysis methodology, descriptions of applications, and/or experimental studies.

4 - Frank P. Ramsey Medal
Ralph Keeney, Duke University, Fuqua School of Business, 101 Lombard Street Suite #704W, San Francisco, CA, 94111, United States, keeneyr@aol.com

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.

■ MD21

C-Room 205

Joint Session DAS/MAS: Muli-criteria Decision Analysis: Army Corps of Engineers Application Case Studies

Sponsor: Decision Analysis, Military Applications
Sponsored Session

Chair: I. Linkov, Intertox Inc.

1 - MCDA and Army Corps: Overview of Methods and Applications
Kim J Suedel B, US Army Engineer Research and Development Center-Environmental Lab

The US Army Corps of Engineers (Corps), Engineer Research and Development Center (ERDC), Vicksburg, MS has developed a risk-informed decision framework (RIDF) for several large-scale planning and restoration projects that draws from current practice in the fields of risk and uncertainty analysis and multi-criteria decision analysis (MCDA). The Corps approaches incorporated within the RIDF will enhance communication and collaboration among decision-makers and stakeholders by providing a clear process for defining objectives, metrics, and weightings that reflect respective priorities. Using these metrics, values and weightings, the techniques comprising MCDA are used to derive quantitative scores for several plans under consideration.

2 - The Risk-informed Decision Framework for Hurricane Protection and Coastal Planning
Kim J Suedel B, US Army Engineer Research and Development Center-Environmental Lab

The Louisiana Coastal Protection and Restoration (LACPR) and the Mississippi Coastal Improvement Program (MsCIP) have developed a risk-informed decision framework (RIDF) that draws from current practice in the fields of risk and uncertainty analysis and multi-criteria decision analysis (MCDA). The approaches incorporated within the RIDF will enhance communication and collaboration among decision-makers and stakeholders by providing a clear process for defining objectives, metrics, and weightings that reflect respective priorities. Using these metrics, values and weightings, the techniques comprising MCDA are used to derive quantitative scores for several plans under consideration.

3 - Risk-based Framework for Establishing Environmental Windows for Sediment Dredging
I. Linkov, Intertox Inc., Kim J Suedel B

The concept of Environmental windows (EW) was introduced to limit dredging operations to windows of time where effects to the ecosystem are minimized. Over time, windows have become increasingly constrained by a multitude of restrictions to minimize ecological impacts, thus greatly limiting the amount of time available to dredge waterways. We will show how ecological risk assessment coupled with multi-criteria decision analysis (MCDA) can be used to assess risks to fish species in the presence of non-chemical stressors associated with dredging activities. We will propose a framework for setting environmental windows that supplements ecological risk assessment with decision analysis and adaptive management components to quantify uncertainties and expert judgment in setting environmental windows.

■ MD22

C-Room 206

DEA: Theory and Application II

Cluster: Data Envelopment Analysis
Invited Session

Chair: Lawrence Seiford, Professor and Chair, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, seiford@umich.edu

1 - An Algorithm for Shortest Path Projections for the Additive Model in DEA
Warren Sutton, Doctoral Student, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States, wsutton@umich.edu, Lawrence Seiford

The DEA Additive Model has an objective that maximizes the sum of the slacks and naturally finds a path to the frontier for inefficient DMUs that is not the shortest possible path. This study presents an algorithm for determining the shortest path projections for inefficient units in the Additive model.

2 - Applying the Directional Distance Function to the Electric Utility
Andrew Johnson, Assistant Professor, Texas A&M University, 237K Zachry Engineering Center, Department of Industrial and Engineering, College Station, TX, 77843, United States, ajohnson@tamu.edu

The directional distance function (DDF) allows the typical assumption of either cost minimization or revenue maximization to be relaxed in the analysis of technical efficiency. This presentation explores the application of the directional distance function to the analysis of electric utilities in both the U.S. and Japan. By applying a novel directional specific method to the panel data, the direction of improvement is identified. This method can be used in a variety of DDF type models.

3 - Measuring the Performance of Professional Services with an Application of DEA to Financial Audits
Paul Rouse, The University of Auckland, p.rouse@auckland.ac.nz

Service/manufacturing distinctions are usually recognised but distinctions within service organisations can be drawn between those that bundle service with a product, to those that provide services only, e.g. professional services. Using a modified production model and DEA (standard and network), we find client and audit branch characteristics affect performance of audits provided within a single auditing firm. From this we provide insights towards better modelling professional services.

4 - The Relative Efficiency of New England VA Medical Facilities
Aysun Sunnecti, Northeastern University, 360 Huntington ave, 334Snell Engineering, Boston, MA, United States, sunnetci.a@neu.edu, James Benneyan

We investigate the relative efficiency of 39 New England Veterans Affairs medical facilities at producing good access, clinical outcomes, satisfaction, and quality. We propose and compare several approaches for handling proportional data bound between 0 and 1 in constant-returns-to-scale DEA models, including an odds-ratio approach. 13 facilities are identified on the efficiency frontier.

■ MD23

C-Room 208

Group Decisions-making

Sponsor: Behavioral Process Management (BPM)
Sponsored Session

Chair: Elena Katok, Associate Professor, Penn State University, 465 Business Building, Penn State University, University Park, PA, 16802, United States, ekatok@psu.edu

1 - An Exploratory Investigation of National Culture on the Behavior of Process Improvement Teams
Kevin Linderman, Associate Professor, University of Minnesota, 321 19th Ave S, Minneapolis, MN, 55455, United States, KLinderman@csom.umn.edu, Adrian Choo

This study investigates Six Sigma teams from a manufacture of computer components. Teams come from countries in North America, Europe, and Asia. Hofstede dimensions of national culture are used to help explain variation in the efficacy process improvement team variables. The study finds that national culture effects critical process improvement team variables. Organizations implementing improvement practices in a global context need to adapt their practices to the national culture.

2 - Judgment and Decision Biases in Inventory Replenishment Decisions: Framing and Anchoring Effects
Travis Tokar, Visiting Assistant Professor, Ohio State University, 311 Fisher Hall, 2100 Neil Ave., Columbus, OH, 43147, United States, tokar_6@cob.osu.edu, Matthew Waller, John Aloysius

Judgment and decision biases have been shown to adversely impact inventory replenishment efficiency. In a serial supply chain, order variance amplification, or the bullwhip effect, is a mechanism by which sub-optimal decision making in a dynamic setting results in cost inefficiencies. This research directly investigates the impact of two judgment biases: (1) loss aversion and (2) anchoring and insufficient adjustment, on replenishment decision making and resulting performance.

3 - An Experimental Study on Quantity Discounts in Supply Chains
Diana Wu, Assistant Prof. of Decision Sciences, University of Kansas, 1300 Sunnyside Ave. 313D, Lawrence, KS, 66045, United States, dianawu@ku.edu

Supply chain contracts have been well studied analytically, yet less is known about their practical performance. Using a controlled laboratory setting, we investigate the performance of one particular type of contract that is widely applied in practice: quantity discounts. Our research question asked is which form of discount schedule is most effective in improving supply chain coordination.

4 - Behavioral Causes of the Bullwhip Effect in a Single Echelon
Francesca Gino, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, fgino@andrew.cmu.edu

Two laboratory experiments on a single-echelon inventory task show that inventory durability interacts with transit lags to create order volatility that exceeds demand volatility (the bullwhip effect). Durability creates bullwhip effects because players adjust orders insufficiently to reflect current inventory and backlogs. Transit lags exacerbate bullwhip-like effects by interfering with players' ability to correct prior errors.

■ MD24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - SAS Institute, Inc. - Versatile, Extensible Optimization Modeling with OPTMODEL
Ed Hughes, Product Manager, SAS/OR, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States, Ed.Hughes@sas.com, Trevor Kearney

OPTMODEL from SAS unifies linear, mixed-integer, quadratic and general nonlinear optimization modeling and provides solvers for each type of model. We'll show several examples of the use of OPTMODEL, with a focus on how you can use its flexibility and extensibility to build algorithms that fit challenging optimization problems.

2 - Salford Systems - Introducing New Release of CART 6.0 PRO EX
Mikhail Golovnya, Salford Systems, golomi@salford-systems.com

Salford Systems is unveiling CART 6.0 PRO EX, our most robust version of our award winning CART software including substantive patent pending technology. The new version includes innovative tools and diagnostics for assessing the quality and reliability of a CART model and extensive modeling automation to accelerate the process of finding high performance models. CART 6.0 PRO EX also includes new methods for uncovering "hotspots"-segments of extraordinarily high value or risk- and new controls for shaping and structuring trees to reflect the needs of the researchers and modelers.

■ MD25

C-Room 210

Joint Session QSR/ DM: Statistical Methods with IT Applications

Sponsor: Quality, Statistics and Reliability, Data Mining
Sponsored Session

Chair: Zhiguang Qian, Assistant Professor, University of Wisconsin at Madison, zhiguang@stat.wisc.edu

Co-Chair: Yasuo Amemiya, IBM Thomas J. Watson Research Center, Yorktown Heights, NY, 10598, yasuo@us.ibm.com

1 - Statistical Challenges in Ecommerce Research

Wolfgang Jank, Assistant Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, wjank@rhsmith.umd.edu, Galit Shmueli

Empirical eCommerce research has been thriving, but with little participation by statisticians. In this talk, we review some of our recent efforts in the field. We discuss typical data structures in ecommerce processes and the statistical challenges that arise. We present novel data-visualizations and a functional modeling approach that capture the dynamic nature of ecommerce processes.

2 - Toward a Complete Active Tomography Framework

Earl Lawrence, Los Alamos National Laboratory, earl@lanl.gov

Active network tomography is concerned with inferring link-level packet metrics in a network based upon end-to-end probing. There are two outstanding problems. The first is the need for a framework that can model loss and empty-queue probabilities with a flexible continuous component for the heavy-tailed delays. The second problem is the need for a spatio-temporal modeling component. I will discuss the use of mixture models in the first problem and a multivariate probit model in the second.

3 - Adversarial Classification

Bowei Xi, Assistant Professor, Purdue University, xbw@stat.purdue.edu

Many data mining applications are faced with active adversaries. In all these applications, initially successful classifiers could degrade easily. We investigate the possibility of an equilibrium in this seemingly never ending game, where neither party has an incentive to change. We develop a game theoretic framework where the equilibrium behavior of adversarial learning applications can be analyzed, and provide a solution for estimating the equilibrium point.

4 - Computer Experiment for Data Center Thermal Management

Zhiguang Qian, Assistant Professor, University of Wisconsin at Madison, zhiguang@stat.wisc.edu, Yasuo Amemiya

Data centers are integrated IT systems consisting of multiple servers. Thermal modelling is a key in running and designing this type of system. Computational fluid dynamics techniques are widely used for simulating data center thermal properties under different configurations. Incorporating physical properties and structural analysis, we present some efficient multivariate analysis methods for modelling the multivariate responses from this experiment.

■ MD26

C-Room 211

Data Mining Applications

Sponsor: Data Mining (Sponsored)
Sponsored Session

Chair: Kaizhi Tang, Intelligent Automation, 15400 Calhoun Dr., Suite 400, Rockville, MD, United States, tangkz@yahoo.com

1 - Biomechanics Data Mining to Support Human Performance and Injury Prevention

Kaizhi Tang, Research Scientist, Intelligent Automation, Inc., 15400 Calhoun Dr., Suite 400, Rockville, MD, 20850, United States, ktang@i-a-i.com, Atul Phadke

Biomechanics with its experimental, simulation and domain rules provides an excellent arena for data mining applications. The unique characteristics of biomechanics datasets including isolated feature space and multiple dependent variables call for innovative data mining solutions. This paper presents the research efforts of Intelligent Automation Inc. on biomechanics data mining, especially summarizes how the unique characteristic and requirements in biomechanics data mining are handled.

2 - Efficient Multidimensional, Multiclass Classification for Mission Critical Applications

Tianyi Wu, Research Assistant, University of Illinois, Urbana-Champaign, 201 N Goodwin Ave, Urbana, IL, 61801, United States, twu5@uiuc.edu, Kaizhi Tang, Atul Phadke, Jiawei Han

The classification on numerical data sets with many features is often multidimensional and multiclass. It is hard because each training set contains multi-dimensional and multi-level class labels. Previous methods use binary classifiers and cannot handle it well. We propose a new method by exploiting the correlation among class dimensions. We cluster class labels based on the correlation and use SVM to obtain the classifier. The experiment on a biodynamic database shows our method is effective.

3 - Data Mining for Forensic Accounting

Boris Kovalerchuk, Professor, Central Washington University, 400 East University Way, Ellensburg, WA, 98926-7520, United States, borisk@cwu.edu, Robert Holtfreter, Evgenii Vityaev

Link discovery and mining rare/imbalanced events and recently became important areas for discovering financial fraud and linking disparate information for fighting terrorism. The traditional misclassification rate is misleading: it is only 0.001 by classifying every transaction as legitimate with reported 0.001 fraud rate out of all wire and credit card transactions globally. We propose a relational data-mining approach to discover rare and unbalanced patterns in a variety of financial data.

4 - Forecasting Financial Time Series via Mining the Underlying Transactions Data

Tom Au, Researcher, AT&T Labs, 180 Park Ave, Rm B184, Florham Park, NJ, 07932, United States, sau@att.com, Felix Eze

This paper looks at ways of forecasting monthly or quarterly financial time series by using the underlying transactions data. First, it establishes a statistical framework in which the concept of a gap time series (essentially the difference between the financial time series and the time series derived from the transactions data) appears. This paper analyzes financial forecasts produced by combining forecasts of the gap time series with transactions data (available some time in advance).

■ MD27

C-Room 212

Data Mining-statistical Issues

Contributed Session

Chair: Noam Goldberg, PhD Candidate, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854-8003, United States, ngoldberg@rutcor.rutgers.edu

1 - Goodness of Fit Tests for Predictive Models

Michael Conerly, Professor, The University of Alabama, Box 870226, Tuscaloosa, AL, 35487-0226, United States, mconerly@cba.ua.edu, Michael Hardin, Winston Choi

The use of Goodness of Fit tests for Logistic Regression models based on Hosmer and Lemeshow's (2000) results are widespread. For data analysis purposes, running this test to check a model's adequacy are routine. Extending this test procedure to other predictive models is straightforward. Applying this test to holdout data enables one to check the validity of a predictive model based on decision trees or neural networks or other analyses.

2 - Hidden-Markov Model Based Hierarchal Clustering for Autonomous Diagnostics

Akhilesh Kumar, Doctoral Candidate, Wayne State University, Manufacturing Engineering Bldg., 4815 Fourth Street, Detroit, MI, 48201, United States, a.kumar@wayne.edu, Ratna Babu Chinnam

This research presents an effective novel approach for autonomous diagnostics that employs model-based hierarchical 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.

3 - Multiple-cross-level Association Rules Mining with Frequent-pattern Tree

Xinxin Bai, IBM China Research Lab, Zuanshi Build,Zhongguancun Software park, Beijing, 100094, China, baixx@cn.ibm.com, Wenjun Yin, Hairong Lv, Yangqiu Song, Jin Dong

Many market basket analysis require that association rules mining be performed at multiple and cross levels of abstraction. In this paper, we first transform the multiple-level problem into a single-level format; then the well-known Frequent-Pattern Tree algorithm is performed; finally, a filtering procedure is applied to remove unnecessary rules. The proposed method is tested in a real retailing case for store merchandise category management decision support.

4 - Quality Measures for Data Clustering

Carol Romanowski, Assistant Professor, Rochester Institute of Technology, 2219 Eastman Bldg, 31 Lomb Memorial Dr, Rochester, NY, 14623, United States, cjrcms@rit.edu, Rakesh Nagi

Since clustering can be time-consuming, we try to avoid reclustering each time new data arrives. However, we would also like to know when existing cluster assignments are no longer valid. In this research, we explore the use of the CUSUM method to signal significant changes in density, shape, and content of spatial data clusters. The method appears to work well although the non-normality of the cluster quality measure requires changes that make monitoring individual clusters less feasible.

5 - Boosting Optimal Logical Patterns Using Noisy Data
Noam Goldberg, PhD Candidate, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854-8003, United States, ngoldberg@rutcor.rutgers.edu, Chung-chieh Shan

We consider the supervised learning of a binary classifier from noisy observations. We use smooth boosting to linearly combine abstaining hypotheses, each of which maps a subcube of the attribute space to one of the two classes. We introduce a new branch-and-bound weak learner to maximize the agreement rate of each hypothesis. We show that our branch-and-bound algorithm is fast in practice and that any boosting algorithm can be combined with our proposed weak learner to construct LAD models.

■ MD28

C-Room 213

Recent Advances in Combinatorial Optimization and Satisfaction

Sponsor: INFORMS Computing Society / Constraint Programming and Optimization
Sponsored Session

Chair: Meinolf Sellmann, Assistant Professor, Brown University, sello@cs.brown.edu

1 - Hidden Structure in Combinatorial Problems
Carla Gomes, Cornell University, Ithaca, NY, United States, gomes@cs.cornell.edu

We will discuss trade-offs in detecting and exploiting hidden structure in combinatorial problems.

2 - Cost-bounded Binary Decision Diagrams for Integer Programming
John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu, Tarik Hadzic

Binary decision diagrams (BDDs) have seen widespread application in logic circuit design and product configuration. We recently applied them to solving linear and nonlinear integer programming problems. A BDD can provide a surprisingly compact representation of the feasible set and can thus provide rapid, in-depth postoptimality analysis if it is not too large. We show how the BDD can be substantially reduced in size, while retaining its usefulness, if it represents near-optimal solutions.

3 - Mathematical Programming Models for the Bandwidth Coloring Problem
Bernard Gendron, Université de Montréal, C.P. 6128, succ. Centre-ville, Montréal, QC, Canada, gendron@iro.umontreal.ca, Alain Hertz, Patrick St-Louis

We consider the bandwidth coloring problem, a generalization of the well-known graph coloring problem. For the latter problem, a classical theorem states that the chromatic number of a graph is bounded from above by the number of vertices in the longest elementary path in any directed graph derived by orienting all edges in the graph. We generalize this result to the bandwidth coloring problem by deriving a series of equivalent mathematical programming models.

4 - The Linear Programming Polytope of Binary Constraint Problems with Bounded Tree-Width
Meinolf Sellmann, Assistant Professor, Brown University, sello@cs.brown.edu, Daniel Leventhal, Luc Mercier

We show how to efficiently model binary constraint problems (BCP) as integer programs. After considering tree-structured BCPs first, we show that a Sherali-Adams-like procedure results in a polynomial-size linear programming description of the convex hull of all integer feasible solutions when the BCP that is given has bounded tree-width.

5 - Randomized Adaptive Spatial Decoupling for Large-scale Vehicle Routing with Time Windows
Pascal Van Hentenryck, Brown University, Box 1910, Providence, RI, United States, pvh@cs.brown.edu

This talk presents a new adaptive decomposition algorithm for finding high-quality solutions to large-scale vehicle routing problems with time windows.

■ MD29

C-Room 214

Joint Session OS/ICS: Computational Decomposition and First Order Methods for Large Scale Conic Programming

Cluster: Optimization /Computational Optimization and Software, INFORMS Computing Society
Invited Session

Chair: Kartik Sivaramakrishnan, Assistant Professor, North Carolina State University, Department of Mathematics, P.O. Box 8205, Raleigh, NC, 27695-8205, United States, kksivara@ncsu.edu

1 - On Solving Specially Structured Large SDP's Using IPMs
Bharath Rangarajan, Assistant Professor, university of Minnesota, 111 Church Street, ME205, Minneapolis, MN, 55455, United States, bharathr@me.umn.edu

The stability conditions for spatially-distributed control systems give rise to large semidefinite programs with specific structure. The standard gradient techniques are usually employed base on the Dantzig-Wolfe decomposition. We explore related smooth counterparts that can be solved using interior-point techniques which promise a faster asymptotic convergence as well as an improvement in global convergence.

2 - A Parallel Conic Interior Point Decomposition Approach for Polynomial Optimization
Kartik Sivaramakrishnan, Assistant Professor, North Carolina State University, Department of Mathematics, P.O. Box 8205, Raleigh, NC, 27695-8205, United States, kksivara@ncsu.edu

Recently, Waki et al. have proposed a hierarchy of structured semidefinite programming (SDP) relaxations in the block-angular form for sparse polynomial optimization problems. We discuss a conic interior point decomposition approach for solving these block-angular SDPs in a parallel and distributed high performance computing environment. We will also present our computational experiences with the algorithm on the distributed Henry2 cluster at NC State University.

3 - A Primal-dual First-order Method for Linear Cone Programming
Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

We first reformulate linear cone programming as primal-dual smooth convex minimization problems. Then we discuss Nesterov's first-order method for solving them, and the associated iteration-complexity bound is derived. The proposed method is finally applied to solve some large-scale linear cone programming problems arising from compressed sensing and date mining.

4 - Performance of Weighted Barrier Decomposition Method for Two Stage Stochastic Conic Programming
Sanjay Mehrotra, Professor, Northwestern University, 2145 sheridan road, Evanston, il, 60201, United States, mehrotra@iems.northwestern.edu

Computational results are presented showing that an efficient and stable implementation of primal decomposition method is possible, however, the implementation uses a weighted barrier. To our knowledge this is the first time apriori selection of weights have given consistently improved performance of the log-barrier methods. We explain the reasons for the better performance of the weighted barrier decomposition method.

■ MD30

C-Room 2A

Panel Discussion: Quality and Productivity Improvement in Nanomanufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Ave., ENB118, Tampa, FL, 33620, United States, huangq@eng.usf.edu

1 - Panel Discussion: Quality and Productivity Improvement in Nanomanufacturing
Moderator: Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Ave., ENB118, Tampa, FL, 33620, United States, huangq@eng.usf.edu, Panelist: Way Kuo, Ashok Kumar, JC Lu, C. F. Jeff Wu, Placid Ferreira

Nanomanufacturing poses significant research challenges for quality and productivity improvement. A panel of faculty will introduce nanomanufacturing and discuss the challenges and research opportunities in designed experiment, reliability, and process control.

■ MD31

C-Room 2B

Developments and Applications in Multivariate Quality Improvement

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Connie Borror, Associate Professor, Arizona State University West, 4506 W. Kaler Circle, Glendale, AZ, United States, conni@asu.edu

1 - Multivariate Process Control of Process Variation
Amit Mitra, Associate Dean, Auburn University, College of Business, Auburn University, Auburn, AL, 36849-5240, United States, mitra@business.auburn.edu

In monitoring variability of processes involving multiple variables, control charts based on the generalized sample variance matrix are utilized. The measures are typically based on the variability of process output variables. In this paper, we consider variability in the process regulatory variables as well as those in the noise factors.

2 - Detectability Study for Statistical Monitoring of Multivariate Dynamic Processes
Nan Chen, University of Wisconsin Madison, 1513 University Avenue, Madison, WI, 53706, United States, nchen3@wisc.edu, Shiyu Zhou

In this article, we propose an intrinsic definition of fault detectability in multivariate dynamic processes. Further, the relationship between the system structures and the detectability for both mean change fault and variability change fault are investigated. Analytical criteria for checking the system detectability are established. Our results can provide guidelines on system design improvement for process monitoring and control.

3 - On-line Surface Defect Detection in Rolling Process for Quality Improvement
Ran Jin, Research Assistant, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States, jinr@umich.edu, Jing Li, Jianjun (Jan) Shi

This research develops a method for surface defect detection based on the image data obtained from rolling production lines. This method first uses a multiscale Principal Component Analysis to remove the noisy texture of the images and then formulates a searching procedure to locate the defects.

■ MD32

C-Room 302

Logistics

Contributed Session

Chair: Hari Natarajan, Assistant Professor, University of Miami, 412-D Jenkins Building, Coral Gables, FL, 33026, United States, hari@miami.edu

1 - An Inventory Routing Problem: Fresh Produce Delivery for HIV Patients in Kenya
Tung Le, PhD Student, Purdue University, 1389 W.State Street, Apt#5, West lafayette, IN, 47906, United States, tle@purdue.edu, Yuehwern Yih, Jean-Philippe Richard

Our research is motivated from the fresh food distribution for HIV patients of AMPATH program in Kenya. The fresh produce is harvested in farms and is taken to distribution sites. HIV patients get there to pick up their portion. Since there is no cold storage at each site, the fresh foods have to deliver frequently by partially loaded trucks. Transportation cost becomes very high. We model our problem as a multi-period inventory routing problem. Solution method is proposed to solve the problem.

2 - Vehicle Routing and Scheduling Models, Simulation and City Logistics
Jaume Barcelo, Professor, Universitat PolitËcnica de Catalunya, Jordi Girona Salgado 1-3, Campus Nord, Edifici C5, Barcelona, 08034, Spain, jaume.barcelo@upc.edu

The distribution of goods in urban areas contributes to and is affected by traffic congestion. City Logistics models should combine vehicle routing and fleet management with models accounting for traffic dynamics. This paper presents an integration of vehicle routing and dynamic traffic simulation that emulating actual traffic providing estimates of the current and forecasted travel times, for the logistic model to determine the optimal dynamic routing and scheduling of the fleet.

3 - Delivery Fee Design for Logistics Partnerships
Hari Natarajan, Assistant Professor, University of Miami, 412-D Jenkins Building, Coral Gables, FL, 33026, United States, hari@miami.edu, Anant Balakrishnan

Manufacturers and distributors are increasingly forming close partnerships in order to serve their customer needs quickly and efficiently. To build and sustain such distribution partnerships, firms must properly negotiate the terms of collaboration and interaction with their partners. Motivated by a problem facing a large building-products manufacturer, we propose and solve an optimization model to determine delivery fees, using fee tables, for a manufacturer's distrubtion partners.

4 - Electronic Procurement and the Number of Suppliers: An Empirical Analysis
Kevin Zhu, The Rady School of Management, University of California, San Diego, La Jolla, CA, 92093-0093, United States, kxzhu@ucsd.edu, Sean Xin Xu, Jason Dedrick

This work addresses the relationship between a firm's use of information technology-based electronic procurement and the number of suppliers it employs. Using results from a survey of U.S. manufacturers, we find that electronic procurement is associated with a greater number of suppliers for custom goods and fewer suppliers of standard goods. Furthermore, for custom goods, the impact of electronic procurement is moderated by the degree of buyer-supplier systems integration.

5 - Solving the Close-enough Traveling Salesman Problem
William K. Mennell, PhD Student, 4th Year, Smith School of Business, University of Maryland, College Park, Van Munching Hall, College Park, MD, 20742, United States, wmennell@rhsmith.umd.edu, Bruce Golden, Edward Wasil

The close-enough traveling salesman problem (CETSP) is a generalization of the traveling salesman problem where nodes are replaced by discs of nonzero radius. The CETSP has been applied to aerial reconnaissance and ship tracking. We develop a heuristic for solving the CETSP and compare its performance to a genetic algorithm.

■ MD33

C-Room 303

Containerization Mini Cluster: Landside Container Distribution

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Anne Goodchild, Assistant Professor, University of Washington, 121E More Hall, Box 352700, Seattle, WA, 98195, United States, annegood@u.washington.edu

1 - Modeling Containerized Cargo Shipments Between Ocean Port and Handling Facilities
Anne Goodchild, Assistant Professor, University of Washington, 121E More Hall, Box 352700, Seattle, WA, 98195, United States, annegood@u.washington.edu, Kaori Fujisawa, Eric Jessup

This research presents a model of container freight movement between ocean ports and handling facilities. We estimate shipper behavior by estimating logistics costs for a set of transportation choices based on shipper volume and value. The model is a practical tool, primarily for policy makers, to understand the impact of land value changes, transportation capacity, and other inputs on logistics strategies and therefore freight flows.

2 - Freight Routing and Containerization in a Parcel Network with Sortation Constraints and Costs
Randolph Hall, Professor (ISE), Vice Provost, USC, Main Campus, LA, CA, United States, rwhall@usc.edu, Apichat Chayanupatkul

This research investigates parcel routing in a network with sorting costs and sorting capacity constraints. Containerization enables shipments to bypass sorting through direct transfer from incoming vehicles to outgoing vehicles, thus permitting more shipments to be processed within available sorting capacity and reducing the cost of sorting shipments.

3 - Integrated Lot Sizing and Queuing Model for Truck Appointment System
Xuesong Zhou, Assistant Professor, University of Utah, 122 South Central Campus Dr., Salt Lake City, UT, 84112, United States, zhou@eng.utah.edu, George List

An integrated lot-sizing and queuing model is developed to optimize truck appointment quotes over different time periods. A pointwise stationary fluid flow approximation method is embedded to describe time-dependent arrival rates and queue lengths for trucks with and without appointments at gates and yards. The presented model can be reformulated and efficiently solved as a dynamic network flow assignment with concave flow exit functions as side constraints.

4 - Estimating Empty Container Trip Reduction from a Virtual Container Yard Operation

Sotiris Theofanis, Rutgers, 100 Brett Road, Piscataway, NJ, United States, stheofan@rci.rutgers.edu, Maria Boile

A Virtual Container Yard (VCY) is an Internet based information sharing platform, aiming at permitting direct empty container interchange and other processes to take place without moving the container back to the marine terminal or an empty container depot. This paper describes a modeling approach used in estimating benefits associated with the implementation of a VCY for various VCY operating scenarios. The microsimulation platform VISTA is used in this effort.

■ MD34

C-Room 304

Dynamic and Stochastic Logistics Problems

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ashlea Bennett, PhD Student, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, ashlea@gatech.edu

1 - Approximate Dynamic Programming for a Spare Parts Problem: The Challenge of Rare Events

Hugo Simao, Research Engineer, CASTLE Lab - Princeton University, EQUAD E220 - Olden St., Princeton, NJ, 08544, United States, hpsimao@princeton.edu, Warren Powell

An aircraft manufacturer needed to design an inventory policy for high-value spare parts (engines, avionics) where small numbers of parts need to be stored at different distribution centers to respond to random, infrequent demands. Demands may be handled by multiple distribution centers. Failed parts are refurbished, while new parts can take months to arrive. We describe the computational challenges arising with the design of an ADP strategy.

2 - The Dynamic Air Cargo Loading Problem

Joseph Hartman, University of Florida, Industrial and Systems Engineering, Gainesville, FL, United States, jch6@lehigh.edu, Robert Storer

Cargo containers of the same size but varying weights arrive to an airplane according to a stochastic process over time. A tradeoff must be made as to whether containers should be loaded upon arrrival, ensuring an on-time or early departure, or held in order to achieve a better balance, improving the operation of the airplane. We report on a number of scenarios defined by high and low variance of arriving weights.

3 - How Good are Multi-agent Systems for Dynamic Vehicle Routing Problems?

F. Jordan Srour, PhD Candidate, RSM Erasmus University, Burg. Oudlaan 50, Rotterdam, NL, 3011AB, Netherlands, JSrour@rsm.nl, Tamas Mahr, Hans Moonen, Steef van de Velde, Rob Zuidwijk

Multi-Agent Systems (MAS) are classically seen as a software technique espoused by social technologists, but largely disregarded by operations researchers. Increasingly there is, however, an interest in applying MAS to a variety of real-time or dynamic settings. We compare a MAS approach to an on-line optimization approach for vehicle routing in the context of maritime container transport.

4 - Home Health Nurse Routing and Scheduling

Ashlea Bennett, PhD Student, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States, ashlea@gatech.edu, Alan Erera

We study the challenge of increasing resource utilization in the home care industry by improving the scheduling of home visits by nurses. The specific resultant problems are in the class of periodic routing problems, but are complicated significantly by the dynamics of a frequently-changing patient set. Solution approaches for dynamic periodic routing problems are presented.

■ MD35

C-Room 305

Methods and Models for Congestion Pricing II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Siriphong Lawphongpanich, University of Florida, Industrial & Systems Engineering, 303 Weil Hall, Gainesville, FL, 32611-6595, United States, lawphong@ise.ufl.edu

1 - Risk Averse Toll Pricing

Xuegan (Jeff) Ban, Assistant Research Engineer, CCIT, University of California, Berkeley, 2105 Bancroft Way, Berkeley, CA, United States, xban@berkeley.edu, Shu Lu, Michael Ferris, Henry Liu

We formulate the second-best toll pricing as a bi-level problem. We show that if the lower level user equilibrium has multiple solutions, many existing toll design schemes are risk-prone: the optimal toll is sought in such a way that one wishes the ideal scenario will always happen. We further propose a risk-averse approach in which the toll is optimal for the worst-case scenario. Some examples are given to illustrate these two toll pricing approaches.

2 - On Path Marginal Cost Analysis and Its Implications to Dynamic Congestion Pricing

Wei Shen, PhD Candidate, Department of Civil and Environmental Engineering, University of California, Davis, 1001 EUIII, One Shields Avenue, Davis, CA, 95616, United States, wshen@ucdavis.edu, Yu (Marco) Nie, Michael Zhang

Dynamic congestion pricing relies on the path marginal cost information, which represents the gradient of the objective function in the system-optimal dynamic traffic assignment problem. We reveal a critical deficiency in existing path marginal cost evaluation methods, and subsequently develop a new method by tracing the propagations of a path flow perturbation. A solution algorithm that incorporates this new method for solving the path-based SO-DTA problem is also designed and tested.

3 - Nonnegative Pareto-improving Tolls with Multiclass Network Equilibrium

Ziqi Song, University of Florida, Weil Hall 508, Gainesville, FL, 32611, United States, ziqi@ufl.edu, Yafeng Yin, Siriphong Lawphongpanich

This study considers nonnegative Pareto-improving toll vectors that improve the social benefit without making anyone worse off in a network with multiple user classes. Since requiring tolls to be nonnegative and anonymous may not be feasible in all cases, the existence conditions for such toll vectors are discussed.

4 - Discrete-time Dynamic Traffic Assignment Models for Managed Lanes

Qipeng (Phil) Zheng, PhD Student, University of Florida, Industrial & Systems Engineering, 303 Weil Hall, ISE, Gainesville, FL, 32611, United States, zqp@ufl.edu, Siriphong Lawphongpanich, Yafeng Yin

In this talk, we present discrete-time traffic assignment models for managed lanes such as HOV and HOT lanes. Unlike discrete-time models for general networks, our models have a simple network structure and their upper bounds can be obtained by solving mixed-integer optimization problems using, e.g., Benders decomposition. Also, numerical results will be presented.

■ MD36

C-Room 306

Urban Transportation Planning Models VI: Stochastic Networks

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Lei Zhang, Assistant Professor, Oregon State University, School of Civil & Construction Eng., 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

1 - Numerical Methods for Solving 2-Stage Stochastic Network Protection Probs. w/Equilibrium Constraints

Yueyue Fan, Assistant Professor, University of California, Department of CEE, Davis, CA, 95616, United States, yyfan@ucdavis.edu, Changzheng Liu

This research focuses on pre-disaster transportation network protection under uncertain disaster scenarios. We assume that the central planner decides which protection strategies to choose, while the network users choose their own best-perceived routes. This problem is formulated as a two-stage stochastic programming model with equilibrium constraints. The applicability of progressive hedging-based solution algorithm will be discussed.

2 - Computation of the Second-order Covariance Matrix of Markov Traffic Assignment Models

Fan Yang, Assistant Professor, City University of New York, 140th St and Convent Ave, New York, NY, 10031, United States, fyang@ccny.cuny.edu

Several iterative or approximated methods were proposed to estimate the stationary covariance matrix of day-to-day Markov traffic assignment models. In this talk, we conclude that we can efficiently compute the analytical solution of the covariance matrix and its inverse under mild condition, i.e., the link travel time function is symmetric.

3 - The Influence of Supply and Demand Fluctuations on Travel Time Reliability

Lei Zhang, Assistant Professor, Oregon State University, School of Civil & Construction Eng., 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

Travel demand exhibits temporal variations. Transportation facilities may experience reduced capacity due to (non)recurrent events. This paper analyzes the influence of these supply-demand uncertainties on travel time reliability using the behavioral user equilibrium model. An important practical implication/complication from the findings is that reducing supply or demand uncertainty alone could exacerbate travel time variation and worsen travel reliability.

4 - Socio-dynamic Discrete Choice on Networks

Elenna Dugundji, Universiteit van Amsterdam, Faculty of Social & Behavioral Sciences, Nieuwe Prinsengracht 130, 1018 VZ, Amsterdam, Netherlands, E.R.Dugundji@uva.nl

A model is considered where a commuter's transportation mode choice is influenced by his peers' mode share, and which accounts for common unobserved attributes of choice alternatives in the error structure. Non-global interactions are addressed within different network structures, combining advanced econometric estimation with computational techniques from multi-agent based simulation. Effects of sample size, initial conditions, geographic scale and systematic omitted links are explored.

■ MD37

C-Room 307

Military Supply Chain Innovation

Sponsor: Military Applications
Sponsored Session

Chair: Greg Parlier, Dr., SAIC, 255 Avian Lane, Madison, AL, 35758, United States, GREG.H.PARLIER@saic.com

1 - Patterns of Aircraft Operations and Spare Parts Demands

George Kuhn, Senior Research Fellow, LMI, 2000 Corporate Ridge, McLean, VA, United States, gkuhn@lmi.org

Research for the U.S. Army has suggested that identifiable regions of the operational spectrum exhibit distinctive patterns of aircraft usage and of associated Class IX maintenance parts demands. Research first reported in 2005 and 2006 is being extended and deepened. The question is whether improved forecasting of both aircraft usage and mixes and magnitudes of parts demands is possible.

2 - Holding PBL to its Promise – the Analytical Challenge

John Millhouse, Chief Scientist, TFD Group, 70 Garden Court, Suite 300, Monterey, CA, 93940, United States, john.millhouse@tfdg.com

If PBL has an Achilles heel, it is that incentives may fail to induce support providers to invest enough in resources to ensure support recipients get the things they need, where and when they need them. An illustration of what can go wrong has been derived through use of readiness-based sparing techniques to evaluate the likely performance outcomes of applying actual incentive provisions of an existing PBL contract to the spares support of a notional weapon system.

3 - Military Logistics Planning Prototype

Allan Manning, SAS, w.a.manning@sas.com, Paul Grant

Logistics planners must ensure the USAF, Army, Navy supply requirements are met while contending with numerous transportation and operational constraints. Using COTS software, SAS consultants developed a logistics optimization prototype called GOLDSS. By linking existing DoD legacy systems, into a new optimization model, an interactive interface was designed to support strategist planners as they analyze and evaluate the results of the optimization model.

4 - A Center for Innovation in Logistics Systems

Greg Parlier, Dr., SAIC, 255 Avian Lane, Madison, AL, 35758, United States, GREG.H.PARLIER@saic.com

Fully engaged in the Global War on Terror, the US Army is also committed to a comprehensive and ambitious Transformation endeavor. An analytical architecture is presented consisting of four complementary modeling approaches collectively referred to as Dynamic Strategic Logistics Planning. An organizational construct is presented to accelerate and sustain continual improvement for Army logistics and supply chain management - a Center for Innovation in Logistics Systems.

■ MD38

C-Room 308

Convergence and Approximation in Games

Cluster: Game Theory
Invited Session

Chair: Vahab Mirrkoni, Researcher, Microsoft Research, One Microsoft Way, Redmond, WA, United States, mirrokni@microsoft.com

1 - (Almost) Optimal Coordination Mechanisms for Unrelated Machine Scheduling

Yossi Azar, Professor, Microsoft Research, One Microsoft Way, Redmond, WA, 98052, United States, t-azar@microsoft.com, Vahab Mirrkoni, Kamal Jain

We investigate the influence of different algorithmic choices on the approximation ratio in selfish scheduling. Our goal is to design local policies that minimize the inefficiency of resulting equilibria. In particular, we design optimal coordination mechanisms for unrelated machine scheduling, and improve the known approximation ratio from m to log m where m is the number of machine.

2 - Inapproximability of Pure Nash Equilibria in Congestion Games

Alexander Skopalik, PhD Student, RWTH Aachen, Lehrstuhl für Informatik 1, Aachen, Germany, skopalik@cs.rwth-aachen.de, Berthold Vcking

A natural and convincing notion of approximation for equilibria in congestion games assumes that agents are ambivalent between strategies whose delay differs by less than a factor of alpha. We show that computing an alpha-approximate equilibrium is PLS-complete, for any alpha > 1. Thus finding an approximate Nash equilibrium is as hard as finding an exact Nash equilibrium or solving any other problem in PLS.

3 - Convergence of Nash Dynamics to Approximate Solutions

Vahab Mirrkoni, Researcher, Microsoft Research, One Microsoft Way, Redmond, WA, United States, mirrokni@microsoft.com

I will survey recent results on convergence to approximate solutions in games. For potential games, we study the speed of convergence of α-Nash dynamics to efficient solutions. I show a polynomial upper bound of the convergence of this dynamics in congestion games with approximation ratio that is arbitrarily close to the price of anarchy of the game. For non-potential games, I will define sink equilibria and survey results about convergence time of random Nash dynamics.

4 - The Complexity of Game Dynamics: Sink Equilibria, BGP Oscillations, and Beyond

Alex Fabrikant, PhD Student, UC Berkeley, 581 Soda Hall, CS Division, UC Berkeley, Berkeley, CA, 94720-1776, United States, alexf@cs.berkeley.edu, Christos H. Papadimitriou

We prove the PSPACE-completeness of 2 problems about best-response Nash dynamics: approximating Goemans, Mirrokni, and Vetta's sink equilibria in graphical games, and predicting oscillation in internet interdomain routing as a function of BGP path preferences. We also propose a new equilibrium concept, unit recall equilibria, that appears algorithmically promising. A relaxation of it is shown to be both tractable and universal (guaranteed to exist in any game).

■ MD39

C-Room 309

Process Improvement in the Hospitals Around the World

Sponsor: Health Applications Section
Sponsored Session

Chair: Nan Kong, Purdue University, 206 S. Intramural Drive, West Lafayette, IN, 47907, United States, kong@eng.usf.edu

1 - Stochastic and Robust Optimization of Multi-OR Surgical Schedules

Brian Denton, Assistant Professor, Edward P. Fitts Department of Industrial & Systems Engineering, North Carolina State University, Campus Box 7906, 111 Lampe Dr, Daniels Hall 400, Raleigh, NC, 27695-7906, United States, bdenton@ncsu.edu, Hari Balasubramanian, Andrew Miller, Todd Huschka

We describe two types of models for scheduling of multi-OR surgical suites under uncertainty. The first is a two-stage stochastic linear program with binary decisions in the first stage. The second is a robust counter-part, in which the objective is to minimize the maximum cost associated with an uncertainty set for surgery durations. We describe the mathematical models, structural properties, methodologies employed, and sample numerical results based on real data to contrast the two models.

2 - Process Improvements in Hospitals
Stefan Nickel, Saarland University, Geb A 5 3, Saarbrücken, 66041, Germany, s.nickel@orl.uni-saarland.de, Ursula Anna Schmidt

Hospitals have to face an increasing pressure with respect to competition as well as in terms of cost reduction. One instrument to overcome some problems is the employment of clinical pathways in German hospitals. We will show in this talk how logistical elements can be incorporated into clinical paths and demonstrate that using some real world examples. Moreover, we will have a closer look at some key logistics processes in hospitals.

3 - Accommodating the Preferences of Nurses via Shift Auctions
Melanie De Grano, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, mxd265@psu.edu

The scheduling system in this research allows nurses to express their preferences for shifts via auction. Nurses bid for their preferred working shifts and rest shifts using points; an optimization model then seeks to award the highest bidders while maintaining hospital requirements. After the auction, vacant shifts are allocated to nurses who have not yet completed their schedules. Test problems indicate that this auction system awards a high percentage of requests.

4 - Preliminary Exploration on Health Care Services in China
Lei Zhao, Assistant Professor, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, lzhao@tsinghua.edu.cn, Li Zheng

In the past decades, the Chinese health care services systems have been undergoing a series of reformations. The efforts are still ongoing and difficulties remain. In this exploratory research, via hospital investigation and public information collection, etc., we tried to collect facts, data, and information regarding the current status of health care systems in China. We are to find out where and how we can help to improve by applying operations research tools.

■ MD40

C-Room 310

OR Models in Health Care Management

Sponsor: Health Applications Section
Sponsored Session

Chair: Stefanos Zenios, Professor, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, stefzen@exch-gsb.stanford.edu

1 - Pharmaceutical Pricing and Access to Innovation
Stefanos Zenios, Professor, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States, stefzen@exch-gsb.stanford.edu, John Cavallaro

We present a discrete event simulation to examine the effect of reduced drug revenue on product development decisions. Restricting reimbursement for pharmaceuticals led to superlinear decreases in both returns and product portfolio sizes while simultaneously increasing risk. Extending the patent protection restored value lost to reduced reimbursement while simultaneously reducing risk. This suggests that there exist an optimal policy system that can simultaneously reduce drug expenditures while maintaining current levels of shareholder value and access to capital.

2 - Calculating Contracts for Institutional Support That Benefit Both the Anesthesia Group and Hospital
Franklin Dexter, Professor, University of Iowa, Dept. of Anesthesia, 6JCP, Iowa City, IA, 52242, United States, franklin-dexter@uiowa.edu

Institutional support to anesthesia groups for clinical care is ubiquitous in the USA. We show that alternatives to two types of agreements either increase profit for the hospital or anesthesia group at the expense of the other. These agreements create incentives whereby the hospital and anesthesia group both profit from increased operating room workload and more accurate specialty-specific staffing (i.e., operating room allocations).

3 - Models to Predict the Duration of Surgical Cases
Polly Biyu He, bhe@stanford.edu, Stefanos Zenios, Alex Macarios

We have analyzed data from more than 30,000 surgical cases in order to develop probabilistic models for the duration of surgery. For each case, the data provided a mnemonic code indicating the type of surgery and the surgeon. We have used partial least squares to collapse 1903 different mnemonics and 369 surgeons into 10 latent variables and then regressed the logarithm of the duration on these variables. Predictions based on these regression models improved prediction accuracy by 7.8% relative to three other commonly used models.

■ MD41

C-Room 3A

Joint Session HAS/ICS: Optimization Challenges in Brain Research

Sponsor: Health Applications Section, INFORMS Computing Society
Sponsored Session

Chair: W. Art Chaovalitwongse, Assistant Professor, Rutgers University, 96 Frelinghuysen Rd, Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu

Co-Chair: Onur Seref, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, seref@ufl.edu

1 - Computational Modeling of Brain Activities in a Perceptual-motor Task
Changxu (Sean) Wu, Assistant Professor, SUNY, Buffalo, 438 Bell Hall, Buffalo, NY, 14260, United States, changxu@buffalo.edu

In this talk, we describe how to use a queueing network approach and other computational methods to model brain activities when human subjects are performing a perceptual-motor task. The extension of our modeling approach in quantifying human performance and mental workload is also discussed.

2 - Quantitative Complexity Analysis in Multi-Channel Intracranial EEG Recordings from Epileptic Brains
Chang-Chia Liu, Research Assistant, University of Florida, Dept.. of Industrial & Systems Engineering, Dep. of Biomedical Engineering, Gainesville, FL, 32611, United States, iamjeff@ufl.edu, Deng-Shan Shiau, J. Chris Sackellares, W. Art Chaovalitwongse, Panos Pardalos

Nonlinear dynamical methods have been successfully used in EEG analysis. We show that the degree of complexity reflected by the value of the minimum embedding dimension converged to lower value during the Ictal state was observed in epileptic regions as well as non-epileptic regions. We suggest that the nonlinear dynamical analysis can provide a useful mechanism for detecting relative changes in brain dynamics, which cannot be detected by conventional linear analysis.

3 - RNA Secondary Structures and Trees
Neng Fan, University of Florida, 401 Weil Hall, Gainesville, FL, 32611, United States, andynfan@ufl.edu

The sequence of bases of the RNA molecule is known as primary structure, and a subset of helical structure consistent with a planar graph is known as secondary structure. We establish several one-to-one correspondences between the structures and trees. The mathematical propositions of RNA arrays, such as structures and enumerations, always having biological backgrounds, will be easy to obtain from the correspondences.

■ MD42

C-Room 3B

Cost Effectiveness Analysis in Health Care

Cluster: Operations Research in Medicine and Health Care
Invited Session

Chair: Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, BC, Canada, Steven.Shechter@sauder.ubc.ca

1 - The Cost-effectiveness of Herpes Zoster Vaccine
Mehdi Najafzadeh, PhD Student, University of British Columbia, 2545 West Broadway, Vancouver, BC, V6K 2E9, Canada, mehdin@interchange.ubc.ca, Eleni Galanis, David Patrick, Carlo Marra

The incidence and severity of herpes zoster and postherpetic neuralgia increase with age in association with a progressive decline in cell-mediated immunity to varicella-zoster virus (VZV). Vaccination against VZV decreases the incidence and severity of herpes zoster and postherpetic neuralgia among older adults. We used a discrete event simulation model to determine the cost-effectiveness of vaccinating against VZV in older adults in British Columba.

2 - Using Cost-effectiveness Analysis to Help Design Phase III Clinical Trials
Nick Bansback, Health Economist, Centre for Health Evaluation and Outcome Sciences, Vancouver, BC, Canada, nbansback@cheos.ubc.ca, Aslam Anis, Alan Brennan, Hyon Choi, Roberta Ara

Increasingly, successful drug development depends not only on regulatory approval, but also the cost-effectiveness of the intervention. We use a decision analytic model to determine the cost-effectiveness of statins in patients with rheumatoid arthritis based on a phase II study. Value of information analysis is

performed to calculate the value of parameter uncertainty and inform on the design of the multi-centre follow up study.

3 - An Economic Evaluation of Opioid Addiction Treatment Services in British Columbia

Bohdan Nosyk, Health Economist, Centre for Health Evaluation and Outcome Sciences, Vancouver, BC, Canada, bnosyk@hivnet.ubc.ca, Aslam Anis

Opioid addiction carries a substantial economic burden, and treatment options currently available are few. Experimental studies on new forms of treatment raise the question of how health and economic outcomes would be affected at the population level, if they were to be implemented. We evaluate this potential impact through a model constructed to simulate current addict populations and treatment conditions in British Columbia, Canada.

■ MD43

S-Grand Ball. A (Lev. 2)

A Week/Month in the Life of an OR Practitioner

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Warren Lieberman, warren@veritecsolutions.com

1- A Week/Month in the Life of an OR Practitioner

Warren Lieberman, Veritec Solutions, warren@veritecsolutions.com

So, what's it like to depend on your wits (and OR skills) to make a living? In this exciting presentation, Warren Lieberman will reveal what his last 20 years have been like, ranging from his early days in the Operations Research Group at American Airlines to taking on responsibility for running a small consulting and software development firm. Come early for a good seat. You won't want to miss this!

■ MD44

S-Grand Ball. B (Lev. 2)

Joint Session INFORMS-ED/ICS: Optimization Software in the Classroom

Sponsor: INFORM-ED, INFORMS Computing Society
Sponsored Session

Chair: Ted Ralphs, Associate Professor, LehighUniversity, 200 West Packer Avenue, Bethlehem, PA, 18015, United States, tkralphs@lehigh.edu

1 - ILOG Optimization Decision Management System (ODMS) in the Classroom

Rosemary Berger, ILOG, Inc, 1195 West Fremont Avenue, Sunnyvale, CA, 94087, United States, rosemary.berger@verizon.net, Thomas Dong

In this talk, we describe the opportunities and resources available for incorporating ILOG software into undergraduate and graduate courses in optimization. We highlight the OPL-CPLEX Analyst Studio and the ILOG Optimization Decision Manager (ODM), which make it easy for students to develop, debug and tune optimization models and then create decision support applications.

2 - Teaching the Use of Mixed Integer Programming Models and Algorithms

Andrew Miller, University of Wisconsin-Madison, 3156 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, United States, amiller@engr.wisc.edu

I will discuss my use of Xpress-MP to teach MIP in courses varying from required undergraduate to PhD elective. Xpress has features that make it useful for teaching beginners, including 1) the modeling language Mosel, which makes it easy for beginners to convert algebraic formulations into code, and 2) graphical displays, which help explain the basics of branch-and-bound and -cut. While Xpress is the software I use, any package that provides these facilities could be used in the same way.

3 - LGO Demo Software for Global and Local Nonlinear Optimization

Janos D. Pinter, Pintér Consulting Services, Inc., 129 Glenforest Drive, Halifax, NS, Canada, jdpinter@hfx.eastlink.ca, Frank J. Kampas

The Lipschitz Global Optimizer software handles constrained global and local optimization models under very general assumptions. We have developed two easy-to-use demo versions of LGO that can be used with a freely available C compiler (called Tiny C) as well as with the C# compiler (the latter is distributed by Microsoft). Both demo software versions are equipped with Windows GUIs. These demos can be used to develop and solve size limited (yet far from trivial) models in the classroom.

4 - Teaching Optimization Modeling to Future OR Practitioners Using SAS

Manoj Chari, Director, Operations Research R&D, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States, Manoj.Chari@sas.com, Ed Hughes

PROC OPTMODEL in SAS/OR is a natural tool for teaching optimization modeling due to its access to a wide range of solvers and its high-level programming features. SAS also provides data access and manipulation, analytical, and reporting capabilities that always accompany optimization use in practical settings. All are included in the new SAS OnDemand for Academics program, which provides quick, easy, affordable access to SAS for coursework use by faculty and students.

■ MD45

S-Capitol Hill (Lev. 3)

Financial Engineering and Portfolio Optimization

Sponsor: Financial Services
Sponsored Session

Chair: John Birge, University of Chicago, Chicago, IL, John.Birge@ChicagoGSB.edu

1 - Arbitrage Pricing of Contingent Claims in Incomplete Markets

Chanaka Edirisinghe, Professor, Management Science, University of Tennessee, College of Business Administration, Knoxville, TN, 37996, United States, chanaka@utk.edu

Pricing contingent claims is addressed using discrete-time multi-period scenario trees. Previously, we developed a simplicial DP procedure for pricing under incomplete markets, but with no trading costs. Introducing proportional costs for trading, results are generalized. In particular, sub- and super-martingales are identified for the pricing problem via an underlying moment problem solution.

2 - Malliavin Greeks Without Malliavin Calculus

Nan Chen, Chinese University of Hong Kong, 709A, William Mong Engineering Building, Chinese University of Hong Kong, Shatin, Hong Kong - ROC, nchen@se.cuhk.edu.hk, Paul Glasserman

We derive and analyze Monte Carlo estimators of price sensitivities ("Greeks") for contingent claims priced in a diffusion model. Recent work derives estimators through Malliavin calculus but requires heavy mathematics. In this article we investigate connections between Malliavin estimators and the traditional and elementary pathwise method and likelihood ratio method. In several cases time-averaging of multiple estimators is key in achieving convergence to the continuous-time limit.

3 - Optimization of Consumption and Investment Decisions Under Consumption and Liquidity Constraints

John Birge, University of Chicago, Chicago, IL, John.Birge@ChicagoGSB.edu, Amit Bhandari

We extend previous work on discrete-time optimization of consumption and investment decisions with non-decreasing consumption rate. Assuming an attractive hedge fund exists, i.e. Merton's (1969) continuous-time model ignoring consumption would conclude that the optimal allocation to this fund should be high. We examine the impact of a discrete-time framework, non-decreasing consumption and liquidity constraints due to the hedge fund's trading rules on optimal consumption and investment policies.

4 - Portfolio Optimization Under Liquidity Constraints on Specific Assets

Amit Bhandari, PhD Candidate, Northwestern University, amitb@northwestern.edu, John Birge

Institutional portfolios have recently increased investments in alternative assets. We assume an agent with CRRA utility can invest in a hedge fund that has a high allocation under Merton (1969). We study the impact of liquidity constraints that arise due to the hedge fund's trading rules on its optimal allocation. We also extend the above analysis to construct a quantitative measure for the value of continuous access to hedge fund performance information.

■ MD46

S-Ballard (Lev. 3)

Power and Energy Market Modeling II

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Benjamin Hobbs, JHU, 313 Ames DoGEE, Baltimore, MD, 21218, United States, bhobbs@jhu.edu

1 - Calculating Marginal Costs for Joint Output Energy Process Technologies
Donald Hanson, Economist, Argonne National Laboratory, 9700 S. Cass Avenue, Bldg 900, Argonne, IL, 60439, United States, dhanson@anl.gov, John Marano, Peter Balash

We will focus on joint output production processes (such as petroleum refineries and polygeneration) which can greatly improve efficiency. The solution to this class of problems involves process equations and their derivatives in order to calculate marginal costs and product prices. Energy and climate technology applications will be discussed and numerical results presented.

2 - Rewarding the 'Uncoordinated Cooperation' Among Grid-connected Wind Farms
Francois Bouffard, Lecturer, University of Manchester, Ferranti B1, P.O. Box 88, Sackville Street, Manchester, M60 1QD, United Kingdom, francois.bouffard@manchester.ac.uk, Efthymios Karangelos

Power imbalance cost allocations schemes ignore that wind farms are dispersed over wide geographical areas and, thus, are exposed to wide spectra of operating conditions. This wide variety of conditions acts to reduce the network-wide power imbalance, albeit in an uncoordinated fashion. Recognizing that this uncoordinated cooperation is beneficial to the economic efficiency and security of a power system, we develop an imbalance cost allocation method effectively rewarding this cooperation.

3 - Dynamic Competition in Electricity Markets: Hydropower and Thermal Generation
Talat Genc, University of Guelph, Dept.. of Economics, Guelph, ON, N1G2W1, Canada, tgenc@uoguelph.ca, Henry Thille

We study dynamic duopolistic competition between hydropower and thermal generation plants under demand uncertainty. We characterize (S-adapted open-loop and Markov perfect) equilibrium investments, hydropower scheduling, and thermal outputs. We compare duopoly equilibrium outcomes with the socially efficient outcomes. In particular, the degree of overinvestment in thermal-capacity and the efficiency of water-use are analyzed.

4 - A Model of the Strategic Petroleum Reserve that Accounts for Forward Markets for Crude Oil
Fernando Oliveira, DR, Warwick University, Warwick Business School, The University of Warwick, Coventry, na, CV4 7AL, United Kingdom, fernando.oliveira@wbs.ac.uk, Fred Murphy

The Strategic Petroleum Reserve has not been used effectively to manage the effect of oil shocks on consuming nations. The main reason is that political aspects of drawdown decisions dominate over economic benefits. We develop an MPEC model of the build up and drawdown of the reserve to maximize consumer welfare subject to the no-arbitrage condition for private inventory holders. The model consists of the government as the leader in a Stackelberg game with private inventory holders as followers.

■ MD47

S-Admiral (Lev. 3)

Mining Applications: Topics in Open Pit and Underground Mining

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Alexandra Newman, Associate Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, anewman@mines.edu

1 - Long Term Optimization of the Production Chain in Open-pit and Underground Copper Mines
Felipe Caro, Assistant Professor, University of California, Los Angeles, Anderson School of Management, Westwood, CA, 90095, United States, fcaro@anderson.ucla.edu, Jaime Catalan, Rafael Epstein, Marcel Goic, Pablo Santibanez, Andres Weintraub

Based on our experience in modeling Chilean open pit and underground copper mines, we discuss the importance of modeling in an integrated way the production chain from the initial extraction to the delivery of final products. In particular, we show the impact of a model used to optimize long term mining plans that has been implemented at Codelco, Chile.

2 - Sequence Optimization for Block Cave Mining
Anita Parkinson, PhD Candidate, University of British Columbia, Vancouver, BC, Canada, Anita.Parkinson@sauder.ubc.ca, S. Thomas McCormick, Maurice Queyranne

An early step in planning a block cave mine is sequence optimization, or deciding where to mine and when. Current practice is a trial and error process. In this work we summarize the techniques used to find a sequence that maximizes the Net Present Value. When the durations of drawpoints are not constant, the problem is similar to the NP Hard problem of scheduling jobs on parallel machines. Requiring a single, contiguous cave makes the problem more challenging.

3 - Optimizing the Transition from Surface to Underground Mining
Alexandra Newman, Associate Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, anewman@mines.edu, Candace Yano, Enrique Rubio

Although many mines commence as open pit to take advantage of the relatively low cost of the mining method and the proximity of the ore to the surface, in order to remain economically viable, mine planners must often transition extraction operations to underground methods. We present an optimization model and results on the optimal timing of this transition.

■ MD48

S-Fremont (Lev. 3)

Simulation II

Contributed Session

Chair: Sharif Melouk, Assistant Professor of Operations Management, University of Alabama, 300 Alston Hall, Tuscaloosa, AL, 35487, United States, smelouk@cba.ua.edu

1 - Analysis of Life Insurance Market Using Multi-Agent Simulation
Takashi Namatame, Associate Professor, Senshu University, 2-1-1 Higashimita, Kawasaki, Kanagawa, Kn, 214-8580, Japan, takashi@isc.senshu-u.ac.jp, Tomoaki Tabata

Recently, the market of life insurance in Japan has been diversifying. Insurance of Japan post service will be privatized, and also the market will be deregulated. In this study, we analyze the life insurance market in Japan using multi-agent simulation framework with macro and individual data concerning with life insurance.

2 - Reflected Variance Estimators for Stationary Simulation Output
David Goldsman, Professor, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, sman@isye.gatech.edu, Melike Meterelliyoz, Christos Alexopoulos, Tuba Aktaran-Kalayci

We propose and analyze a new class of estimators for the variance parameter of a steady-state simulation output process. The estimators are computed from reflections of the original sample path. We discuss reflected versions of nonoverlapping batch means, weighted area, and Cramer-von Mises estimators. We show that it is possible to obtain linear combinations of reflected estimators with smaller variance than the variance of each constituent estimator, often at no cost in bias.

3 - Supply Chain Cost Savings Resulting from a Centralized Information Sharing: Simulation Study
Dmitriy Shaltayev, Assistant Professor of Management, Christopher Newport University, 1 University Place, Newport News, VA, 23692, United States, dmitriy.shaltayev@cnu.edu

One form of coordination in supply chains is sharing of business information with the parties involved in operations. In this research we simulate operations of a two-tiered supply chain. Two scenarios are considered: a traditional model, when the only information shared is quantity of orders placed, and an alternative one with a centralized informational portal. We study the effect of the parameters of supply chain on cost savings that can be achieved through centralized information sharing.

4 - IBatch: An Autoregressive-Batch Means Procedure for Steady-state Simulation Output Analysis
Ali Tafazzoli, PhD Candidate, NCSU, 3500 Cum Laude Ct Apt 203, Raleigh, United States, atafazz@ncsu.edu, James Wilson

We introduce a mathematically traceable interactive batch means method, called IBatch, which is a new automated algorithm for computing steady-state confidence intervals employing an autoregressive approach to estimate the variance of the final point estimator of the steady-state mean. Despite IBatch's substantially simpler and more transparent approach, an extensive performance evaluation provides evidence of its robustness in comparison with some other well-known output analysis methods.

5 - Critical Infrastructure Rebuild Prioritization Using Simulation Optimization
Sharif Melouk, Assistant Professor of Operations Management, University of Alabama, 300 Alston Hall, Tuscaloosa, AL, 35487, United States, smelouk@cba.ua.edu, Nam Suk Cho

This research examines critical infrastructure rebuild strategy following a destructive event such as a terrorist attack or natural disaster. A rebuild simulation model captures the dependency between infrastructures. A simulation optimization approach evaluates rebuild prioritization combinations with a goal of minimizing time needed to achieve acceptable rebuild levels. We recommend a rebuild strategy and areas for further investigation for disaster and emergency management organizations.

■ MD49

S-Greenwood (Lev. 3)

New Methods for the Capacity Control Problem in Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Itir Karaesmen, University of Maryland, College Park, MD, United States, ikaraes@rhsmith.umd.edu

1 - An Exact Solution for Nested Fare RM Problem Using Phase-Type Distributions
German Riano, Assistant Professor, Universidad de los Andes, Calle 19 No 1-37 E, Bogotá, DC, Colombia, griano@uniandes.edu.co, Laura Vielma

In this paper, we present an algorithm to obtain the optimal booking limits for a nested fare classes Revenue Management problem, without the use of Monte Carlo simulation. The algorithm is based on a new closure property of Phase-Type distributions. The use of Phase-Type distributions does not limit the applicability of the model, since this set of distributions is shown to be dense on the real line, and, therefore, it can approximate any data trace.

2 - Time-dependent Bid-prices in Network Revenue Management
Huseyin Topaloglu, Cornell University, Rhodes Hall, Ithaca, NY, United States, ht88@cornell.edu, Sumit Kunnumkal

Linear programming (LP) approaches for the network revenue management problem implicitly assume that the bid-prices remain constant throughout the planning horizon. The dynamic nature of the bid-prices is mimicked by periodically resolving the LPs. In this talk, we present a new class of LPs that naturally yield time-dependent bid-prices. Like the earlier ones, these LPs provide upper bounds on the optimal objective revenue and the bid-prices computed by them are asymptotically optimal.

3 - Robust Dynamic Revenue Management
Huina Gao, University of Maryland, College Park, MD, United States, hgao@rhsmith.umd.edu, Itir Karaesmen, Michael Ball

We analyze the multi-fare, single-leg revenue management problem under limited demand information. Demand in each fare class lies between lower and upper bounds that can be time-variant; no other assumptions are made on arrivals or probability distributions of demand. We analyze this problem using competitive analysis of online algorithms. We provide efficient heuristic methods to obtain booking limits. Computational experiments reveal the benefit of dynamic decision-making.

4 - Pricing of Limited Inventories with Market Segments and Imperfect Customer Identification
Goker Aydin, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States, ayding@umich.edu, Serhan Ziya

We consider the possibility of charging prices that are adjusted according to customer-specific information (a customer signal) as well as time and inventory. Such customization is effective as long as the seller can identify the customer as belonging to a certain market segment, an identification that is not always perfect. We find conditions under which a signal is a meaningful input to pricing decisions. We investigate how the benefits from price customization depend on inventory and time.

■ MD50

S-Issaquah A & B (Lev. 3)

Topics in Pricing and Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Baris Ata, Associate Professor, Northwestern University, Evanston, IL, b-ata@kellogg.northwestern.edu

1 - Dynamic Pricing in a Changing Environment
Omar Besbes, University of Pennsylvania, The Wharton School, 3730 Walnut Street, 551 Jon M Huntsman Hall, Philadelphia, PA, United States, obesbes@wharton.upenn.edu, Assaf Zeevi

We consider a dynamic pricing problem in an environment where the customers' willingness-to-pay distribution is not known and in addition may change over time. We propose a general class of policies which are characterized by three main modules: surveillance (detection), re-estimation (learning) and re-optimization (pricing). Trade-offs between these modules are analyzed and performance guarantees are derived for the proposed policies.

2 - Revenue Management by Sequential Screening
Mustafa Akan, PhD Student, Kellogg School of Management, Managerial Economics & Decision Sciences, Leverone 581, Evanston, IL, 60201, United States, m-akan@kellogg.northwestern.edu, Baris Ata, James Dana

We consider a dynamic model of revenue management, where the consumers are strategic, i.e., forward looking, and learn their valuations over time. A system manager strives to maximize her profits by sequentially screening consumers. Using a mechanism design approach, we characterize the optimal mechanism as a refund contract.

3 - An Approximate DP Approach to Network RM
Vivek Farias, Stanford University, vivekf@stanford.edu, Benjamin Van Roy

We present a scheme for approximating the value function for a class of network RM problems by a concave function separable across inventory levels. Our approach allows for significant (up to 8%) performance gains over exisiting heuristics for such problems and is, in addition, scalable to large problem instances.

4 - Dynamic Pricing with Behavioral Considerations
Javad Nasiry, INSEAD, Blvd de Constance, Fontainebleau, 77300, France, javad.nasiry@insead.edu, Ioana Popescu

We model a dynamic pricing problem where consumers purchase decisions are anchored on multiple reference prices, reflecting past prices, fairness considerations and future price expectations. We characterize the firm's optimal pricing strategies under various models of consumer memory and behavior.

■ MD51

S-Kirkland (Lev. 3)

Stochastic Networks and Resource Allocation

Cluster: Queueing Models
Invited Session

Chair: Mark S. Squillante, IBM T.J. Watson Research Center, Mathematical Sciences Department, 1101 Kitchawan Road, RT 134/P.O. Box 218, Yorktown Heights, NY, 10598, United States, mss@watson.ibm.com

1 - A Linear Programming Algorithm for Steady-state Analysis of Reflected Brownian Motion
Assaf Zeevi, Columbia University, NY, United States, assaf@gsb.columbia.edu, Denis Saure, Peter Glynn

We describe a linear programming-based method for approximately solving the steady-state distribution of RBM in the orthant. The method is based on the basic adjoint relation and approximating the distribution (rather than the density) of the stationary measure. Other applications of the method will be discussed as well.

2 - Bandwidth Sharing Networks in Overload
Bert Zwart, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, 30332, United States, bertzwart@gatech.edu

We consider a multiclass bandwidth sharing network assuming weighted alpha-fair scheduling and at least one of the traffic links is overloaded. Building on work by Gromoll&Williams, we obtain a multidimensional fixed point equation for the growth rates of the number of users. Uniqueness of solutions to this fixed point equation is shown by identifying an associated convex programming problem, which is shown to imply uniqueness of the GW fluid model solution assuming an empty network at time 0.

3 - Optimal Network Scheduling Algorithms
Devavrat Shah, Assistant Professor, MIT, 32-D670, 77 Massachussets Avenue, Cambridge, MA, 02139, United States, devavrat@MIT.EDU, Damon Wischik

We consider question of designing scheduling algorithm for a queueing network in which there are constraints on which queues may be served simultaneously, e.g. wireless networks, switch or bandwidth sharing in the Internet. Using critically loaded fluid model, we obtain insight into designing optimal scheduling algorithm related to the maximum-weight algorithm of Tassiulas-Ephremides (1992).

4 - Optimal Scheduling in a Multiserver Stochastic Network
Mark S. Squillante, IBM T.J. Watson Research Center, Mathematical Sciences Department, 1101 Kitchawan Road, RT 134/P.O. Box 218, Yorktown Heights, NY, 10598, United States, mss@watson.ibm.com, Mayank Sharma, Mohsen Bayati

We consider an optimal scheduling problem in a stochastic network consisting of 2 customer classes and 2 server classes. This problem has received considerable attention in the context of fluid and diffusion scalings of the network. Our goal is to determine the optimal policy and its properties in the original stochastic network, comparing these resuls with those obtained under fluid or diffusion scalings. We believe our approach can be generally applied to a broad class of scheduling problems.

■ MD52

S-Leschi (Lev. 3)

Rail Demand Forecasting

Sponsor: Railway Applications
Sponsored Session

Chair: Clark Cheng, Senior Manager Operations Research, Norfolk Southern Corporation, 1200 Peachtree St. NW, MS 12-117, Atlanta, GA, 30309, United States, clark.cheng@nscorp.com

1 - Forecasting Demand at Union Pacific Railroad

Mark Czerwinski, General Director Business Planning, Union Pacific, 1400 Douglas Street, Stop 1120, Omaha, NE, 68179-1120, United States, MARKCZERWINSKI@UP.COM

The United States economy and overall international trade is booming placing the entire North American transportation infrastructure under stress. The challenge for the North American railroad network is matching resources to meet diverse and growing customer demand. This presentation highlights the process and challenges Union Pacific Railroad faces in forecasting rail demand and integrating the rail demand forecast into the railroad's business planning function.

2 - Demand Forecasting and Resource Planning Utilizing the Operating Plan Tool Set at CSX

Gabe Farra, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32202, United States, Gabe_Farra@csx.com, Dharma Acharya

CSX is utilizing an in-house forecasting tool to input an OD level demand forecast. The Operating Plan Tool (OPT) is then fed the forecasting output to develop resource requirements for crew hiring, car demand, locomotive demand and capacity enhancements. The presentation will describe the process by which OD level demand is input and fed into the OPT tool to develop the operating train plan that allows for developing resource requirements.

3 - Intermodal Demand Forecasting

Maia Pykina, Manager Forecasting and Planning, TTX Company, 101 N Wacker Drive, Chicago, IL, 60606, United States, Maia_Pykina@ttx.com

This presentation will focus on how TTX forecasts the demand for intermodal freight.

4 - Use Demand Forecast for Operations and Asset Planning at Norfolk Southern

Clark Cheng, Senior Manager Operations Research, Norfolk Southern Corporation, 1200 Peachtree St. NW, MS 12-117, Atlanta, GA, 30309, United States, clark.cheng@nscorp.com, Viraj Karnik, Ilya Lavrik, Kitty Vollbrecht

In this presentation, we will give an overview of NS demand forecasting system. We will describe the statistical models that are being used to facilitate business processes and improve forecasting accuracy. The system is tightly integrated into a suite of planning tools and drives the downstream planning processes to optimize operations and assets.

■ MD53

S-Medina (Lev. 3)

New Location Models and Algorithms

Sponsor: Location Analysis
Sponsored Session

Chair: Leyla Ozsen, Purdue University, 315 Grant St, West Lafayette, IN, 47907, United States, lozsen@purdue.edu

1 - A Solution Algorithm for 2-Facility Planar Location-allocation Problems with Dense Demand

Alper Murat, Assistant Professor, Wayne State University, 2051 Manufacturing Engineering Bldg., 4815 Fourth St., Detroit, MI, 48202, United States, amurat@wayne.edu, Vedat Verter

There exists a convex-hull property where two optimal subsets are separated by a line in solving discrete 2-facility planar location and allocation problems. This approach is efficient for small size problems where the size of the problem is determined by number of customers. We propose an extension to this approach for problems with continuous demand and demonstrate its effectiveness for Euclidean and Manhattan metric based distances.

2 - Crossdocking Network Design with Load Balancing and Operational Considerations

Nayoung Cho, PhD Candidate, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States, chon@purdue.edu, Leyla Ozsen

We study a crossdocking network design problem for a two-stage and single product supply chain. Our objective is to determine the optimal location of crossdocking centers and the optimal retailer-crossdocking assignments that minimize the sum of the fixed location, the transportation, the ordering, and the pipeline inventory costs across whole supply chain given the service rate of each facility and the lead time restrictions. We propose a solution methodology based on Lagrangian Relaxation.

3 - Tabu Search Heuristic for the Network Design Model with Lead Time and Safety Stock Considerations

Kyoungsun Lee, PhD Student, Purdue University, 425 W. State Street, West Lafayette, IN, 47907-2056, United States, lee430@purdue.edu, Leyla Ozsen

This paper presents a two-phase tabu search heuristic for the single product network design model with lead time and safety stock considerations. We introduce the concept of indirect-potential cost savings to the move evaluation step. The proposed tabu search heuristic provides near optimum solutions with much less computational efforts than the other published heuristics.

4 - Network Location of a Reliable Center Using the Most Reliable Route Policy

José Santiváñez, Assistant Professor, Universidad del Turabo, P.O. Box 3030, Gurabo, PR, 00778, Puerto Rico, santivanezj@SUAGM.EDU, Emanuel Melachrinoudis

We consider a single location problem on an undirected general network with unreliable edges so as to minimize the maximum expected number of unsuccessful responses to demand requests over all nodes. A polynomial time algorithm and computational results are presented.

■ MD54

S-Queen Anne (Lev. 3)

Dynamic Pricing and Multi-armed Bandits

Sponsor: Applied Probability
Sponsored Session

Chair: Cathy H. Xia, Research Scientist, IBM Research, TJ Watson Research Center, Yorktown Heights, NY, 10598, United States, cathyx@us.ibm.com

1 - Dynamic Pricing to Control Loss Systems with Quality of Service Targets

Robert Hampshire, Professor, Carnegie Mellon University, Pittsburgh, PA, United States, hamp@andrew.cmu.edu, William Massey, Qiong Wang

A wide range of service systems can be modeled as loss systems: agent staffing for call centers, provisioning bandwidth for private line services, and congestion pricing for parking spaces. A major objective for the manager is to find a pricing policy that maximizes total revenue while meeting the quality of service targets desired by the customers. Our pricing solution is a function of the number of customers in the system and a "future congestion tax.

2 - Continuous Multi-hypotheses Testing with Resource Constraints

Ankit Jain, UC Berkeley, 1945 Berkeley Way Apt 327, Berkeley, CA, 94704, United States, ankit@ieor.berkeley.edu, Cathy H. Xia, Parijat Dube, Zhen Liu

We study the problem of efficient resource allocation to answer multiple independent queries in information systems such as sensor networks or traffic monitoring. Presence of continuous streams of data and dynamic environment requires a real time resource allocation mechanism to get information as quickly as possible. We use continuous time control to show for common inference models, the problem reduces to multiple arm bandit and a myopic policy is optimal. We provide bounds for other cases.

3 - Dynamic Decision Making Problems When There are Different Levels of Model Uncertainty

Andrew Lim, Associate Professor, IEOR Department, 4141 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States, lim@ieor.berkeley.edu, George Shantikumar, Peng Li

We consider intensity control problems with different levels of uncertainty for different random factors. We establish a new duality result within this setting which shows how tradeoffs should be made in decision making when there are different uncertainty levels between different factors.

4 - Avoiding Price Dispersion in Learning and Dynamic Pricing with Demand Uncertainty

Cathy H. Xia, Research Scientist, IBM Research, TJ Watson Research Center, Yorktown Heights, NY, 10598, United States, cathyx@us.ibm.com

We revisit the problem of dynamic pricing with demand uncertainty. It has been reported that under the Bayesian Dynamic Programming formulation, the ex ante optimal pricing policy may lead to price dispersion and result in an ex post suboptimal price choice. Such a suboptimal price may hurt the total profit in the long run. We present alternative formulations and dynamic pricing strategies so as to achieve both profitability and the convergence to the ex post optimal price in the long run.

■ MD55

S-Ravenna (Lev. 3)

Robustness and Recovery in Passenger Aviation (A Joint Event with the Alfred P. Sloan Industry Studies Program)

Sponsor: Aviation Applications
Sponsored Session

Chair: Amy Cohn, Assistant Professor, University of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, amycohn@umich.edu

1 - Metrics and Measures of Robustness in Airline Schedules
Shervin AhmadBeygi, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, 48109, United States, shervin@umich.edu, Peter Belobaba, Amy Cohn

Airline plans that are efficient on paper are not always efficient in practice — in fact, planned efficiency and operational robustness are often competing objectives. We discuss metrics and methods for addressing robustness in the airline planning process.

2 - Flight Schedule Adjustments Through Departure and Block Times
Diego Klabjan, University of Illinois at Urbana-Champaign, 205 North Mathews Avenue, Urbana, IL, 61801, United States, klabjan@uiuc.edu, Milind Sohoni, Yu-Ching Lee

Schedule planning divisions determine flight frequencies and preliminary departure times. We provide models that compute exact departure and block times based on the provided stochastic estimates. Operating cost and passenger revenue are captured. Service level based on connecting traffic and the DOT measure is also taken into account.

3 - Robust Optimization for Large-scale, Network-based Resource Allocation Problems
Lavanya Marla, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, United States, lavanya@mit.edu, Cynthia Barnhart

We consider large-scale, network-based resource allocation problems under uncertainty. By proactively modeling data uncertainty, we generate plans which are robust operationally. We propose in this work a decomposition modeling and algorithmic framework that improves solution tractability for deterministic problems and, in addition, models uncertainty. As proof-of-concept, we apply our approach to an airline scheduling problem and evaluate its performance using data from a large carrier.

4 - Decomposition Methods for the Integrated Aircraft Routing and Crew Scheduling Problem
Anne Mercier, CRT, Université de Montréal, C.P. 6128, Succursale Centre-ville, Montréal, Canada, anne.mercier@gerad.ca

In this integrated problem, linking constraints impose minimum connection times for crews that depend on aircraft connections. We propose a model incorporating robustness to handle these constraints and compare two Benders decomposition solution methods. We also consider an additional level of integration by adding some flight scheduling decisions. To solve this extended problem, we propose a compact formulation and a dynamic constraint generation procedure. Computational experiments are presented and some theoretical results are given.

■ MD56

S-Wallingford (Lev. 3)

Auctions in the Wild: Field Studies of Reverse Auctions

Cluster: Auctions
Invited Session

Chair: Otto Koppius, RSM Erasmus University, Dept.. of D&IS (T9-08), P.O. Box 1738, Rotterdam, ZH, 3000 DR, Netherlands, OKoppius@rsm.nl

1 - Portfolios of Buyer-Supplier Relations in Reverse Auctions for IT Services: A Longitudinal Analysis
Uladzimir Radkevitch, PhD Candidate, RSM Erasmus University, Room T09-11, Postbox 1738, Rotterdam, 3000 DR, Netherlands, uradkevitch@rsm.nl, Otto Koppius, Eric van Heck

We study an electronic marketplace for IT services. Despite the transactional nature of the reverse auction mechanism used, many buyers in this market develop relationships with their suppliers. We study the configuration of these relationships over time and show that they evolve into four distinct types of portfolios.

2 - The Value of e-Procurement of Business Services
Fang (Vivian) Zhong, Georgia Institute of Technology, Department of IT Management, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States, Fang.Zhong@mgt.gatech.edu, Tunay Tunca, D.J. Wu

Using online reverse auctions to procure business services is an emerging trend in e-procurement. However, the impact of these auctions on the procurement outcomes is unclear. In this study, we demonstrate empirically that online auctions for business services can achieve sustainable cost reduction, while maintaining supplier quality. We also analyze the effect of incumbent status in supplier selection decisions.

3 - The Influence of Information Architecture on Bidding Activity in Reverse Auctions
Otto Koppius, RSM Erasmus University, Dept.. of D&IS (T9-08), P.O. Box 1738, Rotterdam, ZH, 3000 DR, Netherlands, OKoppius@rsm.nl

In practice, reverse auctions are designed with a wide variety of information architectures that dictate what information is (not) revealed to bidders, such as the lowest bid, bidder's current ranking and total number of bids and bidders. We study the impact that this has on the activity in the auction.

■ MD57

S-Columbia (Lev. 4)

Design Issues in Wireless Sensor Networks

Sponsor: INFORMS Telecommunications Section
Sponsored Session

Chair: Halit Uster, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States, uster@tamu.edu

1 - Complexity Measures and Congestion Issues in Wireless Sensor Networks
Rakesh Nagi, Professor and Chair, University at Buffalo, 438 Bell Hall, Department of Industrial and Systems Eng, Buffalo, NY, 14260, United States, nagi@buffalo.edu, Sumita Mishra, William Lawless, James Llinas, Frank Mufalli

We study the topic of congestion in mobile ad hoc sensor networks in a bandwidth-limited environment. Such sensor networks are prevalent in defense and intelligence-gathering applications. We first present network complexity measures with an interest of determining which characteristics make the network more vulnerable to congestion. We then attempt to study network topology design algorithms that produce relatively congestion free topologies. Results from empirical studies will be discussed.

2 - Bargaining for Resources in Large-scale Wireless Sensor Networks
Abhijit Deshmukh, Program Director, NSF, 4201 Wilson Blvd, Arlington, VA, 22230, United States, adeshmuk@nsf.gov, Timothy Middelkoop

Wireless sensor networks pose interesting challenges when coordination between sensors is required. This talk presents a bargaining protocol designed specifically for resource coordination in distributed sensor networks. This talk will present the bargaining market formulation, characterize the equilibrium solution and present computational results for a large-scale wireless sensor network.

3 - Integrated Topology Control and Routing in Wireless Sensor Network Design
Hui Lin, Texas A&M University, Industrial and Systems Engineering, College Station, TX, linhui@tamu.edu, Halit Uster

We present models employing alternative objectives for integrated topology control and routing in wireless sensor networks. The models attempt to promote energy efficiency with the purpose of prolonging network lifetime. We develop efficient heuristics reinforced with exact methods and cut generations. We provide computational results demonstrating that employing combined objectives based on energy usage and remaining energy characteristics helps to significantly extend the network lifetime.

■ MD58

S-Pike (Lev. 4)

Spreadsheets in OR Practice: Papers from the Interfaces Special Issue

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Thomas Grossman, University of San Francisco, tagrossman@usfca.edu

1 - Time is Money in Trading: Rapid Development of Algorithms Using Excel

Andy Kumiega, Illinois Institute of Technology, akumiega@stuart.iit.edu, Ben Van Vliet

This presentation will discuss a spreadsheet development methodology for quantitative analysts and traders in financial markets. The methodology specifically applies to the development real-time trading tools, and its repetitive design structure allowed a market making firm to quickly develop optimization systems for trading complex products. More generally, the methodology illustrates how to take a mathematical algorithm from initial concept, to working prototype in Excel, to working systems in a C++ client/server environment. The rapid development techniques reviewed will enable firms to quickly derive revenue by implementing new algorithms.

2 - Disseminating Emergency Preparedness Planning Models as Automatically Generated Custom Spreadsheets

Jeffrey W. Herrmann, Associate Professor, University of Maryland, Dept.. of Mechanical Engineering, College Park, MD, United States, jwh2@umd.edu

When public health officials requested operations research models to help county health departments across the United States create plans for dispensing medications and vaccines, we developed capacity planning and queueing network models. We then faced the challenge of distributing these models to a set of persons who have unknown experience with operations research techniques and no resources for acquiring and learning new software. We decided to use spreadsheets, which eliminated the most significant obstacles. To allow users to evaluate a wide variety of plans, we created a spreadsheet application that runs VBA macros to generate customized analytical models without the assistance of an OR professional. Public health emergency preparedness planners can download the software from our web site. Developing spreadsheets for this type of application is very different from end-user modeling and typical spreadsheet applications.

3 - Developments in Microsoft Excel for Analytics

Mor Hezi, Sr. Product Manager, Microsoft

A senior product manager on the Microsoft Office team, will talk on new Excel features and improved Excel features in Office 2007 of particular interest to users of spreadsheets for MS/OR analysis.

■ MD59

S-Seneca (Lev. 4)

Capacity and Technology Acquisition

Cluster: Capacity and Technology Management
Invited Session

Chair: Ali K. Parlakturk, Assistant Professor, Operations, Technology & Innovation Management, Kenan-Flagler Business School, University of North Carolina, Chapel Hill, NC, 27599-3490, United States, Ali_Parlakturk@unc.edu

1 - Mix, Cost and Time Flexibility: Valuation and Trade-offs

Jiri Chod, Boston College, Chestnut Hill, MA, United States, chodj@bc.edu, Nils Rudi, Jan Van Mieghem

We assess the joint impact of different flexibility types on the value of a two-product firm that makes capacity, output and pricing decisions at three time epochs with an underlying continuous-time information evolution. We show that mix and cost flexibilities are substitutes in creating value but both are complementary to time flexibility. We discuss implications of these results for the trade-offs faced by managers when deciding how much to invest in different aspects of flexibility.

2 - Capacity Investment and the Interplay Between Volume Flexibility and Product Flexibility

Manu Goyal, mgoyal@rhsmith.umd.edu, Serguei Netessine

It has been widely recognized that different operational flexibilities are interrelated and that exploiting the linkages between flexibility types can aid decision-making. In particular, both product flexibility and volume flexibility are tools for coping with uncertain demand. We analytically demonstrate the intertwined nature of volume flexibility and product flexibility, and show how their adoption depends on product, market and demand characteristics.

■ MD60

S-University (Lev. 4)

TMS Distinguished Speaker

Sponsor: Technology Management
Sponsored Session

Chair: Moren Levesque, Associate Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, levesque@engmail.uwaterloo.ca

1 - The Impact of Technological Developments on Research in Technology Management

Cheryl Gaimon, Regents' Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, NW, Atlanta, GA, 30308-0520, United States, cheryl.gaimon@mgt.gatech.edu

In this session, TMS Distinguished Speaker Cheryl Gaimon will reflect on how recent major technological developments have impacted research in technology management. She will discuss the differences and similarities of the research that has evolved in manufacturing versus service domains. She will conclude by suggesting opportunities for future research with special attention to multidisciplinary themes.

3 - New Product Diffusion Decisions Under Supply Constraint

Izak Duenyas, Ross School of Business, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States, duenyas@bus.umich.edu, Roman Kapuscinski, Wenjing Shen

We study the optimal pricing, sales and production decisions for a new product when capacity is limited. We generalize the Bass diffusion model by including capacity constraint and dynamic pricing. We find the optimal demand trajectory is unimodal while the optimal price trajectory can be bimodual. Moreover, pricing flexibility is more beneficial when imitation effect dominates innovation effect.

4 - Vertically Differentiated Product Line Design with Shared Capacity

Muge Yayla-Kullu, UNC-Chapel Hill, CB3490 McColl Building, Chapel Hill, NC, 27599, United States, muge_yayla@unc.edu, Jayashankar Swaminathan, Ali K. Parlakturk

We study the product line of a capacity constrained firm. The products differ in their quality and the consumers are heterogeneous in their willingness to pay for quality. We show that accounting for limited capacity can lead to critically different results from that of the existing literature and the capacity plays an important role in determining the optimal product line.

Tuesday, 8:00am - 9:30am

■ TA01

C-Room 602

Supply Chain Optimization II

Contributed Session

Chair: Chase Rainwater, Industrial and Systems Engineering-University of Florida, 303 Weil Hall, Gainesville, 32611-6595, United States, crainwa@ufl.edu

1 - Coordination of Inventory and Transportation Decisions via Shipment Consolidation

Ismail Capar, Assistant Professor, Texas A&M University, TAMU 3367, College Station, TX, 77843, United States, capar@entc.tamu.edu, Burak Eksioglu

A two-stage supply chain with two distribution centers (DCs) and two retailers is analyzed. A central decision maker must decide which DC should replenish a retailer's order and what should be shipment dispatching time. Two models are developed to coordinate inventory and transportation decisions while minimizing the total expected cost per unit time during this dispatching time. A simulation study is performed to illustrate how the proposed models perform under different conditions.

2 - Risk Aversion in NG-markets with Limited Spot Trade Options – The Suppliers Max-profit Model

Frode Römo, Senior Scientist, SINTEF Applied Economics and Operations Research, S.P. Andersens veg 5, Trondheim, NO, 7465, Norway, frode.romo@sintef.no, Marte Fodstad

SINTEF has developed a MIP-model for optimal sourcing of bilateral contracts for the European natural gas markets. We address the special topic regarding the importance of modeling a strategy of never going short in contract obligations, combined with profit maximization and utilization of limited liquid markets and seasonal variations. Combined with physical constraints in the grid, the model gives fast and precise advice for a very complex planning problem in the NG-business.

3 - Supply Chain Optimization Using WAM Systems' Advanced Planning Tool

Frank Kampas, Senior Developer, WAM Systems, 600 W. Germantown Pike, Suite 230, Plymouth Meeting, PA, 19462, United States, fkampas@wamsystems.com

WAM Systems' Advanced Planning tool provides a general transaction-event model for bucketed supply-chain planning with data-cube like reporting. Linear Programming can be used to perform optimized planning using the transaction-event model, without the use of an optimization programming language.

4 - Supply Chain Optimization in the Norwegian Meat Industry

Peter Schütz, SINTEF Technology & Society, Applied Economics and Operations Researc, Trondheim, 7465, Norway, peter.schutz@sintef.no

We discuss a set of mathematical programming models for supply chain optimization. The models have been used as decision-support tools in the Norwegian meat industry and cover different aspects of the supply chain. We present models used for supply chain design, optimization of the material flow within the supply chain, as well as models for optimizing different levels of the chain, such as cutting or processing. We will also report experience from the company for which the models are developed.

5 - Multi-period Production Planning with Flexible Customer Demands

Chase Rainwater, Industrial and Systems Engineering-University of Florida, 303 Weil Hall, Gainesville, 32611-6595, United States, crainwa@ufl.edu, Joseph Geunes, Edwin Romeijn

We consider a profit-maximizing multi-period production planning problem in which a customer will accept quantities within a specified range and revenue is accrued per unit of production. The manufacturer incurs a fixed cost for each agent utilized to satisfy demand. Holding costs are considered if a job is produced prior to a customer's requirement period. We develop a greedy heuristic with subsequent improvement algorithms as well as an exact branch-and-price algorithm.

■ TA02

C-Room 603

Optimization in Postal Logistics

Cluster: Closed-Loop Supply Chains and Sustainable Operations

Invited Session

Chair: Hans- Jürgen Sebastian, Professor, RWTH Aachen University, Templergraben 64, Aachen, 52062, Germany, Sebastian@or.rwth-aachen.de

1 - Optimization of Distribution Networks in Postal Logistics

Hans- Jürgen Sebastian, Professor, RWTH Aachen University, Templergraben 64, Aachen, 52062, Germany, Sebastian@or.rwth-aachen.de

This presentation gives an overview of the area of postal logistics for letter, parcel, express and freight mail.The subsystems of a typical distribution network mail collection,sorting centers and delivery stations, long-haul transportation and the last mile will be discussed and typical optimization problems of the network planning phases will be presented.Finally ,an overview of case studies together with Deutsche Post World Net will be given .

2 - Optimization of Multilevel Facility Location Problems in Postal Logistics

Jens Wollenweber, RWTH Aachen, Templergraben 64, Aachen, Germany, wollenweber@or.rwth-aachen.de

Many location problems in postal logistics can be modeled as multilevel capacitated facility location problems. We introduce such a multilevel problem with additional properties and propose a two-phase heuristic approach which calculates near optimal solution for instances with up to 3,000 candidate facilities. The approach consists of a construction heuristic, based on the solution of the LP-relaxation, and of a variable neighborhood improvement heuristic in the second phase.

3 - Planning and Optimization of Postal Distribution Networks with TransIT

Tore Gruenert, General Manager, GTS Systems and Consulting GmbH, Raiffeisenstr. 10, Herzogenrath, NW, 52134, Germany, gruenert@gts-systems.de

In this talk we present the decision support system TransIT. TransIT is an interactive planning and supervision system for vehicle routing and dispatching. TransIT is used in different fields of distribution planning and dispatching and combines state-of-the-art optimization technology with modern software technology for GPS routing, electronic mapping, and web and mobile communication.

■ TA03

C-Room 604

Supply Chain Operations

Cluster: Supply Chain

Invited Session

Chair: Fernando Bernstein, Associate Professor, Duke University, 1 Towerview Dr., Durham, NC, 27705, United States, fernando@duke.edu

1 - Characterizing Supply Chain Orchestration

Pranab Majumder, Assistant Professor, Duke University, Fuqua School of Business, Box 90120, Duke University, Durham, NC, 27708, United States, majumder@duke.edu, Ashok Srinivasan

Using the network model of supply chains from Majumder and Srinivasan (2007), we present a characterization of the trade-offs involved in supply chain orchestration. We illustrate that large network supply chains must be orchestrated in order to be efficient, since a reasonably featured model cannot be optimized using current supply chain contract knowledge. However, we also show that orchestration is not guaranteed to make the supply chain more efficient.

2 - Competitive Price Matching Guarantees in an Uncertain Demand Environment

Arcan Nalca, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, arcan.nalca@mcgill.ca, Tamer Boyaci, Saibal Ray

Price matching guarantees are offers to match any lower price of the competitor. Firms require the availability of the product at the competitor location in order to match the price. If the product is not available there, the price is not matched. A duopoly model is built to investigate the price and inventory decisions and also the verification of inventory before matching the price. We show that verification of inventory allows firm to price discriminate based on the availability.

3 - What Contributes to the High Cost of College Textbooks?

Haresh Gurnani, Professor, University of Miami, 417B Jenkins Building, Department of Management, Coral Gables, FL, 33124, United States, haresh@miami.edu, Shuya Yin, Saibal Ray

We consider a decentralized supply chain comprising of a bookstore and a textbook publisher. The bookstore decides the buyback price for used books and can also buy unused books from the publisher for sale to students. The publisher decides whether to publish a new edition (at a cost) or not to release a new edition, and accordingly sets the wholesale price. Our analysis sheds light on the role that buybacks and/or new edition releases play on soaring prices in the college textbook industry.

4 - Managing Operational Risks in Contract Manufacturing
Fernando Bernstein, Associate Professor, Duke University, 1 Towerview Dr., Durham, NC, 27705, United States, fernando@duke.edu

To mitigate the risks associated with demand variability and supply variability, firms employ a variety of hedging strategies, e.g., resource flexibility, component commonality, supplier diversification, etc. We investigate the impact of outsourcing production to a contract manufacturer on the implementation of these hedging practices.

■ TA04

C-Room 606

Tutorial: Econometric Models in Operations Management

Cluster: Tutorials
Invited Session

1 - Econometric Models in Operations Management
Christian Terwiesch, Professor, The Wharton School, 3730 Walnut St, Philadelphia, PA, 19104, United States, terwiesch@wharton.upenn.edu

The last couple of years have witnessed an increased interest in empirical research in Operations Management. However, unlike other management disciplines, Operations Management does not have a strong record of connecting theory development and empirical analysis. The objective of the tutorial is to address this disconnect. We will discuss several forms in which theoretical (modeling) research can be combined with empirical (econometric) research, including structural estimation, micro-level productivity studies, and instrumental variable estimation.

■ TA05

C-Room 607

Decision Analysis

Contributed Session

Chair: Kris Lieckens, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, kris.lieckens@ua.ac.be

1 - Decision Support for Analysis of Operator Errors
Alexander Yemelyanov, Professor, Georgia Southwestern State University, 800 GSW University Drive, Americus, GA, 31709, United States, ay@canes.gsw.edu, Alla Yemelyanov

A method of modeling of human operator errors is presented. This method is based on the activity theory, object-oriented analysis and design, and uses theory of frames, modal logic, and results of psychological experiments. It takes into account personal and social factors of operator activity, his conscious and unconscious motives, as well as organizational and technical components. The suggested approach was implemented in aviation in the decision support system for analysis of pilot errors.

2 - The Movie Shoot Scheduling Problem
Felix Bomsdorf, University of Cologne, Pohligstr. 1, Cologne, 50969, Germany, bomsdorf@uni-koeln.de, Ulrich Derigs

Creating a movie shoot schedule is an important part of the movie production process. Even for a small movie project 50 activities requiring 130 resources such as actors, director, locations etc. have to be scheduled respecting complex constraints which may be imposed on single resources as well as on every activity. We present the movie shoot scheduling problem(MSSP)as well as our decision support system 'Schedule This' with its model component based on the formal MSSP and its dialog component.

3 - A Cybernetic-based Multi-criteria Decision Analysis Model for Maximising Commercial 'Well Being'
Stephen J Brewis, BT Wholesale, BT Group plc, BT Centre 81 Newgate St, London, EC1A 7AJ, United Kingdom, steve.brewis@bt.com, K. Nadia Papamichail, Vidya Rajaram

This paper illustrates how a cybernetic intervention can be used to cohere disparate models and provide navigational functionality to direct and steer an enterprise through multidimensional commercial environments. A multi-criteria decision analysis model that seeks to achieve the ultimate systemic Eudomic goal of ëWell Being' is presented.

4 - Queueing Manufacturing Models in Action at Atlas Copco Portable Air
Kris Lieckens, University of Antwerp, Prinsstraat 13, Antwerp, 2000, Belgium, kris.lieckens@ua.ac.be, Nico Vandaele

Faced with high variabilities in the performance of their suppliers and internal processes, the division of portable air tools at Atlas Copco applies Advanced Resource Planning techniques to support their capacity decisions. The engine is a queueing model that accounts for various stochastic elements. It also predicts a delivery time that can be quoted to customers with a specified probability. Management can then decide on the trade-off between resource investments and customer satisfaction.

■ TA06

C-Room 608

Supply Chain Planning Under Uncertainty

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Chung-Yee Lee, Department Chair, Hong Kong Univ of Sci. & Tech., Clear Water Bay, Kowloon, HK, Hong Kong - ROC, cylee@ust.hk,

Co-Chair: Chung-Piaw Teo, Professor, Department of Decision Sciences, National University of Singapore, Singapore, bizteocp@nus.edu.sg

1 - Supply Chain Coordination with Two-direction Adjustment Contract
Rong Li, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, 178899, Singapore, rongli@smu.edu.sg, Jennifer Ryan

We study coordination issues for a supply chain, which consists of a retailer and a supplier, who provides a short-life product under a wholesale price contract and an adjustment contract. The retailer can purchase at a low price before the selling season. In the middle of the selling season, the retailer can adjust inventory level upwards or downwards at a higher cost under the adjustment contract, which reduces the inventory risk for the supply chain.

2 - Optimal Purchasing Policies of Fresh Product with Random Delivery Times
Xiaoqiang Cai, Professor, Chinese University of HK, Dept. of SE&EM, Shatin, NT, Hong Kong - ROC, xqcai@se.cuhk.edu.hk, Xiaolin Xu

A distributor purchases a fresh product from multiple suppliers, to sell it at a whole-sale market. The delivery time from each supplier is uncertain. The whole-sale market opens for trading only in a short period, and so any product arriving earlier has to wait and faces the risk of decay, while arriving later will lose the sales opportunity. We formulate the problem as a multi-supplier selection problem with random yield, and derive the optimal selection criteria.

3 - To Offshore or Not to Offshore? An Analysis of Risk and Benefits
Letian Wang, PhD Student, McGill University, 1001 Sherbrooke Street West, Montreal, Quebec, H3A 1G5, Canada, lwang87@po-box.mcgill.ca, Shanling Li

This research considers a global capacity planning problem. A manufacturer has an option to build plant(s) in either domestic or foreign countries to meet global demand. With the uncertainty in foreign exchange rate or demand, we study the optimal capacity expansion and operational solutions by risk-neutral and risk-averse decision makers.

4 - Risk Adjusted Portfolio Procurement Management
Chung-Yee Lee, Department Chair, Hong Kong University of Sci. & Tech., Clear Water Bay, Kowloon, Hong Kong - ROC, cylee@ust.hk, Qi Fu, Chung-Piaw Teo

Many procurement managers reported the need of meeting their performance target as the primary concern when making procurement decisions. This study proposes a risk adjusted approach to address this type of performance measurement in a portfolio procurement environment. We compare the procurement decisions under this risk adjusted approach with those of the risk neutral approach, and discuss how different performance measurements could affect the choice of procurement strategy.

■ TA07

C-Room 609

Competition and Incentives (talks by job market candidates)

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Serguei Netessine, Associate Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu

Co-Chair: Gerard Cachon, University of Pennsylvania, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, cachon@wharton.upenn.edu

1 - Incentives in Low-Demand Service Systems
Sang-Hyun Kim, Doctoral Student, The Wharton School, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, shkim@wharton.upenn.edu, Morris Cohen, Serguei Netessine

We study contracting arrangements in a supply chain in which the service delivery is outsourced and the demands for services arrive infrequently but have high impacts. Such cases arise often, for example, in after-sales services of expensive equipments. Low-demand environment presents unique challenges, in particular, an assessment of the contractor's performance. We identify inefficiencies and risks inherent in this setting and propose ways to mitigate them.

2 - Long-term Contracts Under the Threat of Supplier Default
Robert Swinney, Doctoral Student, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, rswinney@wharton.upenn.edu, Serguei Netessine

We address the issue of contracting with suppliers facing the threat of failure when the probability of failure is directly influenced by contract terms (e.g., price and length of contract). We model this dynamic through a two period contracting game with two suppliers, a single buyer, and uncertain production costs and total demand. We determine when it is optimal to commit to a long-term relationship, and how this decision is affected by suppliers under the threat of failure.

3 - Beating the Accuracy Trap: Overinvestment in Demand Forecasting and Supply Chain Coordination
Hyoduk Shin, PhD Candidate, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States, hshin@stanford.edu, Tunay Tunca

We study supply chain coordination with investment in demand forecasting. We show that common pricing schemes suffer from overinvestment in forecasting. We demonstrate that wholesale price and two-part tariff scheme can result in full loss of efficiency, and explore the determinants of the levels of inefficiency in investment and surplus. We also propose a contracting scheme that utilizes market interaction and solves important implementation problems in addition to achieving full coordination.

4 - Competition in Large-scale Service Systems: Do Waiting Time Standards Matter
Itai Gurvich, Doctoral Student, Columbia Business School, Uris Hall, 3022 Broadway, New York, NY, 10027, United States, ig2126@columbia.edu, Gad Allon

We study the equilibrium behavior in a market with both small- and large-scale service providers that compete on both price and service level attributes. Applying the epsilon-Nash equilibrium framework to a sequence of markets with growing aggregate demand allows us to identify key properties of these markets. When restricting the demand models under consideration, we show that competition forces the firms to operate in the Quality and Efficiency Driven (QED) operational regime.

■ TA08

C-Room 611

Strategies and Architecture of Supply Chains for Managing Disruptions

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Laird Burns, Michigan State University, N370 North Business Complex, Eli Broad Graduate School of Business, East Lansing, MI, 48824, United States, burnslai@msu.edu

1 - Organizational Strategy and Supply Chain Architecture: A Multi-method Study of Supply Disruptions
Laird Burns, Michigan State University, N370 North Business Complex, Eli Broad Graduate School of Business, East Lansing, MI, 48824, United States, burnslai@msu.edu, Steven A. Melnyk

This study extends classical strategy-structure research by investigating firm performance differences under conditions of supply disruption. This study uses computational modeling to evaluate the interactive aspects of firm strategy, supply chain design/architecture, and risk management/risk planning using empirical firm data and actual supply networks. Implications for academics and practitioners will be presented on these critical areas of research.

2 - Revisiting Vertical Integration
Augusto Ruperez Micola, Research Fellow, IMD - Institute for Management Development, Chemin de Bellerive, 23, Lausanne, 1007, Switzerland, Augusto.RuperezMicola@imd.ch, James Henderson

We revise and provide new vertical integration motives including creating of upstream/downstream markets, supply chain optimisation, importance of quality, market power and risk factors. The analysis is based on the systematic examination of a wide array of industries including, among others the commodities, luxury goods, hospitality and paper sectors.

3 - The Impact of Disruptions on Supply Chain Strategy and Performance
John Macdonald, University of Maryland, 3411 Van Munching Hall, College Park, MD, 20742, United States, jmacdona@umd.edu, Tom Corsi

Disruptions in supply chains have strategic and performance consequences. Some supply chains make strategic changes after a disruption while others choose to maintain the same strategy. Using the theory of strategic persistence and an experimental methodology, we will manipulate the impact of a disruption and observe its effect on strategic persistence and relative performance. This will provide significant managerial insights for determining strategic directions after disruptions.

4 - Dynamic Oligopolistic Competition in a Disruptive Supply Chain Network
Reetabrata Mookherjee, Sr. Scientist, Zilliant Inc, 3815 S Capital of Texas Hwy, Suite 300, Austin, TX, 78704, United States, reeto.mookherjee@gmail.com, Terry Friesz

In this talk we describe a family of competitive models of supply chains operating in realistic decision environments reflecting demand uncertainty and supply side disruptions.

■ TA09

C-Room 612

Emergency Response and Disaster Relief Logistics Planning

Cluster: Homeland Security
Invited Session

Chair: Emmett Lodree, Jr., Auburn University, Industrial and Systems Engineering, 207 Dunstan Hall, Auburn, AL, 36849, United States, elodree@auburn.edu

1 - Network Flow in Emergency Response
Jarrett Chapman, North Carolina A&T State University, 1601 East Market Street, Greensboro, NC, 27411, United States, jc016446@ncat.edu, Funda Samanlioglu, Lauren Davis

Motivated by the lack of logistics in the wake of hurricane Katrina, this research determines an effective strategy to pre-position and allocate supplies before and after an event. A stochastic linear programming model is developed to minimize the cost associated with satisfying demand, taking into consideration uncertainty associated with demand and damage to the supply caused by the event. The benefits associated with pre-positioning versus non-pre-positioning will be illustrated.

2 - Lane-based Evacuation Route Planning for Two Heterogeneous Flows
Amani Saleh, Inustrial Engineer- PhD Student, University of Central Florida, 530 Buckingham Rd. #1031, Richardson, TX, 75081, United States, asaleh@mail.ucf.edu, Christopher Geiger

In emergency situations, at least flows occur almost simultaneously – the flow of evacuees from a hazard area to areas of safety and the flow of emergency first responders to the impacted areas. These two flows are incompatible, traversing a transportation network with lane-based roads and intersection merge and cross points. The route planning problem is viewed as a max flow problem and formulated as an integer linear program. Experimental results for a specific geographical area are presented.

3 - Evacuation Relief Shelter Planning for Anticipated Hurricane Events
Abeer Sharawi, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States, asharawi@mail.ucf.edu, Renee Butler, Christopher Geiger

The need for better disaster planning models has grown significantly, especially in the aftermath of Hurricane Katrina. Several Federal authorities state that there are weaknesses in the models currently used in practice. We present a robust optimization model for identifying relief shelter locations and the levels of emergency supplies to position at the shelters prior to a hurricane threat to a targeted area. We apply the model to three different evacuation scenarios and show its promise.

4 - Emergency Supplies Inventory Planning Before the Hurricane Season
Selda Taskin, University of Auburn, taskise@auburn.edu, Emmett Lodree, Jr.

We introduce a stochastic inventory model with Bayesian forecast updates that is relevant to determining inventory levels for emergency supplies that will potentially be consumed during the hurricane season. The model addresses the trade-off between forecast accuracy and cost efficiency over time and integrates evolving hurricane predictions into the decision process.

■ TA10

C-Room 613

Supply Chains: Information and Product Flows

Cluster: Inventory
Invited Session

Chair: Alp Muharremoglu, Columbia Business School, Decision, Risk and Operations Division, 3022 Broadway, 410 Uris Hall, New York, NY, 10027, United States, alp2101@columbia.edu

1 - The Multi-location Transshipment Problem with Positive Replenishment Lead Times

Enver Yucesan, Professor, INSEAD, Technology and Operations Management Are, Boulevard de Constance, Fontainebleau, 77305, France, Enver.Yucesan@insead.edu, Yeming Gong

Transshipments, monitored movements of material at the same echelon of a supply chain, represent an effective pooling mechanism. Earlier papers dealing with transshipments either do not typically incorporate replenishment lead times into their analysis. This paper uses simulation optimization to examine the multi-location transshipment problem with positive replenishment lead times. It demonstrates the computation of optimal base stock quantities through sample path optimization.

2 - Competing for Scarce Capacity with Advance Purchasing Orders

Denis Saure, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, DSaure05@gsb.columbia.edu, Nicolas Stier-Moses, Alp Muharremoglu

We study a supply chain with a single supplier and two retailers. The supplier has a fixed capacity that is shared by both retailers' orders. Retailers have the option to place an advance order. Later, after uncertainty is resolved, they can increase their order size if they wish. At both ordering points, the supplier applies the uniform allocation rule to distribute capacity to retailers. We characterize the equilibrium behavior of this supply chain game.

3 - Impact of Replenishment Policies on the Value of Demand Information in a Serial Supply Chain

Kevin Shang, Fuqua School of Busines, Duke University, Durham, NC, United States, khshang@duke.edu, Sean Zhou

A supply chain includes material and information flows. Only when these two flows are managed simultaneously, the value of information can be maximized. This paper addresses this issue by investigating how the value of demand information is affected by inventory replenishment practices, i.e., responsive and periodic replenishments.

4 - Inventory Management with Advance Demand Information and Flexible Delivery

Tong Wang, PhD Candidate, Insead, Decision Sciences Area, Fontainebleau Cedex, 77305, France, tong.wang@insead.edu, Beril Toktay

We consider an inventory model with advance demand information and flexible delivery. We develop a lower-bound approximation based on an allocation assumption, and propose protection level heuristics that yield upper bounds on the optimal cost. Numerical analysis quantifies the benefit of delivery flexibility (14% on average) and the optimality gaps of the heuristics (2% on average).

■ TA11

C-Room 614

Capacity Management and Channel Incentives

Cluster: Manufacturing
Invited Session

Chair: Li Jiang, Assistant Professor, Hong Kong Polytechnic University, Department of Logistics, Hung Hom, KN, Hong Kong - ROC, L.Jiang@inet.polyu.edu.hk

1 - The Effect of Special Orders on Manufacturer-retailer Interactions

Diwakar Gupta, Professor, University of Minnesota, 111 Church Street SE, Minneapolis, MN, 55455, United States, guptad@me.umn.edu, Hao-Wei Chen, Haresh Gurnani

Many retailers offer to special order out-of-stock items at no additional cost to the customers assuming that special orders increase demand, reduce stock outs, and thereby increasing profits. We study the relative benefit of special ordering to the retailer under single and two-price price mechanisms with single and dual sourcing.

2 - Competitive Due-date and Capacity Management in Internal Markets

Murat Erkoc, Assistant Professor, University of Miami, Dept.. of Industrial Engineering, P.O. Box 248294, Coral Gables, FL, 33124, United States, merkoc@miami.edu, David Wu, Haresh Gurnani

In this study we consider a make-to-order (MTO) firm where marketing and manufacturing divisions simultaneously make due-date and capacity investment decisions, respectively. We study the impact of how two divisions share the costs associated with tardy deliveries, and derive the equilibrium policies. We investigate the value of capacity flexibility.

3 - Pricing, Product Variety and Inventory Decisions in the Presence of Supply Disruptions

Saed Alizamir, University of Florida, 2909, SW 13th St., Apt 34, Gainesville, FL, 32608, United States, saed@ufl.edu, Aydin Alptekinoglu, Amar Sapra

We consider a manufacturer that offers multiple variants in two brands of a product with a long life-cycle. Both brands use a critical component that is sourced from two different suppliers, which are prone to disruption. As a consequence of this supply uncertainty, the manufacturer may not be able to offer product variants of a brand in the marketplace. We examine how this uncertainty in supply affect her pricing, product variety and inventory decisions.

4 - Endogenous Flexibility Installation Under Asymmetric Cost Structure and Demand Uncertainty

Li Jiang, Assistant Professor, Hong Kong Polytechnic University, Department of Logistics, Hung Hom, KN, Hong Kong - ROC, L.Jiang@inet.polyu.edu.hk

We provide a detailed analysis of flexibility decision by firms in monopoly and competitive settings facing demand uncertainty. By defining flexibility on a continuous spectrum to allow it to affect production cost after demand uncertainty is resolved, we completely characterize flexibility and expected profit of firms with asymmetric cost structures, and discuss the effects of demand, competition, decision sequence, and cost parameters on flexibility, capacity and profitability.

■ TA12

C-Room 615

Competition, Cooperation and Contracts in Scheduling Games

Cluster: Scheduling
Invited Session

Chair: George Vairaktarakis, Associate Professor, Case Western Reserve University, 323 PBL, 10900 Euclid Ave, Cleveland, OH, 44124, United States, George.Vairaktarakis@case.edu

1 - Subcontracting Strategies with Stochastic Third-party Capacity and Tardiness Sharing Contracts

Tolga Aydinliyim, Assistant Professor, Decision Sciences Department, Lundquist College of Business, University of Oregon, Eugene, OR, 97403, United States, tolga@uoregon.edu, George Vairaktarakis

A manufacturer cannot process all his workload before the customer due date and subcontracts part of his workload to a third-party with stochastic prior commitments. We study two different contracts; (i) a price-only contract, and (ii) a tardiness penalty sharing contract. The second contract coordinates the chain, Pareto-dominates all non-coordinating contracts if the contract parameters are negotiated jointly, and achieves higher chain efficiency even when there is coordination failure.

2 - Decentralization Cost in Scheduling - A Game Theoretic Approach

Eran Hanany, Assistant Professor, Tel Aviv University, Department of Industrial Engineering, Faculty of Engineering, Ramat Aviv, 69978, Israel, hananye@post.tau.ac.il, Yossi Bukchin

Decentralized organizations may incur inefficiencies due to scheduling based competition for limited resources. We analyze the `Decentralization Cost', the ratio between the Nash equilibrium cost and the cost attained at the centralized optimum. Solution properties and bounds on the decentralization cost are derived for a dispatching-sequencing model. A scheduling-based coordinating mechanism is then provided, ensuring that the centralized solution is obtained at equilibrium.

3 - Centralization vs. Competition in Subcontracting Operations

George Vairaktarakis, Associate Professor, Case Western Reserve University, 323 PBL, 10900 Euclid Ave, Cleveland, OH, 44124, United States, George.Vairaktarakis@case.edu, Tolga Aydinliyim

A set of manufacturers allocate their workloads among an in-house resource and a flexible third-party resource, each with the objective of completing his workload the soonest possible. The competitive subcontracting strategies or the FCFS schedules do not result to maximum utilization of the third-party capacity. We present optimal centralized strategies, compare centralized and decentralized schedules, and provide policy guidelines that facilitate centralization by allocating savings.

4 - Encouraging Cooperation in Sharing Supermodular Costs
Nelson Uhan, PhD Candidate, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue, E40-130, Cambridge, MA, 02139, United States, uhan@mit.edu, Andreas Schulz

The least core value of a cooperative game is the minimum penalty for defection that encourages agent cooperation. We study complexity and algorithmic aspects of the least core value of cooperative games with supermodular costs. We also provide motivation for studying these games by showing that a particular class of optimization problems has supermodular optimal costs. This class includes many problems in machine scheduling, and more generally, combinatorial optimization.

■ TA13

C-Room 616

Integer Programming

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Gabor Pataki, Department of Statistics and Operations Research, UNC Chapel Hill, Chapel Hill, NC, United States, pataki@email.unc.edu

1 - Multi-stage Integer Programs in Power Networks
Daniel Bienstock, Columbia University, dano@ieor.columbia.edu, Abhinav Verma

We present continuing work on various models for the dynamics of a blackout. These models lead to difficult multi-stage mixed-integer programs. In particular, we are interested in optimal 'attack' problems which server as a paradigm for exposing hidden weaknesses in a network. Joint work with A. Verma.

2 - On Generating Cuts for Facial Solutions
Sanjay Mehrotra, Professor, Northwestern University, 2145 sheridan road, Evanston, il, 60201, United States, mehrotra@iems.northwestern.edu, Huanyuan Sheng

We will present methods for generating cuts for facial solution of integer programming problems. These cuts are generated from exploring lattices associated with the sub-faces of a given face. A lattice characterization of the cuts is also given.

3 - Parallel Approximation, and Integer Programming
Gabor Pataki, Department of Statistics and Operations Research, UNC Chapel Hill, Chapel Hill, NC, United States, pataki@email.unc.edu, Mustafa Tural

The Parallel Approximation Problem is: Given an integral vector a, find an integral vector p, which is near parallel to a, and has much smaller norm. More generally, the vector a should be approximated with a combination of k integral vectors. We prove a bound on the quality of the approximaton, and as a corollary we show in subset sum problems with sufficiently large norm of the left hand side for almost all right hand sides the problem has a simple proof of infeasibility.

4 - Probabilistic Set Covering Problem: Distributions with Sparse Support
Anureet Saxena, Tepper School of Business, CMU, 5624 Fifth Ave, Appt C13, Pittsburgh PA 15232, United States of America, anureets@andrew.cmu.edu

We give a MIP reformulation of the probabilistic set covering problem where the 0-1 random variable has a sparse support distribution. The number of variables in the model is independent of the support size and we give a simple linear time algorithm to separate the possibly exponential sized constraints. Finally we extend our results to arbitrary poly-time computable distribution functions and discuss computational results.

■ TA14

C-Room 617

Robust Optimization Modeling and Applications

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Xin Chen, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States, xinchen@uiuc.edu

1 - Uncertain Linear Programs: Extended Affinely Adjustable Robust Counterparts
Xin Chen, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61801, United States, xinchen@uiuc.edu, Yuhan Zhang

Wintroduce the extended affinely adjustable robust counterpart to modeling and solving multi-stage uncertain linear programs with fixed recourse. We demonstrate both theoretically and computationally that our approach may significantly outperform the affinely adjustable robust counterpart. Similar to the affinely adjustable robust counterpart, our approach ends up with deterministic optimization formulations that are tractable and scalable to multi-stage problems.

2 - Portfolio Value-at-risk Optimization Using Partitioned Statistics
Melvyn Sim, Professor, NUS Business School, Singapore, dscsimm@nus.edu.sg, Kian-Guan Lim

We present an approach for minimizing portfolio VaR that takes into consideration asymmetries in the distributions of asset returns. Essentially, the space of random returns is partition into positive and negative half-spaces, which map directly into profit and loss respectively in the portfolio outcomes. Using the statics information on these two half-spaces, we introduce a so-called partitioned VaR measure, in which minimizing the risk measure is a tractable problem in the form of SOCP.

3 - Satisficing Measures for Analysis of Risky Positions
David Brown, Assistant Professor, Duke University: Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, dbbrown@duke.edu, Melvyn Sim

In this work we consider a class of measures for evaluating the quality of risky portfolios based on their performance relative to desired targets. We call these measures satisficing measures and show that they are dual to classes of corresponding risk measures. These dual descriptions have significant practical value in that they involve specifications of target or benchmark performance levels as opposed to risk tolerance parameters.

■ TA15

C-Room 618

Stochastic Programming Applications and Modeling

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Guzin Bayraksan, Assistant Professor, University of Arizona, P.O. Box 210020, Tucson, AZ, 85721, United States, guzinb@sie.arizona.edu

1 - Sample Average Approximation of Mean-risk Stochastic Programs
Shabbir Ahmed, Georgia Institute of Technology, sahmed@isye.gatech.edu, Wei Wang

Sample Average Approximation (SAA) has been very successful for solving traditional risk-neutral stochastic programs involving an expectation objective. We investigate the SAA method for solving some classes of risk averse stochastic programs involving a weighted mean-risk objective.

2 - Probabilistic Constarints with Cumulative Random Right-hand Sides
Miguel Lejeune, Assistant Professor, mlejeune@andrew.cmu.edu

We study stochastic problems containing joint probabilistic constraints with cumulative random right-hand sides. We propose several reformulation approaches for this type of problems, analyze their properties and test their computational tractability.

3 - Optimal Draining of Fluid Networks with Parameter Uncertainty: Recourse Case
Burak Buke, PhD Candidate, The University of Texas at Austin, OR/IE Program, 1 University Station C2200, Austin, TX, 78712, United States, bukeb@mail.utexas.edu, John Hasenbein, David Morton

In this work, we explore the makespan problem in fluid networks with parameter uncertainty. The initial controls are set without complete knowledge of the parameters. After some fixed time T, the controller is allowed to take a recourse action. This problem turns out to be a non-convex stochastic programming problem. We analyze the structural properties of this stochastic programming problem and discuss possible solution methodologies.

4 - Reliability Constrained Multi-area Power Systems Adequacy Planning Using SP with SAA
Panida Jirutitijaroen, Research Assistant, Texas A&M University, 400 Nagle St. Apt 102, College Station, TX, 77840, United States, pjirut@ece.tamu.edu, Chanan Singh

We first address the challenges of the problem, namely, reliability evaluation and optimization. The problem is formulated as a two-stage recourse model where randomness in generation, transmission lines, and loads are considered. Reliability index is the expected cost of load loss as it incorporates duration and magnitude of load loss. Sample-average approximation technique, using Monte Carlo and Latin Hypercube sampling, is employed. The method is tested on an actual twelve-area power system.

■ TA16

C-Room 619

Optimization Applications

Cluster: Optimization (Invited)
Invited Session

Chair: David Kim, Oregon State University, 121 Covell, Corvallis, OR, 97330, United States, kimda@engr.orst.edu

1 - Minimizing Total Weighted Tardiness on Burn-in Ovens in Semiconductor Manufacturing
Shubin Xu, Charles H. Lunquist College of Business, University of Oregon, Eugene, OR, 97403-1208, United States, sxu@uoregon.edu, James Bean

We study burn-in oven scheduling in semiconductor manufacturing with parallel, non-identical ovens and total weighted tardiness objective. Jobs have non-zero ready-time and variable processing times. We present a random keys genetic algorithm that finds good solutions in reasonable computation time.

2 - Efficient Methods for Solving a Large-Scale Multistage Stochastic Program
Sarah Ryan, Iowa State University, IA, United States, smryan@iastate.edu, Yan Wang

We use a rolling two-stage procedure to solve a multistage stochastic program to assess the effects of uncertainties in fuel prices and demands on optimal energy flows in the U.S. To avoid solving large deterministic equivalents, we investigate decomposition, sampling and scenario reduction methods that exploit both the generalized network structure of the optimization model and the multistage nature of forecast revision and uncertainty resolution.

3 - A Hybrid Methodology for Freeway Work Zone Optimization with Time Constraints
Ning Yang, University of Maryland, Department of CEE, Glenn L. Martin Hall, College Park, MD, 20742, United States, ningyang@umd.edu, Paul Schonfeld

In this paper, optimization techniques are applied to determine the appropriate work zone lane-closure schedules and traffic control strategies which can minimize the total costs, subject to working time constraints. A heuristic optimization algorithm, named two-stage modified simulated annealing (2SA), is developed to search for an optimized solution. A macroscopic analytic model and a microscopic simulation program are used to evaluate the objective function in the two stages, respectively.

4 - Predictive Model of the Read Performance of EPC RFID Tags in Supply Chain Environments
J. David Porter, Associate Professor, Oregon State University, 110 Covell, Corvallis, OR, 97331, United States, david.porter@orst.edu, Mario Magaña, David Kim

RFID technology is quickly becoming the item-tracking solution of choice in supply chain applications. However, most RFID deployments are currently preformed on a trial-and-error basis. This research aims to develop a predictive model of the read performance of EPC RFID tags in supply chain environments. This predictive model will be used to determine the optimal number of tags that can be consistently read in a specific warehouse facility prior to the deployment of an RFID system solution.

■ TA17

C-Room 620

Services Management and Pricing Strategies

Sponsor: Information Systems Society
Sponsored Session

Chair: John Zhang, University of Conn., 1 Univ. Place, Stamford, CT, 06901, United States, John.Zhang@business.uconn.edu

1 - How Does Free Riding on Customer Service Affect Competition?
Jiwoong Shin, Assistant Professor, Yale University, 135 Prospect St., New Haven, CT, 06520, United States, jiwoong.shin@yale.edu

The paper shows that free riding benefits not only the free riding retailer but also service provider. The service provider has a postservice advantage, because of shopping cost. Also, allowing free riding gives the free rider less incentive to compete on price, because many customers eventually will switch to it through free riding. In turn, this induced soft strategic response enables the service provider to charge a higher price and enjoy positive profit.

2 - Perpetual vs. Subscription Licensing of Software with Network Externalities
Jennifer Zhang, Assistant Professor, University of Texas at Arlington, 701 S. West St. #520, Box 19437, Arlington, TX, 76013, United States, jiezhang@uta.edu, Abraham Seidmann

This paper looks at a software vendor who can sell or lease his product, where he guarantees that the subscribers will always have the latest version of the software. We demonstrate how a software vendor can manage the trade-offs of selling and leasing to achieve a higher profit, as well as the corresponding welfare effect on consumers. Our paper also contributes to durable goods theory by showing that network externalities have a significant effect on the vendor's licensing decisions.

3 - A Competitive Model of Price Dispersion in Online Retailing
Jan Stallaert, Associate Professor, University of Conn., 2100 Hillside Road, Storrs, CT, 06269, United States, jan.stallaert@business.uconn.edu, John Zhang, Sulin Ba

We propose a competitive model, based on online retailers' differentiation, to explain price dispersion. We empirically test the predictions of this model and find that the model is a viable alternative to the hedonic price model. In addition, our competitive model is able to predict and explain observations that are seemingly inconsistent with a hedonic model.

■ TA18

C-Room 201

Condor for High-throughput Computing at Clemson

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Mary Beth Kurz, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, mkurz@CLEMSON.EDU

1 - Introduction to Condor: Resources for High-throughput Computing
Matthew Saltzman, Clemson University, Department of Mathematical Sciences, Clemson, SC, United States, mjs@clemson.edu

High-throughput computing (HTC) means running large numbers of relatively independent tasks. HTC is an appropriate pardigm for many different computational tasks, such as simulations, metaheuristics, and computational testing. The Condor system—developed at the University of Wisconsin—is designed to reclaim idle computing resources and manage them in support of HTC tasks. We describe the Condor system and its operation and use in HTC applications.

2 - Enumerating Solutions for an NP-hard Scheduling Problem Using Condor
Mark McElreath, Clemson University, 110 Freeman Hall, Dept.. of Industrial Engineering, Clemson, SC, 29634, United States, mmcelre@clemson.edu, Mary Beth Kurz, William Ferrell, Priyantha Devapriya

Consider the fleet sizing problem of a vendor who produces/distributes a perishable product. The integrated analysis of production-distribution scheduling of this problem is NP-hard; a genetic algorithm (GA) is used to find a near optimal solution. Without lower bounds or a feasible MIP for a moderate size problem, we use Condor, a high throughput computing solution, to enumerate all solutions for a moderate size problem and provide a basis for evaluating the performance of the GA.

3 - A Condor Application: Solving Constrained Facility Layout Problems with Genetic Algorithm
Esengul Tayfur, Clemson University, Department of Industrial Engineering, 110 Freeman Hall, Clemson, SC, 29634, United States, etayfur@clemson.edu, Mary Beth Kurz

Many researchers have focused on the solution approaches used for locating departments with unequal areas into a facility. Some of them have suggested a genetic representation with the use of adaptive penalty functions. We proposed an alternate genetic algorithm representation by using same penalty functions. During the experimentation process of this research, the Condor software is utilized in order to solve many different genetic settings in a considerably shorter period of time.

4 - Large-scale Testing for the Design of Genetic Algorithms Using High Throughput Computing
Mary Beth Kurz, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, mkurz@CLEMSON.EDU

Design of effective genetic algorithms depends on several factors, perhaps foremost on how the solution is represented. Several solution representations are generally possible for each problem, with various implications for solution quality and running time. Through the use of Condor (a high throughput computing solution) and over 250,000 CPU hours, we are able to explore a new solution representation designed for flexible flow line scheduling (extensions to other problems are easily conceived).

■ TA19

C-Room 203

ICS Prize Winners 2006

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: John Chinneck, Professor, Carleton University, Systems and Computer Engineering, 1125 Colonel By Drive, Ottawa, ON, K1S5B6, Canada, chinneck@sce.carleton.ca

1 - Applications of A Probability Programming Language (APPL)
Diane Evans, diane.evans@rose-hulman.edu, Lawrence Leemis, Andrew Glen, John Drew

Probability theory uses algebra and calculus to solve problems involving random variables from the sciences, engineering, and business. Many results in probability have been derived as a means to approximate quantities that are difficult to determine exactly due to lengthy or intractable mathematics. This talk introduces the Maple-based software tool APPL that was designed to manipulate random variables. The functionality of APPL will be highlighted through examples and applications.

***Additional prizewinning work will be presented in this session.

■ TA20

C-Room 204

DA Arcade II

Sponsor: Decision Analysis
Sponsored Session

Chair: Steve Derby, sgderby@pacbell.net

1 - Comparison of Approaches to Untraded Asset Valuation
Steve Derby, sgderby@pacbell.net, Ross Shachter

We examine a range of approaches for the valuation of uncertain cash flows from untraded assets, with trading opportunities in a no-arbitrage market. Traditional decision analytic valuation does not exploit market opportunities and provides a lower bound. Standard financial option theory imposes conditions of completeness and provides an upper bound.

2 - The Value of Hedging
Thomas Seyller, PhD Candidate, Stanford University, Dept.. of Management Science & Engineerin, Stanford, CA, 94305, United States, tseyller@stanford.edu

We will present a decision analysis approach to hedging. We will first use indifferent buying and selling prices to define the value of hedging that an uncertain deal provides with respect to the decision maker's existing portfolio; we will then examine some of the fundamental properties of the value of hedging and show how probabilistic dependence and risk attitude affect it. Throughout the presentation, we will refer to concrete examples to illustrate the approach.

3 - Random Utility Theory Without Utility
Bob Bordley, General Motors Operations Research, M/C 480-106-256, 30500 Mound Road, Warren, MI, 48090, United States, robert.bordley@gm.com

Models of customer choice usually assume that customers maximize utility, even though empirical evidence has refuted this assumption. This paper establishes that these same market models can be derived without any assumption of utility-maximization (and without using the concept of utility).

4 - Optimal Allocation of Resources Between R&D and Marketing
Dinah Vernik, PhD Candidate, Duke University, Fuqua School of Business, 1 Towerview Rd, Box 311, Durham, NC, 27708, United States, dav2@duke.edu, James Smith

Firms engaged in both selling and improving their products must decide how to balance their investments in these two activities. We model this tradeoff as a stochastic dynamic program where the goal is to maximize expected future profit. We study structural properties of the model and illustrate it with examples.

■ TA21

C-Room 205

Scoring Rules: Eliciting and Evaluating Forecasters' Probabilities

Sponsor: Decision Analysis
Sponsored Session

Chair: Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville, VA, 22906, United States, lichtendahlc@darden.virginia.edu

1 - On Good Quantile Assessors
Victor Richmond Jose, Duke University, Fuqua School of Business, Box 90120, Durham, NC, 27708, United States, vrj@duke.edu, Robert L. Winkler

Quantile assessments are commonly encountered in the elicitation of probability distributions in decision analysis, forecasting, and risk analysis. We discuss aspects of goodness in evaluating quantile forecasts and draw comparisons with the evaluation of probability forecasts. In particular, we focus on the motivation, properties, and potential use of proper scoring rules for quantiles.

2 - Some Comparisons Among Quadratic, Spherical, Logarithmic Scoring Rules
Eric Bickel, Texas A&M University, ebickel@tamu.edu

Strictly proper scoring rules continue to play an important role in probability assessment. While many such rules have been developed, relatively little guidance exists as to which rule is the most appropriate. In this presentation, we discuss two important properties of quadratic, spherical, and logarithmic scoring rules. From an ex post perspective, we compare their rank-order properties. From an ex ante perspective, we analyze their performance under non-linear utility.

3 - Probability Elicitation, Scoring Rules, and Cooperation Among Forecasters
Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville, VA, 22906, United States, lichtendahlc@darden.virginia.edu, Robert L. Winkler

We develop the notion of a joint scoring rule (a collection of interdependent scoring rules) and show that proper joint scoring rules can be generated on a project-by-project basis when eliciting probabilities from independent forecasters. These rules mimic the cooperative stakes business shares would naturally induce. We discuss the extent to which dependent forecasters deviate from the truth under slightly revised stakes.

4 - Strictly Proper Scoring Rules
Tilmann Gneiting, University of Washington, Department of Statistics, Seattle, WA, United States, tilmann@stat.washington.edu, Adrian Raftery

Scoring rules evaluate probabilistic forecasters, by assigning a numerical score based on the prediction and on the event or value that materializes. A scoring rule is said to be proper if the forecaster maximizes the expected score if she follows her true beliefs in issuing the forecast. It is strictly proper if the maximum is unique. This talk reviews the theory of proper scoring rules, gives examples, and closes with a case study on probabilistic forecasts of wind energy resources.

■ TA22

C-Room 206

Data Envelopment Analysis I

Contributed Session

Chair: Gholamreza Khoshsima, Instructor, Vali-e-Asr University of Rafsanjan, Department of Industrial Management, Vali-e-Asr University of Rafsanjan, Rafsanjan, Ke, 7713936417, Iran, khoshsima@vru.ac.ir

1 - An Performance Analysis of the Airports in Korea-Super-Efficiency and DEA Approach Using WLU
Seockjin Hong, Professor, University of Incheon, Miraegun 2F Songdo-dong, Yeonsu-gu, Incheon, 406-130, Korea, Republic of, sjhong@incheon.ac.kr, Sang Hwa Song, Taebok Kim

There is a need for Korean airports to conduct an accurate comparison and analysis of the managerial performances of the fourteen airports in Korea. Furthermore, in order to overcome the limitations of conducting a financial comparison based solely on WLU, the DEA and Super-efficiency model was also employed to evaluate airport efficiency; moreover, the benchmarking method was used to establish the input-output goals.

2 - Recovering of Delays - A Study of US Airport Efficiency Using DEA

Warren Sutton, Doctoral Student, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States, wsutton@umich.edu, Seungkee Baek

This study examines the efficiency of 92 US airports using Data Envelopment Analysis (DEA). The study uses a decomposition of the airport into terminal and airside operations. Each airport is evaluated using a slack-based measure and then significant differences amongst hub and non-hub airports are noted using ANOVA.

3 - Efficiency Measurement of Stochastic Service Productions

Andreas Kleine, University of Hohenheim (510A), I nstitute of Business Administration, Stuttgart, D-70593, Germany, ankleine@uni-hohenheim.de

In this contribution we deal with the fact that a stochastic external factor has to be included into the service production. We chose DEA as the basis for our methodology. The main prerequisite for application of the methodology is the availability of different productions per decision making unit under different, more or less favorable qualities of the external factor. Using this information we introduce new efficiency measures: selective efficiency and adaptive efficiency.

4 - An Empirical Study on the Correlation between KM Level and Efficiency in Ceramic Tile Industry

Gholamreza Khoshsima, Instructor, Vali-e-Asr University of Rafsanjan, Department of Industrial Management, Vali-e-Asr University of Rafsanjan, Rafsanjan, Ke, 7713936417, Iran, khoshsima@vru.ac.ir, Mehdi Ebrahiminejad

This paper investigated the correlation between the level of knowledge management (KM) and efficiency of ceramic tile companies in Iran. KM was measured with four components: infrastructure, process, people, and strategy and then efficiency was measured with data envelopment analysis (DEA). Paper including factor analysis, partial correlation, multiple linear regressions and DEA. Results showed positive relationship between the KM level and the efficiency in ceramic tile industry.

■ TA23

C-Room 208

Laboratory Studies of the Newsvendor Problem

Sponsor: Behavioral Process Management (BPM)
Sponsored Session

Chair: Elena Katok, Associate Professor, Penn State University, 465 Business Building, Penn State University, University Park, PA, 16802, United States, ekatok@psu.edu

1 - Anchoring and Group Dynamics in a Newsvendor Setting: Results From an Experimental Study

Srinagesh Gavirneni, Assistant Professor, Cornell University, Johnson Graduate School of Management, Ithaca, NY, 14853, United States, sg337@johnson.cornell.edu, Yusen Xia

We conducted a newsvendor experiment in which the subjects (individuals or groups) were presented multiple pieces of anchor-able information. We study whether the subjects tended to change their anchor based on the experimental setting. A secondary objective was to study the impact of group dynamics. We observed that (i) the subjects did not anchor on any particular value, but chose an anchor that was closer to the optimal decision; and (ii) the groups demonstrated a lower tendency to anchor.

2 - Expertise and the Newsvendor Problem

Ulrich Thonemann, Professor, Department of Supply Chain Management and Management Science, University of Cologne, Albertus-Magnus-Platz, Koeln, K, 50923, Germany, Ulrich.Thonemann@uni-koeln.de, Gary Bolton, Axel Ockenfels

We report the results of Newsvendor-type laboratory experiments conducted with two groups of subjects, purchasing managers of major retailers and students. In a first experiment, participants received information on the optimal order quantity after several rounds of ordering. In a second experiment, participants received a one-hour video lecture including an exam before the experiment. Our results show that the two groups of participant react very differently to information and to teaching.

3 - The Use of Framing in Inventory Decisions

Ken Schultz, Associate Professor, University of Alberta, 340-G Business School, Edmonton, Ab, T6G 2R6, Canada, klschult@ualberta.ca

We investigate the use of framing to influence order quantities in inventory decisions. We fail to achieve the expected results based and investigate why. We increase the complexity of the situation to gain insight into behavioral reactions. In the process we discuss both the relevance of the findings and some of the difficulties inherent in behavioral research in operations management.

4 - Decision Postponement in Supply Chains: Value of Flexibility and Utility of Waiting

Mirko Kremer, mirko.kremer@bwl.uni-mannheim.de, Elena Katok, Stefan Minner, Luk Van Wassenhove

We report on the results of a laboratory experiment designed to answer the following question: How accurate are judgments of the value of decision postponement in a supply chain context? Relative to the normative benchmark commonly assumed in model-based research on this topic, we find that decision makers are consistently willing to pay too much for avoiding the mismatch costs associated with making inventory decisions under uncertainty.

■ TA24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Syncopation Software - DPL 7.0 Preview: Portfolio Analysis and More!

Chris Dalton, Syncopation Software, 1623 Main Street, Concord, MA, 01742, United States, cdalton@syncopation.com

Learn about the powerful new features in DPL 7.0! See how you can glean more insights with the Initial Decision Alternatives Tornado and Option Value Diagram. Save time in the pre-presentation crunch with the new endpoint replay capability. Go beyond project-level analysis by analyzing a portfolio of opportunities.

2 - GoldSim Technology Group - A Hybrid Probabilistic Simulation Environment

Rick Kossik, GoldSim Technology Group, 22516 SE 64th Place, Issaquah, WA, 98027, rkossik@goldsim.com

An introduction to building probabilistic simulation models using GoldSim, a hybrid simulator that can simultaneously represent continuous and discrete dynamics. GoldSim provides powerful probabilistic simulation capabilities to support representation of uncertain and/or stochastic systems. The session will provide an overview of GoldSim's features and capabilities.

■ TA25

C-Room 210

Wavelet Applications (Multiscale Pattern Analysis)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Satish Bukkapatnam, Associate Professor, Oklahoma State University, School of IE and Mgt., Stillwater, OK, 74078, United States, satish.t.bukkapatnam@okstate.edu

Co-Chair: Myong K. (MK) Jeong, Assistant Professor, University of Tennessee, 311 ESH, Knoxville, TN, 37996, United States, mjeong@utk.edu

1 - Automatic Signal Segmentation for Multiple Embedded Operations Monitoring Using Wavelets Analysis

Yong Lei, Industrial and Operations Engineering, University of Michigan, Ann Arbor, MI, 48109, United States, ylei@umich.edu, Judy Jin

In complex systems, available sensing signals are usually the combined responses of multiple embedded operations, which generate a high dimensional nonlinear profile data, and cause challenges in finding failed individual operations. In this research, wavelet analysis is used to achieve automatic signal segmentation with the enhanced diagnosability of individual operation conditions.

2 - Optimizing Wavelet Functions for Biomedical Diagnostic Applications

Hui Yang, School of Industrial Engineering and Management, Oklahoma State University, 322 Engineering, Stillwater, OK, 74075, United States, hui.yang@okstate.edu, Satish Bukkapatnam

Most biomedical signals emerge from complex systems that exhibit low-dimensional chaotic dynamics. The recurrence properties of the dynamics are used to design a wavelet function that yields over two orders of magnitude more compact representation.

3 - A Shannon Entropy Measure for Identifying Wavelet-based Feature Extraction

Sagar Kamarthi, sagarkamarthi@gmail.com

Shannon's entropy measure is used for identifying competent wavelet coefficients. The features are formed by calculating the energy of coefficients clustered around the competent clusters. The method is tested on benchmark classification problems. The experimental results show that the method performs better than other leading feature extraction methods.

4 - Multiresolution Approach to Freeway Incident Detection
Young S. Jeong, yjeong@utk.edu, Myong K. (MK) Jeong, Lee D. Han, Manoel Castro-Neto

This paper presents a wavelet-based multiresolution approach to freeway incident detection based on traffic sensor measurements such as traffic flow, speed, and occupancy. Comparisons of results from incident detection experiments using actual traffic data from California in 2007 suggest that the proposed multiresolution approach to be superior to other popular methods. The paper also presents the possible applications of the proposed approach to other problems in novelty detection area.

■ TA26

C-Room 211

Joint Session DM/ICS/Computational Methods for Data Mining: Trees and Tree Ensembles: Software and Applications

Sponsor: Data Mining (Sponsored), INFORMS Computing Society, Computational Methods for Data Mining
Sponsored Session

Chair: James Schimert, The Boeing Company, P.O. Box 3707 MC 7L-43, Seattle, WA, 98124, United States, James.Schimert@boeing.com

1 - Ensemble Learning with S-plus
Lixin Gong, Insightful Corporation, lgong@insightful.com

An on-going effort at Insightful Corp. will produce next generation classification and regression software based upon ensembles of decision trees. The software's modular design and extensible structure facilitates rigorous validation of promising approaches and further development of novel ensemble methods. We demonstrate preliminary results on protein mass spectrometry data. Future work will include parallel implementation and techniques for scaling ensemble learning to large datasets.

2 - New Developments in Tree-based Methods for Oncology
Michael Leblanc, Member, Fred Hutchinson Cancer Research Center, 1100 Fairview Ave N, M3-C102, Seattle, 98109, United States, mleblanc@fhcrc.org

New measures of patient and tumor biology and therapies targeted at specific biologic processes have led to heightened interest in the study of clinical outcomes in subgroups of patients based on molecular markers. In this talk, we investigate novel tree-based models for both main and interaction effects with molecular markers associated with the drug target. We demonstrate the new methods and discuss the impact on the design of future randomized studies.

3 - Estimating Class Probabilities Using Tree Ensembles
Dragos Margineantu, The Boeing Company, dragos.d.margineantu@boeing.com

Averaging probability estimation models and changing internal mechanisms of decision tree induction have proven to make trees better probability estimators. This presentation will review the techniques that make the Bagged Probability Estimation Trees and the Bagged Lazy Option Trees good probability estimation techniques. We will analyze the individual contribution of the mechanisms employed by these classes of methods: not pruning trees, the laziness, the options in trees, and Bagging.

4 - Ensemble Methods for Adaptove Logistic Models
Douglas Clarkson, Chief Scientist, ScienceOps, 11711 Noth Creek Parkway, Suite D-113, Bothell, WA, 980118808, United States, clarkson@scienceops.com

Here we examine ensemble methods in adaptive logistic models with particular interest in dissimilarity measures, detecting outliers, variable importance and missing value imputation.

■ TA27

C-Room 212

Data Mining Applications

Contributed Session

Chair: Vladimir Boginski, University of Florida REEF, 1350 N Poquito Rd, Shalimar, FL, 32547, United States, vb@ufl.edu

1 - Semi-supervised PRIDIT Method for Active Fraud Detection
Jing Ai, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States, jing.ai@PhDmccombs.utexas.edu, Patrick Brockett, Linda Golden

This paper presents a semi-supervised hybrid method for classification based on the unsupervised PRIDIT method (Brockett et al., 2002). With an objective of total cost minimization, this method can be applied in a variety of classification tasks, especially when it is impossible or cost-prohibitive to even obtain an initial training dataset. We also demonstrate and evaluate the method empirically.

2 - Adaptive Clustering Model for Color Consistency
Chao-Lung Yang, PhD Student, Purdue University, School of Industrial Engineering, 315 N. Grant St., West Lafayette, IN, 47907, United States, yang33@purdue.edu, Yan-Fu Kuo, Yuehwern Yih, George T. C. Chiu, Jan P. Allebach

The cartridge is one of main factors on the print quality of the color laser printer. In this study, time-series sensor data and color measurement of several cartridges have been collected. The adaptive clustering model is proposed to classify the cartridges based on their characteristics. A compensation algorithm is developed for each group of cartridges to improve the color consistency.

3 - Evaluating Database Marketing Models: More than Meets the Eye
Sam Koslowsky, VP CRM Analytics, Harte Hanks, 55 Fifth Avenue, New York, NY, 10003, United States, sam_koslowsky@harte-hanks.com

Practitioners are most secure using the gains table in evaluating the potency of their marketing database models. While identifying more desirable prospects at the top of this performance measure, and fewer on the bottom, is the sought-after result, it is not the only feature that needs to be examined. Some key metrics are ignored or at the very least minimized. These include variations in lift, unevenness in decile performance, the stability of predictions and the interpretations of results.

4 - Optimization-based Data Mining Techniques for Classification of Chemical Compounds
Vladimir Boginski, University of Florida REEF, 1350 N Poquito Rd, Shalimar, FL, 32547, United States, vb@ufl.edu

We consider the problem of distinguishing different types of disaccharides, chemical compounds that are quite important in biochemistry and medicine. We were able to achieve very high classification accuracy by applying predictive modeling techniques based on mass spectroscopic data representing dissociation spectra of different disaccharide samples.

■ TA28

C-Room 213

Production Scheduling

Sponsor: INFORMS Computing Society / Constraint Programming and Optimization
Sponsored Session

Chair: Jayant Kalagnanam, Research Staff Member, IBM T.J. Watson Research, 1101 Kitchawan Rd, P.O. Box 218, Yorktown Heights, NY, 10591, United States, jayant@us.ibm.com

1 - Constraint-based Scheduling: A Review of Recent Tools and Algorithms
Pascal Van Hentenryck, Brown University, Box 1910, Providence, RI, United States, pvh@cs.brown.edu

This talk reviews some recent results in constraint-based scheduling tools and algorithms.

2 - Production Scheduling for Steel Making
Jayant Kalagnanam, Research Staff Member, IBM T.J. Watson Research, 1101 Kitchawan Rd, P.O. Box 218, Yorktown Heights, NY, 10591, United States, jayant@us.ibm.com, Andrew Davenport, Fatma Kilinc Karzan

Production scheduling in the hot metal shop has a flow shop flavor but with some variations. The scheduling is done on a rolling horizon and hence the job selection/packing aspect is introduced. In addition, there are proximity constraints on some of the resources that lead to a special structure. Another complicating constraint is the hot metal inventory that has to be maintained between a minimum and maximum level. We outline some formulations and an approach to address this problem.

3 - Algorithmic Challenges in the Scheduling of Robotic Cells
Neil Geismar, Texas A&M University, Mays Business School, College Station, TX, United States, ngeismar@yahoo.com, Milind Dawande

Despite much recent research in the scheduling robotic cells, some very important foundational problems remain open. We detail the state of the art in this field, describe the most significant open problems, suggest potential approaches to them, and report recent approximation results.

■ TA29

C-Room 214

Joint Session OS/ICS: Decomposition Methods in Integer Programming I

Cluster: Optimization /Computational Optimization and Software, INFORMS Computing Society
Invited Session

Chair: Matthew Galati, Optimization Interface Lead, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513-2414, United States, Matthew.Galati@sas.com

1 - DECOMP: A Framework for Decomposition in Integer Programming
Matthew Galati, Optimization Interface Lead, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513-2414, United States, Matthew.Galati@sas.com, Ted Ralphs

Decomposition techniques such as Lagrangian Relaxation and Dantzig-Wolfe decomposition are well-known methods of developing bounds for discrete optimization problems. We draw connections between these classical approaches and techniques based on dynamic cut generation. We discuss methods for integrating cut generation and decomposition in a number of different contexts and present DECOMP, an open-source framework that provides a uniform interface for implementation of these various techniques.

2 - A Branch-and-price Algorithm for the Bin Packing Problem with Conflicts
Samir Elhedhli, Associate Professor, Dept.. of Management Sciences, University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada, elhedhli@uwaterloo.ca

We propose a branch-and-price algorithm for the bin packing problem (BPP) with conflicts, a variant of the BPP that takes item conflicts into account. The strength of the proposed approach relies on the fact that the branching constraints match the conflicting constraints, thus preserving the structure of the subproblems after branching. We provide an efficient algorithm where proper data structures are used, warm starting is exploited and valid inequalities are generated for the subproblems.

3 - Pricing Problem Based Sampling in Metaheuristics for Mixed Integer Programs
Chun Wang, University of Wisconsin - Madison, 1513 University Avenue, Room 4126, Madison, 53705, United States, wang26@wisc.edu, Andrew Miller, Leyuan Shi

Nested Partitions (NP) is a metaheuristic strategy that focuses on promising feasible subregions while maintaining a global view of the whole solution space. An important feature of NP is the sampling scheme, which is used to generate good feasible solutions. We discuss ways to use information from the pricing problem from a Dantzig-Wolfe reformulation to bias the sampling. This approach can help NP find better samples and thus improve computational convergence.

4 - Analysis of a Branch-and-Price Decomposition for the Multi-dimensional Knapsack Problem
Elif Ilke Gokce, Texas A&M University, TAMUS 3131, College Station, TX, 777843-313, United States, elifg@tamu.edu, Wilbert Wilhelm

This paper analyzes the bounds that might be obtained from a branch-and-price decomposition of the multi-dimensional knapsack problem with generalized upper bound constraints. It evaluates alternative decompositions and implementation tactics, assessing the trade off between the tightness of resulting bounds and the run time required to obtain them.

■ TA30

C-Room 2A

IIE Transactions Paper Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Susan Albin, Professor and Director, Rutgers University, 96 Frelinghuysen Road, CoRE Building, Room 201, Piscataway, NJ, 08854, United States, salbin@rci.rutgers.edu

1 - Signature Construction and Matching for Fault Diagnosis in Manufacturing Processes
Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53711, United States, szhou@engr.wisc.edu, Nong Jin

This paper presents a variation source identification method for manufacturing processes by assuming a linear model between the quality measurements and process faults. The variation source identification is achieved through testing of the common eigenspace between the fault signatures and the covariance matrix of the newly collected samples. A case study is conducted to illustrate the effectiveness of the methodology.

2 - Designing Experiments for Robust Optimization Problems: The Vs-optimality Criterion
Irad Ben-Gal, Dept.. of Industrial Engineering, Tel-Aviv University, Tel-Aviv, 69978, Israel, bengal@eng.tau.ac.il, Hilla Ginsburg

We suggest an experimentation strategy for robust design of empirically fitted models. A new design of experiment optimality criterion, termed Vs-optimal, prioritizes the estimation of the model's coefficients, such that the variance of the optimal solution is minimized. We present an analytical formulation for linear models and a numerical procedure for higher-order models. In a case study, the proposed approach results in a better robust solution in comparison to standard methods.

3 - Error Cancellation Modeling and Its Application to Machining Process Control
Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Ave., ENB118, Tampa, FL, 33620, United States, huangq@eng.usf.edu, Hui Wang

The product quality in a manufacturing process can be affected by multiple error sources. One error source could cancel the effects of others on certain quality characteristics. To obtain insights into this fundamental phenomenon, we developed error equivalence modeling and analysis approach for improved dimensional control in manufacturing.

■ TA31

C-Room 2B

Optimization Methods in Quality, Reliability and Statistics Applications

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhiguang Qian, Assistant Professor, University of Wisconsin at Madison, zhiguang@stat.wisc.edu

1 - Algorithms for Model Selection Problems in Statistics
Stephen Wright, Professor, University of Wisconsin-Madison, swright@cs.wisc.edu

Many problems in statistics and signal processing can be formulated as large-scale optimization problems in which the objectives are the weighted sum of a convex smooth term (e.g. a least-squares function or a log-likelihood function) and a convex nonsmooth regularization term. We survey the many optimization algorithms that have been proposed, focusing in particular on gradient projection methods, and presenting computational results.

2 - Smooth Optimization Approach for Sparse Covariance Selection
Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

Given a sample covariance matrix, we consider a maximum likehood problem penalized by 1-norm of entries of the inverse covariance matrix to perform sparse covariance selection. By exploiting the structure of this problem, we develop a smooth optimization approach that has better theoretical complexity, and outperforms substantially the existing methods in practice.

3 - Selecting Unique Designs in Complex Design Spaces
Abhishek Shrivastava, PhD Student, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States, akshriv@tamu.edu, Yu Ding

Real problems usually have interacting variables giving rise to design points that can not be represented by a simple set of variables. Even when these can be represented with graphs, multiple graphs may represent the same real design point. We apply a canonical labeling based approach to find the unique graphs. In particular, we solve two problems - cataloging good fractional factorial designs, and selecting equipment configuration for a phone quality testing system.

4 - A Statistical Application of Stochastic Programming
Zhiguang Qian, Assistant Professor, University of Wisconsin at Madison, zhiguang@stat.wisc.edu

Stochastic programming is an important tool for solving decision-making under uncertainty problems. In this work, we apply this method to solve an estimation problem in statistics.

■ TA32

C-Room 302

Vehicle Routing I

Contributed Session

Chair: Wen-Chyuan Chiang, Professor, University of Tulsa, 600 South College Avenue, Tulsa, OK, United States, wen-chyuan-chiang@utulsa.edu

1 - A Split Delivery Vehicle Routing Problem Heuristic

Joseph Wilck, PhD Candidate, Pennsylvania State University, Leonhard Building, Department of Industrial Engineering, University Park, PA, 16802, United States, jhw157@psu.edu, Tom Cavalier

The Split Delivery Vehicle Routing Problem (SDVRP) allows customers to be assigned to multiple routes. A new construction heuristic is presented and computational results are given.

2 - Optimizing Departure Times in Vehicle Routes with Time-dependent Travel Times

Leendert Kok, PhD Candidate, University of Twente, P.O. Box 217, Enschede, 7500AE, Netherlands, a.l.kok@utwente.nl, Erwin Hans, Marco Schutten

Most solution methods for the vehicle routing problem develop routes from the earliest feasible departure time. However, due to temporary traffic congestions, such solutions are not optimal with respect to minimizing the total travel time. We study the vehicle departure time optimization problem (VDO), in which the total travel time is minimized. We approach the VDO as a post-processing step of a VRPTW. We develop an ILP-formulation for the VDO and solve it with CPLEX.

3 - Solving a Family of Single Vehicle Pickup and Delivery Problems by Tabu Search

Irina Gribkovskaia, Associate Professor, Molde University College, Postbox 2110, N-6402, Molde, Norway, Molde, Norway, irina.gribkovskaia@himolde.no, Gilbert Laporte

In 1-M-1 pickup and delivery single vehicle routing problem a vehicle delivers from a depot to a set of customers as well as pickups at the same customers before returning to the depot. We propose a unified tabu search heuristic for several variants of the problem: the general case, the case with customers having limited capacity, the case with selective pickups, and the case with constraints on the time-lag or sequencing order between the pickup and delivery visits at the customer location.

4 - ALGACEA Algorithms for the CVRP Using Environmental Criteria

Javier Faulin, Associate Professor, Public University of Navarre, Dept. Statistics and OR-Campus Arrosadia, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es, Garcìa delValle Alejandro, Fernando Lera-Lòpez, Jesus M Pintor, Justo Garcia-Ortega, Sergio Ubeda

The Capacitated Vehicle Routing Problem is usually solved optimizing distance or costs. We have developed a variant of the ALGACEA algorithms that extend the objective function to include environmental costs. Thus, we have compared the cost increase in the solution problem considering those costs in order to make environmental-friendly decisions in companies. Finally, we comment on the solutions of several real cases using our ALGACEA procedures, reaching promising conclusions.

5 - A Simulation / Metaheuristic Approach to Newspaper Production and Logistics Problems

Wen-Chyuan Chiang, Professor, University of Tulsa, 600 South College Avenue, Tulsa, OK, United States, wen-chyuan-chiang@utulsa.edu, David Zepeda, Robert Russell, Xiaojing Xu

We consider a newspaper production and distribution problem for which key operations such as production, loading, and travel times are stochastic. We generate candidate route solutions satisfying zone constraints and various approximate probabilities of satisfying delivery deadlines. Simulation using ProModel is used to determine the most effective solution.

■ TA33

C-Room 303

Containerization Mini Cluster: RFID and Container Security

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Panagiotis Tsilingiris, Management Science & Engineering Dept., Stanford University, Palo Alto, CA, United States, tsilipan@yahoo.com

1 - A Data Envelopment Analysis Model to Asses the Efficiency of Inter-modal Transportation Systems

Evangelos Kaisar, Assistant Professor, Florida Atlantic University, 777 Glades Rd., Boca Raton, FL, United States, evangelos@civil.fau.edu, Ramesh Teegavarapu, Elisabeth Gundersen

United States has become progressively more concerned about safety and security issues regarding the country's transportation systems. In this research, DEA model is developed to assess the efficiency of the assorted transportation modes. The objective of the study is to identify the problems associated with the intermodal transportation system to enhance safety and security.

2 - Before Our Ports: Ubiquitous Monitoring for Shipping Container Security

Les Atlas, Professor, University of Washington, Department of Electrical Engineering, Box 352500, Seattle, WA, 98195, United States, atlas@ee.washington.edu, Patrick McVittie

There has been increasing legislation for solutions which offer continual shipping container content validation and protection at low cost. We have teamed with industry and ports to provide acoustic-based sensing systems, installed at or before the port of lading, which also offer shippers improved container tracking. Active acoustic sensing has being shown to offer an inexpensive and accurate approach for this problem, expanding the possibility of solutions for efficient container security.

3 - RFID in Containerization

Panagiotis Tsilingiris, Management Science & Engineering Dept., Stanford University, Palo Alto, CA, United States, tsilipan@yahoo.com, Harilaos Psaraftis, Dimitrios Lyridis

This presentation addresses the issue of RFID utilization in containerization from a practical standpoint. To that end, we report the status and perspectives of RFID in container transportation and handling. Moreover, since new processes are considered indispensable to match the revolutionary characteristics of RFID, we describe container handing processes re-engineering. Finally, we discuss Management Science opportunities that have emerged within this new area of research.

■ TA34

C-Room 304

Transportation Hazard Planning and Operations

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: Srinivas Peeta, Professor, Purdue University, Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, peeta@purdue.edu

1 - Dynamic Coordinated Search and Rescue

David Fajardo, davidf@mail.utexas.edu, S. Travis Waller, Avinash Unnikrishnan

We formulate an instance of the Dynamic Search and Rescue Problem in which vehicles have the ability to communicate information. We provide numerical results, as well as heuristic solution methods.

2 - Dynamic Rerouting of Emergency Vehicles in Post-earthquake Response Operations

Georgios Kalafatas, gkalafat@purdue.edu, Srinivas Peeta

In the event of an earthquake first responders will be routed from their bases to the hot-spots. Nevertheless, the road network might have suffered such disastrous damage in unknown links, that routing through these links is impossible. In our study, we provide a robust operational response methodology for addressing the problem of routing in a network of unknown condition. A case study is presented in the seismically prone region of South-West Indiana.

■ TA35

C-Room 305

Transportation Network Pricing

Sponsor: Transportation Science & Logistics

Sponsored Session

Chair: S. Travis Waller, Assistant Professor, Department of Civil Engineering, University of Texas, Earnest Cockrell Jr. Hall, 6.204, Austin, TX, 78712, United States, stw@mail.utexas.edu

1 - A Link-node Formulation for Dynamic Congestion Pricing

Xuegan (Jeff) Ban, Assistant Research Engineer, CCIT, University of California, Berkeley, 2105 Bancroft Way, Berkeley, CA, United States, xban@berkeley.edu, Henry Liu

We formulate the dynamic congestion pricing as a bi-level problem. We then establish the solution existence condition for such a model, independent of the

actual formulation of the underlying dynamic user equilibria. By applying the link-node dynamic user-equilibrium model we proposed recently, the toll pricing problem can be converted into a single level nonlinear programming problem defined on the decision variable and the destination-specific link inflows.

2 - Robust Pricing for Networks with Demand Uncertainty

Lauren Gardner, Graduate Research Assistant, The University of Texas at Austin, 1 University Station C1761, ECJ Hall Suite 6.2, Austin, TX, 78712, United States, lmgardner@mail.utexas.edu, Jennifer Duthie, Avinash Unnikrishnan, S. Travis Waller

Robust pricing is of interest due to the uncertainties that arise in networks, specifically demand uncertainty. We will use a stochastic optimization model to determine optimal link tolls for a given network, and provide some insight into the robustness of this pricing scheme by examining UE preformance under various origin-demand matrices.

3 - Dynamic Congestion Pricing Using Dual Approximation Techniques: An Initial Study

Dung-Ying Lin, Graduate Research Assistant, The University of Texas at Austin, 1 University Station C1761, ECJ Hall Suite 6.208, Austin, TX, 78712, United States, dylin@mail.utexas.edu, S. Travis Waller

New dual approximation techniques based on cell transmission model (CTM) are developed to investigate the dynamic congestion pricing problem in urban highway system. We examine the implication of duals in the CTM mathematical formulation as an efficient way to price the congestion. Numerical examples and insights are presented and discussed.

4 - Multi-criterion Dynamic User Equilibrium for Road Pricing Applications with Heterogeneous Users

Hani Mahmassani, Professor, The University of Maryland at College Park, Department of Civil & Environmental Engi, College Park, MD, 20742-3021, United States, masmah@umd.edu, Chung-Cheng Lu

We develop an efficient parametric approach for the assignment of heterogeneous users with continuously distributed value of time, value of schedule delay and value of reliability, in a network with dynamic prices and managed lanes on certain roadway facilities. The algorithm determines equilibrium user responses in terms of path and departure time choices, and the associated network flow patterns.

■ TA36

C-Room 306

Urban Transportation Planning Models VII: Extensions of Network Design

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Henry Liu, University of Minnesota, Department of Civil Engineering, Minneapolis, MN, United States, henryliu@umn.edu

1 - A Class of Normative Link Flow Control Problems in Transportation Networks

Henry Liu, University of Minnesota, Department of Civil Engineering, Minneapolis, MN, United States, henryliu@umn.edu

Transportation network equilibrium problems describe how individuals travel through a transportation system. In many cases, the analysis is motivated by the need to decide on a transportation investment, regulation, or policy, to achieve system objectives desired by public authorities. These analyses are normative, not descriptive. We present an inverse variational inequality formulation and solution method based on a proximal point algorithm (PPA) for a class of network flow control problems.

2 - The Network Evolution Problem in Transportation Planning

Lei Zhang, Assistant Professor, Oregon State University, School of Civil & Construction Eng., 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

In response to increased transportation system preservation costs and insufficient funds for needed system expansion, this paper formulates the Network Evolution Problem (NEP) that considers strategic resource allocation between system preservation and expansion. The proposed analytical framework allows certain parts of the system to grow and certain other parts to degenerate in response to changing demand patterns. Solutions to the NEP are demonstrated on several stylized networks.

3 - A Long Haul Freight Network Design Framework and Associated Branch and Bound Solution Method

Amelia Regan, Professor and Associate Dean, University of California, Irvine, Dept. of Computer Science, Irvine, CA, 92697, United States, aregan@uci.edu

The Network Design Problem is to choose the set of improvement alternatives to optimize efficiency. Previous work focuses mainly on efficient algorithms for the highway network while our objective is to formulate and solve the network design problem for multi-modal long haul freight networks. Shipper-carrier freight flow prediction is performed along with the branch and bound algorithm.

4 - Optimal Design of Hydrogen Storage Facilities Under Supply and Demand Uncertainties

Yueyue Fan, Assistant Professor, University of California, Department of CEE, Davis, CA, 95616, United States, yyfan@ucdavis.edu, Yongxi Huang

The process of producing hydrogen from biomass involves seasonal fluctuation of feedstock supply and highly uncertain future demand. In this work, we propose a multistage stochastic model for optimal design of the storage facilities and their operating schedules, to improve the economics and reliability of the entire energy supply chain.

■ TA37

C-Room 307

Military Logistics Transformation

Sponsor: Military Applications
Sponsored Session

Chair: Greg Parlier, Dr., SAIC, 255 Avian Lane, Madison, AL, 35758, United States, GREG.H.PARLIER@saic.com

1 - Operational Analysis Readiness, Availability and Logistics of a System with Modern Condition-Based Maintenance

Donald Gaver, Distinguished Professor, Naval Postgraduate School, DGaver@nps.edu, Patricia Jacobs, Ernest A. Seglie, Kevin Glazebrook

Condition-Based Maintenance deters catastrophic failures (cfs) by reporting precursors/diagnostics (pds) in advanced real time (hence CBM+). Logistics demand and supply-chain load can thus be lightened and smoothed, and readiness improved. Our analysis invokes fragility-enhanced, or multiple-stochastic shock models for catastrophic failuress and prognostic/ddisagnostic failuress.

2 - Transforming the Army's Rapid Fielding Initiative

Scott Crino, Assistant Professor, Mahan Hall, Bldg 752, West Point, NY, 10996, United States, scott.crino@usma.edu

The Army's Rapid Fielding Initiative (RFI) is the process by which new equipment is distributed to soldiers either at home station or in a theater of operations. Equipment is shipped from over 50 suppliers around the United States to a warehouse on the east coast where it is packaged into sets. Sets are shipped to the end user stationed at one of over 40 locations around the world. This paper investigates the use of Lean Methods to significantly improve efficiency of the RFI process.

3 - Automatic Identification Technology for Arms Room Management

John Willis, Assistant Professor, US Military Academy, Department of Systems Engineering, Mahan Hall, West Point, NY, 10996, United States, john.willis@usma.edu

Current arms room management systems are not positioned to provide reporting or inventory control beyond the level of the individual arms room nor are there opportunities to integrate the arms room into other activities. This paper describes the use of proven automatic identification technology (AIT) and supporting software/hardware to automate the personnel identification and sensitive item issue, turn-in, and inventory processes.

4 - Connecting CBM to the Supply Chain

Greg Parlier, Dr., SAIC, 255 Avian Lane, Madison, AL, 35758, United States, GREG.H.PARLIER@saic.com, Michelle Liddon

This paper examines creative methods for connecting CBM to the supply chain utilizing usage data from the CBM Data Warehouse to improve supply chain operations and management. We also outline how CBM Data Warehouse information can be combined with supply chain initiatives to significantly increase part demand forecast accuracy, improve supply chain inventory management, and enhance readiness.

■ TA38

C-Room 308

Algorithmic Mechanism Design II

Cluster: Game Theory
Invited Session

Chair: Tim Roughgarden, Stanford University, 462 Gates Building, 353 Serra Mall, Stanford, CA, 94705, United States, tim@cs.stanford.edu

1 - Incentive-compatible Distributed Routing

Michael Schapira, The Hebrew University, Jerusalem, Israel, mikesch@cs.huji.ac.il, Aviv Zohar, Hagay Levin

We present a game-theoretic model of interdomain routing in today's Internet. The model enables complex dynamic interactions between the agents

(asynchronous, sequential, and based on partial-information). We provide realistic conditions that guarantee that greedy and myopic behaviour is in the best interest of each of the players.

2 - Efficiency-Revenue Trade-offs in Search Auctions
Mukund Sundararajan, Sanford University, mukunds@stanford.edu

We study the simultaneous optimization of efficiency and revenue in pay-per-click keyword auctions in a Bayesian setting. Our main result is that the efficient keyword auction yields near-optimal revenue even under modest competition. In the process, we build on classical results in auction theory to prove that increasing the number of bidders by the number of slots outweighs the benefit of employing the optimal reserve price.

3 - The Power of VCG: On Algorithms That are Maximal in Range
Sharar Dobzinski, Hebrew University, CS dept, Givat Ram Campus, Jerusalem, Israel, shahard@cs.huji.ac.il

Consider the following simple type of approximation algorithms: limit the set of possible outcomes, and completely optimize over the restricted subrange. We study the power of these algorithms in two settings: multi-unit auctions, and combinatorial auctions with subadditive bidders. From a game-theoretic perspective, our results characterize of the power of VCG. We will also discuss the connection of our results to proving lower bounds on the power of poly-time truthful mechanisms.

4 - Posted Prices vs. Negotiations: An Asymptotic Analysis
Liad Blumrosen, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States, liadbl@microsoft.com, Thomas Holenstein

A full bidding process may be infeasible or costly in some environments. Posted price mechanisms are a simple and quick alternative. In this work, we compare full-revelation mechanisms to posted-price mechanisms, both with symmetric and discriminatory prices. We show that optimal discriminatory prices are nearly as good as full-revelation mechanisms, while a single posted price is asymptotically worse.

■ TA39

C-Room 309

RFID Applications in Healthcare Industry

Sponsor: Health Applications Section
Sponsored Session

Chair: Shiwoo Lee, Oregon State University, 118 Covell, Corvallis, OR, United States, Shiwoo.Lee@oregonstate.edu

1 - Location Based Healthcare Workflows
Jonathan Emanuele, Product Manager, Siemens Medical Solutions, 51 Valley Stream Pkwy, Malvern, PA, 19355, United States, jonathan.emanuele@siemens.com

Healthcare information systems today are designed to increase patient safety and operation efficiency, while at the same time decreasing costs. At the forefront are workflow driven healthcare information systems that track the state of a patient and push work items to the hospital staff. A missing piece in these systems has been real time location information. This session will look at how an integrated RFID solution can fill this gap.

2 - RFID Application in the Blood Transfusion Supply Chain
Oguzhan Alagoz, Assistant Professor of Industrial and Systems Engineering, University of Wisconsin-Madison, 3162 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53706, United States, alagoz@engr.wisc.edu, Raj Veeramani, Alfonso Gutierrez

Our research aims at enhancing the safety, quality, productivity and responsiveness of our nation's blood transfusion supply chain (including collection, manufacturing, distribution and transfusion) through RFID application. The project, being conducted in collaboration with multiple blood centers and leading RFID companies, has yielded several promising results and insights to date.

3 - How Can RFID Fix the Challenges in Healthcare Industry?
Shiwoo Lee, Oregon State University, 118 Covell, Corvallis, OR, United States, Shiwoo.Lee@oregonstate.edu

According a new study, it is the biggest health-care players that are moving the quickest and investing in large deployments of the technology. RFID technology is not an exception. US healthcare industry is increasingly seeing adoption of RFID as a major potential contributor to improved healthcare. This presentation will talk about the various challenges in healthcare industry, which can be fixed by RFID applications in near future.

■ TA40

C-Room 310

Data Driven Models in Healthcare Engineering

Sponsor: Health Applications Section
Sponsored Session

Chair: Tapas K. Das, Professor, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, das@eng.usf.edu

1 - Large-Scale Genomic Pattern Recognition and Classification for Cancer Prediction
Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Jin Shi

Early detection and diagnosis is critical to successful treatment of cancer. In this talk, we first present pattern recognition algorithms in finding hidden sequence signatures in the human genome that are related to cancer formation. Next using these patterns, an optimization-based classification model is used to classify normal patients versus cancer patients and develop the predictive rule, which can then be used for early cancer diagnosis for future patients.

2 - Hybridization Noise Removal From cDNA Microarrays
Chaitra Gopalappa, PhD Student, Dept. of IMSE, University of South Florida, 4202 E. Fowler Ave, Tampa, FL, 33620, United States, chaitra@eng.usf.edu, Steven Eschrich, Steven Enkemann, Tapas K. Das

Microarray technology offers a significant tool for harnessing the true potential of human genome discovery via development of efficient disease diagnosis and treatment planning tools. A major impediment in this process has been the presence of noise distorting the gene expression values. We present a multiresolution strategy for removal of hybridization noise in microarrays.

3 - Breast Cancer Risk Prediction Using Mammography Bayesian Network
Jagpreet Chhatwal, University of Wisconsin-Madison, 4126 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53706, United States, jchhatwal@wisc.edu, Oguzhan Alagoz, Elizabeth Burnside, Charles E. Kahn

While diagnosing breast cancer, radiologists need to interpret mammographic findings and make complex decisions such as surgical biopsy, and advanced imaging exams. We developed a Mammography Bayesian Network (MBN) based on the variables recorded by radiologist during their daily clinical practice to aid radiologists in the interpretation of mammograms. Training MBN's parameters on the available data significantly improves its performance in predicting the risk of breast cancer.

4 - A Priori Performance of a Myopic Clinical Scheduling Policy
Ayten Turkcan, Associate Research Scientist, Purdue University, e-Enterprise Center, West Lafayette, IN, 47907, aturkcan@purdue.edu, Kumar Muthuraman, Mark Lawley

A myopic clinical scheduling algorithm schedules patients at the time of their call without changing the previous appointment times and without considering the future calls. In this study, performance measures such as expected waiting time of patients, expected time in the system, variance in waiting times and time in system, queue length and utilization are determined a priori for a myopic clinical scheduling policy that considers patients with different no-show probabilities.

■ TA41

C-Room 3A

Planning and Scheduling in Healthcare

Sponsor: Health Applications Section
Sponsored Session

Chair: Hari Balasubramanian, Post-doctoral Research Associate, Mayo Clinic, 200 2nd Street SW, Rochester, MN, United States, balasubramanian.hari@mayo.edu

1 - Bi-criteria Scheduling of Surgery Delivery Systems
Serhat Gul, Research Assistant, Arizona State University, Dept.. of Industrial Engineering, Tempe, AZ, 85287, United States, serhat.gul@asu.edu, John Fowler, Brian Denton, Todd Huschka

We present a prototype simulation model for an Outpatient Procedure Center (OPC) of Mayo Clinic which has 11 Operating Rooms(ORs). We propose simple heuristics to schedule arrivals for each department in the OPC and investigate how the schedule affects average patient waiting time and OR utilization. We use a Genetic Algorithm to generate the (near) Pareto Optimal front.

2 - Applications of Outpatient Visit and Referral Forecasting
John Osborn, Mayo Clinic, 200 1st St SW, Centerplace 6, Rochester, MN, 55905, United States, osborn.john@mayo.edu, Ritesh Banerjee, Melissa Gregg, Brian Denton, Molly Destro-Borgen

Access to outpatient services is a key component of a successful healthcare system. With improved decision support, providers could better allocate scarce capacity to meet patient demand. Practice managers at a large, multi-specialty academic medical center must trade-off between appointment access for internally and externally referred patients. This paper describes models developed to forecast internal referral volume, and to optimize the mix of internal and external patient access.

3 - Optimization of Catheterization Lab Scheduling Using Computer Simulation
Qing Li, Arizona State University, 1711 S. Rural Road, Tempe, AZ, 85287, United States, qli30@asu.edu, Mohan Gopalakrishnan, Srimathy Mohan, Antonios Printezis, John Fowler

Based on an in-depth study of a catheterization facility within a large hospital organization in Arizona, we will present the scheduling problem and design a simulation model to support the construction and revision process of their daily scheduling activities. We use historical data to evaluate the performance of our scheduling approach in terms of utilization, staff overtime and patient waiting time.

4 - A Stochastic Programming Approach to a Multi-OR Surgery Allocation Problem
Sakine Batun, Research Assistant, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, sab79@pitt.edu, Andrew Schaefer, Brian Denton

We present a stochastic programming model to solve the multiple operating room (OR) scheduling problem with surgeon constraints, setup times, and uncertain surgery durations. We consider performance measures such as fixed cost of opening ORs, overtime and surgeon idle time. We present computational results based on real data.

5 - A Systems Engineering Approach to Improve Operational Performance in a Colonoscopy Suite
Bjorn Berg, Mayo Clinic, 200 First Street SW, Rochester, MN, 55905, United States, berg.bjorn@mayo.edu, Angela Bailey, Ahmed Rahman, Heidi Nelson, Keith Lindor, Hari Balasubramanian, Brian Denton

In our study we address the resource allocation and operational planning problem in a high volume colonoscopy delivery service using discrete event simulation. This involves determining several key aspects such as the optimal number of Endoscopists operating, the number of operating rooms to open each day, and the number of patients that can be served on any given day. Such an analysis allows the practice manager to determine the most cost-effective settings at which to operate the suite.

■ TA42

C-Room 3B

Machine Learning Approaches to Medical Diagnosis and Health Care

Cluster: Operations Research in Medicine and Health Care
Invited Session

Chair: Jinbo Bi, Staff Scientist, Siemens Medical Solutions, 51 Valley Stream Parkway, Malvern, PA, 19355, United States, jinbo.bi@siemens.com,

Co-Chair: R. Bharat Rao, Senior Director, Knowledge Solutions, Siemens Medical Solutions Inc, 51 Valley Stream Parkway (MS E51), Malvern, PA, 19355, bharat.rao@siemens.com

1 - Mathematical Programming Approaches to Reduce Gene Signature Size
Glenn Fung, Senior Scientist, Siemens Medical Solutions, 51 Valley Stream Parkway, Malvern, PA, 19355, United States, glenn.fung@siemens.com

Recent technologies to capture gene expression levels from a DNA microarray have made possible to find new gene expression signatures with prognostic and diagnostic significance but that depend on thousands of genes. This may lead to poor signature generalization capabilities on unseen data. We explore the use of several mathematical-programming-based techniques to reduce the gene signature sizes while maintaining the signature prognostic and diagnostic significance.

2 - Statistical Dept.h and Outlier Detection
Yixin Chen, Assistant Professor, Department of Computer and Information Science, University of Mississippi, University, MS, 38677, United States, ychen@cs.olemiss.edu

Statistical depth functions provide from the deepest point a center-outward ordering of multi-dimensional data. We propos a novel statistical depth, the kernelized spatial depth (KSD), and a outlier detector based on KSD.

3 - Active Feature Learning for Medical Diagnosis
Chih-Lin Chi, PhD Student, Health Informatics Program, The University of Iowa, Iowa City, IA, 52242, United States, chih-lin-chi@uiowa.edu, Nick Street

We present an active machine learning algorithm to support triage decisions in medical diagnosis. The algorithm actively determines the next medical test required based on a patient's known features. Specialized classifiers are used to reduce the number of diagnostic tests required, resulting in faster, less costly, and more accurate decisions.

4 - Quality in Health Care
David Czerwinski, MIT, Room E40-130, 77 Massachusetts Ave, Cambridge, MA, 02139, United States, dczerwin@mit.edu, Dimitris Bertsimas, Michael Kane

We used medical insurance claims data to assess the quality of care that patients received. Claims data has the advantage of being readily available for a large number of patients. However, it has the disadvantage that the information it contains is quite limited and tends to be noisy. We developed a variety of statistical models focused on different aspects of quality care. We present our findings and discuss some of the interesting challenges involved.

5 - Deformable Models and Energy Minimization for Medical Image Segmentation
Xiaolei Huang, Assistant Professor, Department of Computer Science and Engineering, Lehigh University, 19 Memorial Drive West, Bethlehem, PA, 18015, United States, huang@cse.lehigh.edu

We present deformable models that integrate shape and appearance for reliably locating object boundaries in medical images. The models are energy-minimizing, smooth splines that are pulled toward boundary features by external image forces. The image forces are derived in a variational framework that consists of edge-based and region-based energy terms, both differentiable w.r.t. deformation parameters. We show the effectiveness of the models using organ and tumor segmentation examples.

■ TA43

S-Grand Ball. A (Lev. 2)

Panel Discussion: How to Have an OR Career

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Stephen Strauss, PTSM, AT&T Labs, 180 Park Avenue, Building 103 Room A009, Florham Park, NJ, 07932-1003, United States, sstrauss@att.com

1 - Panel Discussion: How to Have an OR Career
Moderator: Stephen Strauss, PTSM, AT&T Labs, 180 Park Avenue, Building 103 Room A009, Florham Park, NJ, 07932-1003, United States, sstrauss@att.com, Panelist: Michael Berliner, Russ Labe, Michael Grant, Srinivas Bollapragada, Hena Bar

Panelists from a range of industries; experience; and educational levels and backgrounds will discuss how they got into OR, how they got some of their positions and what kind of career paths they have had.

■ TA44

S-Grand Ball. B (Lev. 2)

Pedagogical Research: What is it and What is it Not?

Sponsor: INFORM-ED
Sponsored Session

Chair: Donna Llewellyn, Director, Georgia Tech, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@cetl.gatech.edu

1 - An Introduction to Pedagogical Research - What it is and What it is Not?
Donna Llewellyn, Director, Georgia Tech, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@cetl.gatech.edu

This session will explore what people mean when they talk about pedagogical or educational research. What is involved in performing this type of research, how it differs from your content/technical research, and what resources are needed. The session will be the introductory session of a series of four sessions at this conference on pedagogical research.

■ TA45

S-Capitol Hill (Lev. 3)

Portfolio Optimization

Cluster: Financial Engineering
Invited Session

Chair: Michael J. Best, Professor of Mathematics, University of Waterloo, Waterloo, ON, N2L 3G1, Canada, mjbest@math.uwaterloo.ca

1 - Markowitz Principles for Multi-period Portfolio Selection Problems with Moments of any Order

Thamayanthi Chellathurai, Treasury and Risk Management, Canadian Imperial Bank of Commerce, 21 Melinda Street, CCE-9, Toronto, ON, M5L 1A2, Canada, Thamayanthi.Chellathurai@cibc.ca, Michael Best

The multi-period portfolio selection problem is formulated as a Markowitz mean variance optimization problem in terms of time-varying means, covariances and higher order moments of the asset prices. The expected return of the portfolio depends on the means and higher order moments of the asset prices. The variance of the portfolio depends on the second and higher order moments. Analytical solutions for the optimal trading strategies are obtained.

2 - Portfolio Selection with Kinked Linear Utility Functions: Some Computational Results

Robert R. Grauer, Professor of Business Administration, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, grauer@sfu.ca, Michael Best

Most financial models assume that utility functions are strictly increasing, smooth and concave. Prospect theory postulates that the utility function is characterized by a kink at zero gains or losses. We examine the portfolios of investors with kinked linear utility functions. The computations employ the method described in Best, Grauer and Hlouskova (2007).

3 - Kinked Linear Utility Functions in Portfolio Optimization

Michael J. Best, Professor of Mathematics, University of Waterloo, Waterloo, ON, N2L 3G1, Canada, mjbest@math.uwaterloo.ca, Robert R. Grauer, Jaroslava Hlouskova

In the portfolio selection problem, utility functions are typically differentiable. There has been recent interest in kinked, or non differentiable utility functions. We consider the problem of maximizing a kinked linear utility function subject to linear constraints. This can be formulated as a typically, large LP . We present a modification of an active set LP algorithm which efficiently solves this LP by doing calculations in the much smaller space of original problem assets.

■ TA46

S-Ballard (Lev. 3)

Power and Energy Market Modeling III

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Shmuel Oren, University of California Berkeley, IEOR Department Rm 4119 Etcheverry Hall, Berkeley, CA, United States, oren@ieor.berkeley.edu

1 - Equilibrium Bidding in Unit Commitment Auctions

Ramteen Sioshansi, University of California, Berkeley, Industrial Engineering and Operations Re, 1117 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, ramteen@ieor.berkeley.edu, Emma Nicholson

The efficiency ranking and incentive properties of centralized and decentralized unit commitment remains an open question. While centralized commitment can find the most efficient dispatch, the auction mechanism used to solicit generator data is thought to provide poor incentives. Decentralized commitment will suffer coordination losses but may have better incentive properties. We analyze a simple equilibrium model and compare the generator incentives and settlement costs of the two regimes.

2 - Tradeoffs and Complementarities between Congestion and Reliability in Electric Power Networks

Seth Blumsack, Postdoctoral Research Fellow, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, sblumsac@andrew.cmu.edu

In AC power networks, it is possible to build new transmission that causes congestion. Sometimes these lines can provide a reliability benefit in case of outages. Through simulations on a 118-bus network, we demonstrate that the relationship between congestion and reliability is a function of the state of the network and the topology of certain sub-networks. Contrary to current U.S. policy, the economic and reliability aspects of transmission investments cannot be easily decomposed.

3 - Stochastic Policy Modeling of Wind Energy Benefits

Jeremy Hargreaves, PhD Student, The Johns Hopkins University, DoGEE, 313 Ames, 3400 No. Charles St., Baltimore, MD, 21218, United States, jjh@jhu.edu, Sebastiaan Hers, Benjamin Hobbs

Wind energy displaces fossil fuels and lowers emissions, but increases the volatility of net demand on thermal facilities. To quantify wind's net benefits for policy analysis purposes, we propose a stochastic optimization model to simulate balancing energy requirements and day-ahead commitments of generators, considering uncertainty in load and generation. Markov chains are used to represent wind, load, and generator availability. An application to the Netherlands energy market is presented.

4 - Equilibrium Model-based Comparison of CO2 Allowance Allocation Schemes in Multiple Markets

Benjamin Hobbs, JHU, 313 Ames DoGEE, Baltimore, MD, 21218, United States, bhobbs@jhu.edu, Jinye Zhao, Jong-Shi Pang

When different allowance allocation rules apply to different jurisdictions, but their industries compete in a common market, output-based allocation can sometimes be superior to auctioning. A complementarity model of a long run electricity market in which submarkets are subject to different allocation rules is used to examine how alternative schemes affect electricity prices, generation mix, emissions, and economic efficiency.

■ TA47

S-Admiral (Lev. 3)

Mining Applications: Topics in Open Pit Mining

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Alexandra Newman, Associate Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, anewman@mines.edu

1 - Scheduling a Large Open-pit Mining Operation

Eduardo Moreno, Universidad Adolfo Ibañez, School of Engineering, Chile, eduardo.moreno@gmail.com, Daniel Espinoza, Marcos Goycoolea

We consider a collection of medium to large sized open-pit copper mines in Chile. Given precedence relationships and capacity limits over time, we obtain provably good feasible solutions as fast as possible by incorporating a simple rounding heuristic, pre-processing techniques, and cutting planes in a branch and bound algorithm to solve a classical integer program. We present computational results using the CPLEX solver.

2 - Capacitated Water Truck Routing Problem for Open Pit Mines

Jing-Quan Li, Postdoctoral Researcher, University of Arizona, Tucson, AZ, United States, jingquan@email.arizona.edu, Peter Knights, Paul Lever, Pitu Mirchandani

Water trucks are used to maintain the condition of haul roads and reduce mine dust in open pit mines. Each road segment is assigned a watering frequency and a sliding time window. Multiple refill stations are available. We propose heuristics to solve this multi-depot, infinite horizon capacitated Chinese postman problem with time windows.

3 - The Open Pit Mine Production Scheduling Problem

Alexandra Newman, Associate Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States, anewman@mines.edu, Kevin Wood

We describe some techniques to expedite solution time of the classical open pit block sequencing problem, i.e., that of maximizing net present value subject to operational capacity and block sequencing constraints. We then address topics in ore grade uncertainty of the blocks.

■ TA48

S-Fremont (Lev. 3)

Simulation III

Contributed Session

Chair: David Hoffman, Consultant, Hoffman& Associates, P.O. Box 111829, Anchorage, AK, 99511, United States, dhoffman@alaska.net

1 - Multivariate Slice Sampler and Its Application

Jingjing Lu, Drexel University, Decision Sciences Department, 101 North 33 St, Philadelphia, PA, 19104, United States, jl466@drexel.edu, Merrill Liechty

The traditional Markov chain Monte Carlo method can be improved by implementing the slice sampler. In the current literature, this sampling technique involves a single auxiliary variable and little has been done for a multivariate slice sampler. In this paper, we propose several variations of a new multivariate normal slice sampling method and compare them by simulated examples. We also give out the application of multivariate normal slice sampler in the business area.

2 - Stochastic and Bayesian Modeling of a Search Over Three-dimensional Terrain

Kyle Kliewer, Mathematics Instructor, U.S. Naval Acadmey, USNA Math Department, 572C Holloway Rd, Annapolis, MD, 21402, United States, kliewer@usna.edu, Chrisopher Nigus

Analysis of 3D search patterns is done using pre-computed data structures for rapid table look-up to quickly determine all possible visible locations from each search point. A Monte Carlo simulation against a single randomly placed moving target provides an overall probability of success. Second, analysis using Bayesian theory to update probability of location from search information and random spread of target uncertainty provides both search success over time as well as a coverage map.

3 - Efficient Sampling Method for Prediction and Optimization by Different Prediction Data

Koji Tsuchiya, Osaka University, 2-1 Yamadaoka, Suita, Japan, koji.tsuchiya@ist.osaka-u.ac.jp, Hiroshi Morita

It is often limited the number of experiments by time or cost in sampling data. The precision of prediction depends on the number and the precision of sample, which have a trade-off relation in sampling. We propose the prediction method which combines the different precision sample to provide an efficient prediction. The prediction is sequentially updated by giving higher precision sample. In addition, we consider a possibility of each prediction being optimal to decide sampling points.

4 - Response Surface Methodology for Net Present Value Optimization in Mine Planning and Feasibility

Chee-Peng Gan, Data Engineer, Freeport McMoran, 625 Main St., Safford, AZ, 85546, United States, gancheepeng@hotmail.com

Net present value (NPV) optimization for a mine is important in determining the feasibility of mine operations and start-up. The optimization process is however often attempted in an iterative, laborious and inefficient manner. This paper presents response surface methodology as a robust and effective method to optimize mine NPV for long-range mine planning and feasibility evaluation. Specifically, controllable factors affecting NPV are considered, making optimization more realistic.

5 - Assessing Project Risk Using Simulation

David Hoffman, Consultant, Hoffman& Associates, P.O. Box 111829, Anchorage, AK, 99511, United States, dhoffman@alaska.net

This paper describes using simulation to demonstrate the complexities associated with fully assessing project time risk. Using the simulation language Extend(TM), hypothetical examples are simulated to show the effects of variances, as applied to project tasks and to the ultimate estimate for completing a project.

■ TA49

S-Greenwood (Lev. 3)

New Directions in Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Ming Hu, Columbia University, mh2252@columbia.edu

1 - Dynamic Pricing and Price Communications Strategies Under Sticker Shock Effects

Wei Ke, wke10@gsb.columbia.edu

We consider an extension on Popescu & Wu (2006) by separating the effect of price communications from price changes. Communicating a retail price that is lower than the current reference price may attract demand in the current period, but comes at the expense of reducing the reference price. Conversely, communicating a retail price that is higher than the current reference price reduces demand in the current period, but this creates a higher reference price that is beneficial in the long run.

2 - Testing the Validity of a Demand Model: An Operations Management Perspective

Omar Besbes, University of Pennsylvania, The Wharton School, 3730 Walnut Street, 551 Jon M Huntsman Hall, Philadelphia, PA, United States, obesbes@wharton.upenn.edu, Assaf Zeevi, Robert Phillips

Various studies in the statistics and econometrics literature develop methods to test the specification of a statistical model. However, a revenue manager is in general more interested in the effect that pricing or capacity control decisions have on the eventual profits (performance), rather than the validity of the demand model per se. We develop a framework and statistical test that addresses this question and illustrate it with the aid of an empirical data set.

3 - Competition with Real Options

Ozge Sahin, Assistant Professor of OMS, Ross School of Business, University of Michigan, Ann Arbor, MI, 48109, United States, ozge@bus.umich.edu, Guillermo Gallego

We study duopoly competition of capacitated providers with real options under proportional rationing rule. We compare and contrast the revenues of the providers with and without options.

■ TA50

S-Issaquah A & B (Lev. 3)

Network Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Gustavo Vulcano, Assistant Professor, New York University, 44 West Fourth St., Suite 8-76, New York, NY, 10012, United States, gvulcano@stern.nyu.edu

1 - A Model for Competition in Network Revenue Management

Nishant Mishra, Management Science and Operations, London Business School, Regents Park, London, NW1 4SA, United Kingdom, nmishra.phd2003@london.edu, Victor DeMiguel

We consider oligopolistic competition in network revenue management. Starting with a Cournot type capacity competition, for such a system, we show the existence and uniqueness of Nash Equilibrium under certain regularity conditions. Our approach is using Variational Inequalities and we also discuss how this analysis can be extended to the case of Bertrand price competition. Finally, we present results from numerical experiments and discuss how competition can affect revenue management practice.

2 - Capacity-dependent Bid Prices in Network Revenue Management

Huseyin Topaloglu, Cornell University, Rhodes Hall, Ithaca, NY, United States, ht88@cornell.edu, Sumit Kunnumkal

We propose a new method to compute bid prices. The novel aspect of our method is that it explicitly considers the temporal dynamics of the itinerary arrivals and generates bid prices that depend on the remaining leg capacities. Our method is based on relaxing certain constraints that link the decisions for different flight legs by associating Lagrange multipliers with them. This decomposes the network revenue management problem by the flight legs and we concentrate on one flight leg at a time.

3 - Upsell Effects in Network O&D Revenue Management

Richard Ratliff, Sr. Research Scientist, Sabre, 3150 Sabre Dr., Southlake, TX, 76092, United States, Richard.Ratliff@sabre-holdings.com

This presentation will provide a practitioner's perspective on the issues involved in incorporating upsell and recapture effects in network O&D revenue management (including the impact of demand dependencies across fare classes).

4 - A Column Generation Algorithm for Choice-based Network Revenue Management

Gustavo Vulcano, Assistant Professor, New York University, 44 West Fourth St., Suite 8-76, New York, NY, 10012, United States, gvulcano@stern.nyu.edu

In this paper, we consider the choice-based, deterministic, linear programming model (CDLP) of Gallego et al.(2004), and the follow-up dynamic programming (DP) decomposition heuristic of van Ryzin and Liu (2004), and focus on the more general version of these models, where customers belong to overlapping segments. We propose a column generation algorithm that leads to high quality results in feasible computational times.

5 - Revenue Management for Online Advertising

Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kfridgeirsdottir@london.edu, Victor Araman

The Internet offers many advantages as an advertising medium compared to traditional media. We develop a new modelling framework for the operation of a web host that generates revenues from selling advertising space on its website. We show that the models developed have some similarities to known queueing systems but also some fundamental differences. We analyze different service disciplines and study the revenue maximization problem of the web host.

■ TA51

S-Kirkland (Lev. 3)

Dynamic Control of Queueing Networks

Cluster: Queueing Models
Invited Session

Chair: Alexander Stolyar, Bell Labs, Alcatel-Lucent, 600 Mountain Ave, 2C-322, Murray Hill, NJ, 07920, United States, stolyar@research.bell-labs.com

1 - George-Harrison II: Dynamic Control of a Queue with Admission Control and Adjustable Service Rate

John Hasenbein, Associate Professor, University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States, jhas@mail.utexas.edu, A. Kranthi Mitra

We resolve several open questions posed in a 2001 OR paper by George and Harrison. That paper investigated dyanamic control of a queue with general holding costs, adjustable service rates, and a cost of effort function. We relax assumptions on the cost of effort function, allowing admission control, and we prove that stationary policies are optimal in this system. It is also shown that the elegant G-H algorithm can be extended.

2 - A Distributed Switch Scheduling Algorithm

Petar Momcilovic, Assistant Professor, University of Michigan, 1301 Beal Av, Ann Arbor, MI, 48109, United States, petar@eecs.umich.edu

The Maximum Weight Matching (MWM) algorithm is a high-performance scheduling algorithm for cross-bar switches. It is known that MWM performs optimally under heavy loads and results in low packet delays. However, its centralized nature and high computational complexity limit algorithm's applicability. We present a randomized algorithm for distributed switch scheduling that is capable of delivering high throughput.

3 - Optimal Utility-based Control of a Network Supporting Multi-rate Multicast

Alexander Stolyar, Bell Labs, Alcatel-Lucent, 600 Mountain Ave, 2C-322, Murray Hill, NJ, 07920, United States, stolyar@research.bell-labs.com, R. Srikant, Loc Bui

The model is a queueing network shared by a number of multicast sessions, each with a single sender and multiple receivers. Key feature: receivers (even within same session) may have different (concave) utility functions of the average received rate. We present a joint scheduling and congestion control algorithm, asymptotically maximizing the total utility.

4 - A Stochastic Network with Concurrent Resources: Heavy Traffic Limit Under Multiple Bottlenecks

Hengqing Ye, Dept. of Logistics, Faculty of Business, Hong Kong Polytechnic University, Hong Kong, China, lgtyehq@inet.polyu.edu.hk, David D. Yao

We study a stochastic network where the resources (service capacities) are controlled by a utility maximizing scheme. We establish a heavy traffic (HT) theorem for such a network when there are multiple bottlenecks and the resource pooling condition does not hold.

■ TA52

S-Leschi (Lev. 3)

Artificial Intelligence Applications I

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Jason Deane, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, jdeane1@vt.edu

1 - Using Multivariate Adaptive Regression Splines to Predict Bids for Highway Construction Projects

Seth Guikema, Assistant Professor, Texas A&M University, 3136 TAMU, College Station, TX, 77843-3136, United States, sguikema@civil.tamu.edu, Roshan Pawar

Estimating bid prices for a project is important for both bidders and state agencies. Predictions of competitor bids can help bidders estimate their chances of winning the bid. Bid predictions can help state agencies formulate better price estimates early in the project life-cycle. We will use data from actual highway projects to demonstrate that MARS models can yield fairly accurate bid prices based on past bids and help agencies and bidders better understand the major drivers of bid prices.

2 - Heuristic and Metaheuristic Solutions to the Wireless Network Tower Placement Problem

Jason Deane, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States, jdeane1@vt.edu, Kevin Scheibe, Loren Rees, Terry Rakes

Much of our expansive fiber optic backbone remains unused because of the data capacity bottleneck which exists at the user level. While various technologies have emerged to provide greater end-point capacity, one very promising alternative is high-speed wireless service. While models have been developed to assist in the planning for minimum cost tower placement, these models can be quite large and complex to solve. This paper explores alternate heuristic and meatheuristic (GA) solution methods.

3 - Classifying Hyperspectral Imagery via a Novel Method for Augmentation by Contextual Information

Robert Brigantic, Pacific Northwest National Laboratory, 902 Battelle Blvd., P.O. Box 999, Richland, WA, 99352, United States, robert.brigantic@pnl.gov, Lawrence Chilton

This presentation summarizes a method for improved performance of Bayesian classifiers for hyperspectral imagery via a novel method for augmentation by considering contextual information. In particular, we present the use of a modified form of the Iterated Conditional Modes (ICM) method. We show this method can significantly outperform standard Bayesian classification techniques. We then generalize this modified approach for performing hyperspectral imagery classification.

■ TA53

S-Medina (Lev. 3)

Network Location

Sponsor: Location Analysis
Sponsored Session

Chair: Zvi Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States, zdrezner@exchange.fullerton.edu

1 - Identifying Optimal Designs in Competitive Facility Location and Design Problem

Oded Berman, Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5S3E6, Canada, Berman@Rotman.Utoronto.Ca, Robert Aboolian, Dmitry Krass

We provide efficient solution methodology for single and multi-facility versions of the Competitive Facility Location and Design Problem. For uniform design model we develop an exact solution approach. Our methodology can be applied to develop optimal non-uniform designs for different budget level for use as inputs to a scenario-based model.

2 - Un-weighted Min-max Location in R^n with Euclidean Distance

P.M. Dearing, Professor, Clemson University, P O Box 340975, Clemson, SC, 29634-0975, United States, pmdrn@CLEMSON.EDU, Christiane Zeck

A dual algorithm is presented that solves the min-max problem in R^n over a sequence of subsets S of the given points. If a subproblem is not optimal, a new point is added to the set S and an existing point is replaced. The min-max solution to the new set is determined by following directions based on bisectors.

3 - A New Voronoi Heuristics to Divide a Network into Equal Sized Sub-networks

Atsuo Suzuki, Professor, Nanzan University, 27 Seirei-cho, Seto, Ai, Japan, atsuo@nanzan-u.ac.jp, Takehiro Furuta, Atsuyuki Okabe

By the network Voronoi diagram and the linear programming technique, we introduce a new method which divides a road network into equal sized sub-networks in a reasonable time. For location analysis on the Euclidean plane, such as the cell count method, we divide a region into equal size sub-regions easily. On the other hand, on a network, to divide a road network into equal sized sub-networks is a challenging problem. We apply our method to actual road networks and show the effectiveness.

4 - Joint Ambulance/Aeromedical EMS Coverage Models

Rajan Batta, Professor/Associate Dean, SUNY at Buffalo, 412 Bonner Hall, Buffalo, NY, 14260, United States, batta@eng.buffalo.edu, Peter Rogerson, Alan Blatt, Marie Flanigan, Elif Tokar-Erdemir

We propose location coverage models and solution methods for the problem of locating ambulances, aeromedical servers and landing zones. Coverage of a crash location can be obtained by sending only an ambulance, only a helicopter, or a combination of both ground and air EMS servers. We address uncertainty in accident locations by providing coverage to both accident points and regions (or paths). We illustrate the models on case studies using New Mexico traffic accident data.

■ TA54

S-Queen Anne (Lev. 3)

Message-passing: New Algorithms and Analytical Tools for Applied Probability

Sponsor: Applied Probability
Sponsored Session

Chair: Ciamac Moallemi, Stanford University, Electrical Engineering, Packard 274, Stanford, CA, 94305-9510, United States, ciamac@stanford.edu

Co-Chair: Devavrat Shah, Assistant Professor, MIT, 32-D670, 77 Massachussets Avenue, Cambridge, MA, 02139, United States, devavrat@MIT.EDU

1 - A Message-passing Paradigm for Decentralized Control and Optimization

Ciamac Moallemi, Stanford University, Electrical Engineering, Packard 274, Stanford, CA, 94305-9510, United States, ciamac@stanford.edu, Benjamin Van Roy

We propose a message-passing paradigm for decentralized resource allocation problems. This is a conceptual framework that generalizes price-based systems. We demonstrate that this is equivalent to approaches based on shadow prices when the utility functions are concave. However, the message-passing approach also extends to more general cases, and yields an incentive-based framework with certain optimality guarantees even when utilities are not concave or resources are indivisible.

2 - Network Message-passing Algorithms

Devavrat Shah, Assistant Professor, MIT, 32-D670, 77 Massachussets Avenue, Cambridge, MA, 02139, United States, devavrat@MIT.EDU

I will present message-passing algorithms for network scheduling and resource-allocation building on a simple summation algorithm. Key features of the algorithms are their simplicity, iterative nature and robust againt network dynamics.

3 - Phase Transitions in Loss Networks

Kavita Ramanan, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States, kramanan@math.cmu.edu, Brad Luen, Ilze Ziedins

We consider Markov random field models of large loss networks, and characterise the behavior of their steady state distribution. In particular, we identify parameter values when so-called phase transitions occur, and describe their implications for performance of the network. This talk is based on various joint works with Ilze Ziedins and Brad Luen.

4 - Decentralized Optimization and Correlation Decay

Theophane Weber, MIT Operations Research Center, 77 Massachusetts Avenue, E40-131, Cambridge, MA, 02139, United States, theo_w@mit.edu, David Gamarnik, John Tsitsiklis

Consider a network of cooperating agents, each of which has to take a one-shot decision. All agents seek to optimize a global function decomposable as a sum of edge functions, where the value of each depends on the decisions at the endpoints. Is it possible for agents who know the network within a distance r to compute a decentralized decision? How is performance affected by the distance r? We look at these questions using a correlation decay technique in an average-case probabilistic setting.

■ TA55

S-Ravenna (Lev. 3)

Joint Session AAS/TSL: Air Traffic Management

Sponsor: Aviation Applications, Transportation Science & Logistics
Sponsored Session

Chair: Michael Ball, Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States, mball@rhsmith.umd.edu

1 - En-route Air Traffic Modeling and Strategic Flow Management Using Decomposition Method

Dengfeng Sun, Graduate Student Researcher, University of California at Berkeley, 604 Davis Hall, University of California at Berkeley, Berkeley, CA, 94720, United States, sundf@berkeley.edu, Alexandre Bayen

A new Eulerian-Lagrangian Cell Transmission Model for air traffic flow is developed on a graph-theoretic network flow model constructed from historical air traffic data. The predictive capabilities of the model are successfully validated against recorded air traffic data. A large-scale optimization problem of controlling sector aircraft counts over the National Airspace System is posed as a Mixed Integer Linear Program. The problem is solved using dual decomposition method.

2 - Network Fairness in Air Traffic Flow Management (ATFM)

Douglas Fearing, PhD Student, MIT Operations Research Center, 77 Massachusetts Avenue, Building E40-149, Cambridge, MA, 02139, United States, dfearing@MIT.EDU, Dimitris Bertsimas, Amedeo Odoni

We extend a network formulation for ATFM with a measure of fairness. This extension is consistent with highly successful practices. Additionally, we show how we can incorporate a three-stage Collaborative Decision-Making (CDM) approach. For the single-airport case, we compare our three-stage approach to the three-stage approach utilized in a CDM-enhanced GDP. In our computational results, we use simple network scenarios to demonstrate the trade-off between system delay and fairness.

3 - Ordinal Regression Model for Forecasting Enroute Controller Requirements

Shin-Lai Tien, Graduate Research Assistant, Department of Civil and Environmental Engineering, University of Maryland, Dept. of Civil & Environmental Engineering, University of Maryland, College Park, MD, 20742, United States, alextien@umd.edu, Paul Schonfeld

A model for forecasting enroute controller requirements in response to future flight demand is developed for incorporation into the FAA's NAS Strategy Simulator. Probabilities of using between 0 and 4 controllers per sector are estimated from the controller work history based on traffic densities and other sector characteristics. The model's results can help in estimating future capacity and evaluating enroute performance.

4 - A Randomized Procedure for the Equitable Assignment of Slots in an Air Space Flow Program

Nasim Vakili, ISR, 3117 AVW Building, University of Maryland, College park, MD, 20742, United States, nasimv@umd.edu, Michael Ball

The FAA recently introduced the Airspace Flow Program (AFP) to manage airborne traffic in congested airspace. We describe randomized procedures to allocate limited slots among carriers based on their relative preferences for delay and re-routing options. We derive important properties of these methods with respect to fairness and their ability to satisfy carrier preferences.

■ TA56

S-Wallingford (Lev. 3)

Online Auctions

Cluster: Auctions
Invited Session

Chair: Peter Popkowski-Leszcyc, Associate Professor of Marketing, University of Alberta, 4-20 F School of Business, Edmonton, AB, T6G 2R6, Canada, ppopkows@ualberta.ca

1 - The Effect of Competition on Reserve Price Strategies in Auctions

Peter Popkowski-Leszcyc, Associate Professor of Marketing, University of Alberta, 4-20 F School of Business, Edmonton, AB, T6G 2R6, Canada, ppopkows@ualberta.ca, Terry Elrod, Junjun Xie

We model the effect of competitive reserve prices strategies on prices in online auctions, and show that competition matters. However sellers tend not to adapt to competition or different market conditions. To determine sellers' profit maximizing reserve price strategies under different market conditions we build a comprehensive simulation model. This model incorporates competitive sellers and bidder segments who vary in their propensity to bid in auctions with different reserve price strategies.

2 - The Effect of Information on the Bidding and Survival of Entrants in Procurement Auctions

Dakshina De Silva, Texas Tech University, Department of Economics, Lubbock, TX, 79409-1014, dakshina.de-silva@ttu.edu, Georgia Kosmopoulou, Carlos Lamarche

This paper examines the impact of a policy change by the Oklahoma Department of Transportation on the bidding patterns of entrants and incumbents, and the survival rates of entrants in highway procurement auctions. The Department of Transportation in Oklahoma, in April of 2000, started releasing along with the project plans, the state's internal estimate of the costs to complete highway construction projects. We found that entrants bid more aggressively and won auctions with significantly lower bids than incumbents before April 2000 but the bidding differential decreased substantially since then. The discrepancy in their bidding patterns can be attributed to informational and cost asymmetries between entrants and incumbents. The reduction in informational asymmetries, induced by the policy change, weakened the stochastic dominance relation between the bidding distributions of the two groups at the lower end. We also found that, entrants continue bidding for an exte nded period of time after the policy change, suggesting higher survival rates in the procurement auctions.

3 - Concurrency of Online Auctions

Wolfgang Jank, Assistant Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States, wjank@rhsmith.umd.edu

We consider the phenomenon of concurrency and how it affects bidding and winning in online auctions. Concurrency arises from auctions that take place over the same time period and interact with each other. Interaction can occur in the form of bidders participating in simultaneous auctions or in the form of sellers evaluating their competition and adjusting selling strategies. In this work we consider several ways of measuring, visualizing and modeling concurrency in online auctions.

4 - Minimum Bid Increments and Last-Minute Bidding in Online Auctions

Alex Rogers, University of Southampton, Southampton, S017 1BJ, United Kingdom, acr@ecs.soton.ac.uk, Esther David, Jeremy Schiff, Nicholas Jennings

We consider the effects of minimum bid increments within online auctions (particularly eBay style auctions). We show the while last minute bidding (sniping) is an effective strategy against incremental bidders, in general, a bidder should attempt to be the first sniper to bid (i.e. it should 'snipe before the snipers').

■ TA57

S-Columbia (Lev. 4)

Performance Analysis and Resource Management in Computer-communication Systems

Sponsor: INFORMS Telecommunications Section
Sponsored Session

Chair: Natarajan Gautam, Associate Professor, Texas A&M University, 235A Zachry, Mailstop 3131, College Station, TX, 77843, United States, gautam@tamu.edu

1 - Robustness and Performance of Threshold-based Resource Allocation Policies

Atul Bhandari, Post-Doctoral Associate, University of Pittsburgh, 1178c Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States, abhandari79@gmail.com, Alan Scheller-Wolf, Mor Harchol-Balter, Takayuki Osogami

We provide the first analytical study of the mean response time and robustness of a wide range of threshold-based resource allocation policies for a multi-server queuing system with flexible routing such as those commonly used in modeling call centers. We find that using multiple thresholds can have significant benefit over using only a single threshold with respect to robustness, but that multiple thresholds surprisingly offer only small advantage with respect to mean response time.

2 - Time Reversibility Analysis for the Erlang Abandonment Formula

William Massey, Professor, Princeton University, ORFE Department, Princeton, NJ, United States, wmassey@Princeton.EDU

Performance metrics for the steady state behavior of multi-server loss and delay queues were first characterized by Erlang through his B and C formulas. Call centers have focused on the extra feature of abandonment. The performance metric for such a model has been referred to as the Erlang-A formula. Using the methods of time-reversibility, we simplify the steady state analysis for deriving this formula and find some simple recursive algorithms to compute it.

3 - A Selective Broadcast Query Protocol for High-density Wireless Sensor Networks

Jeffrey Kharoufeh, Associate Professor, Northeastern University, 334 Snell Engineering Center, Boston, MA, 02115, United States, jkharoufeh@coe.neu.edu, Christopher Mann, Rusty Baldwin

We present a search protocol to facilitate queries for data and services in high-density wireless sensor networks. The objective is to minimize the total energy expenditure of the network by determining the optimal number of data/service replicates and the number of nodes that receive each query transmission.

4 - Resource Management in Web Hosting Centers for Energy Conservation

Natarajan Gautam, Associate Professor, Texas A&M University, 235A Zachry, Mailstop 3131, College Station, TX, 77843, United States, gautam@tamu.edu, Yiyu Chen, Cesar Rincon Mateus

Web hosting services and data centers consume a phenomenal amount of electric power to run farms of servers. In this talk we present effective resource management strategies to reduce this energy consumption. We take advantage of the fact that user requests vary tremendously both spatially and temporally. Using a statistical model to predict user-request patterns and a queueing model for performance measures, we formulate and solve an optimization problem for resource management.

■ TA58

S-Pike (Lev. 4)

Product Architecture

Cluster: New Product Development
Invited Session

Chair: Glen Schmidt, Professor, University of Utah, David Eccles School of Business, Salt Lake City, UT, 84103, United States, glen.schmidt@business.utah.edu

1 - Modularity and Redesign of Components in Complex Products

Manuel Sosa, Assistant Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu

Using a network approach we define modularity of product components based on their lack of connectivity with other components in the product. Component redesign is defined as the proportion of component design content that is not carried over from previous product generations. We test two competing propositions about the impact of component modularity on component redesign by analyzing the design of a large commercial aircraft engine.

2 - Explaining the Dearth of Modularly Upgradeable Products

Sezer Ulku, Assistant Professor, Georgetown University MSB, su8@georgetown.edu, Glen Schmidt

In markets with fast technological change, often the prescription is to use modular architectures. However, the evolution of products in the consumer electronics industry tells a different story. Handspring was initially conceived as a modular platform that allowed new applications. This feature was discarded in favor of an integral architecture that does not allow expansion. In this paper we build an analytical model to examine the demand for and supply of modularly upgradeable products.

3 - Disentangling the Theories of Governance Modes: Exploring the U.S. Bicycle Component Industry

Jin-Kyu Park, Assitant Professor, Florida International University, Industrial & Systems Engineering, 10555 West Flagler St. / EC 3100, Miami, FL, 33174, United States, kyupark@fiu.edu

This study attempts to disentangle competing theoretical explanations of firm governance mode choice between transaction cost economics, prior transaction view, and resource based view. To do so, we investigate the U.S. bicycle component industry from 1980 to 1992, using a statistical research method. This study strongly supports resource based view.

4 - Willingness to Pay for Modular Products

Glen Schmidt, Professor, U. of Utah, David Eccles School of Business, Salt Lake City, UT, 84103, United States, glen.schmidt@business.utah.edu, Sezer Ulku

The market offers relatively few high-tech products that are modular-in-use, whereby the customer can upgrade individual components of the product as technology improves. We explore as a possible contributing factor the notion of hyperbolic discounting – customers may prefer the instant gratification offered by a lower-cost integral product, rather than pay a rational premium for a modular-in-use design.

■ TA59

S-Seneca (Lev. 4)

Capacity Planning and Inventory Control

Cluster: Capacity and Technology Management
Invited Session

Chair: Woonghee Tim Huh, Assistant Professor, Columbia University, 500 W 120th Street, MC 4704, New York, NY, 10027, United States, th2113@columbia.edu

1 - Capacity Planning for Manufacturing in the Biotech Industry

Micah Siegel, Associate Production Planner, Global Biologics Supply Chain, 200 Tournament Drive, HTD-6-1, Horsham, PA, 19044, United States, MSiegel1@GBSUS.JNJ.COM

We will discuss the factors to be considered in making capacity decisions in the Biotech industry. The topics we will cover are: Description of manufacturing process, factors affecting capacity allocation and expansion decisions, practical issues arising from the implementation of capacity expansion, and description of challenges facing a capacity planning group in the industry.

2 - Continuous Improvement in JIT Logistics: The Defect Bullwhip Effect

Young Ro, University of Michigan, yro@umich.edu, Kuo-Ting Hung

In the supply chain literature, little work has been done on modeling the propagation pattern of quality defects in supply chains. We quantitatively model a defect bullwhip effect in supply chains that can be addressed logistically by reducing time intervals between product deliveries. We also consider production

characteristics such as the frequency of supplier failure and stringency of the buyer's inspection process. Implications for managers are suggested.

3 - Inventory Models with Ordering Time Constraints Due to Limited Supplier/Transportation Capacity

Metin Cakanyildirim, School of Management, The University of Texas at Dallas, 2200 N Floyd Rd, Richardson, TX, United States, metin@utdallas.edu, Lama Moussawi, Alain Bensoussan

An ordering time constraint is considered, which allows a retailer to order only when there is no outstanding order. This can be caused by the limited supplier capacity, or limited transportation capacity between the supplier and the retailer. In the former case, the supplier can process only one order at a time and does not start to process the next order before finishing the outstanding order. We establish the optimality of (s,S) policies and show the uniqueness of some policy parameters.

4 - Convexity Results for Capacitated Stochastic Inventory Systems

Woonghee Tim Huh, Assistant Professor, Columbia University, 500 W 120th Street, MC 4704, New York, NY, 10027, United States, th2113@columbia.edu, Ganesh Janakiraman

In this paper, we study a capacitated assembly system managed using an echelon order-up-to policy, and show that the shortage penalty cost over any horizon is jointly convex with respect to the base-stock levels and production capacity levels. This property is useful in developing algorithms for making optimal inventory and capacity decisions.

■ TA60

S-University (Lev. 4)

Linking Managerial Agency and Technological Change: A Dynamic Capability Perspective

Sponsor: Technology Management
Sponsored Session

Chair: Krsto Pandza, Marie Curie Intra-European Fellow, The University of Leeds, Maurice Keyworth Building, Leeds, LS2 9JT, United Kingdom, kp@lubs.leeds.ac.uk

1 - Dynamic Managerial Capabilities and Adaptive Change

Margaret Peteraf, Professor of Strategic Management and Organization, Tuck School of Business at Darmouth, 100 Tuck Hall, Hanover, NH, 03755, United States, Margaret.A.Peteraf@Dartmouth.EDU, Randal Reed

This paper explores the question of how the differential exercise of managerial choice can facilitate organizational adaptation and improve efficiency over periods of regulatory change. This is an adaptive mechanism that helps firms adjust to environmental change or maneuver over a rugged landscape. We view this as a type of dynamic managerial capability for achieving dynamic fit under changing conditions.

2 - From Vinyl to Chips: Capability Adaptation and New Products in Cultural Industries

Bernardino Provera, Post-Doctoral Fellow, Bocconi University, Viale Isonzo 23, 20135, Milan, 20135, Italy, bernardino.provera@unibocconi.it, Gianmario Verona, Giuseppe Soda

This paper investigates the process of incumbent adaptation to technological change in a mature industry. We focus on the music industry to analyze the transition from a traditional to a digital business model, investigating how incumbents responded to an externally-driven radical change by adapting their capabilities over time. We adopt a mixed method approach exploring the role of human capital, social capital and cognition in defining response to a new technology.

3 - Dynamic Capabilities in Evolutionary Fit: Knowledge From Cross-sectional and Longitudinal Analysis

Stuart Horsburgh, Head of Division, Manchester Metropolitan University Business School, Aytoun Building, Aytoun Street, Manchester, UK, M1 3GH, United Kingdom, S.Horsburgh@mmu.ac.uk, Zhi Wang

In the research we explore how cross-sectional and temporal linkages affect the evolution of policy choice combinations. We make the connection between the literature on complementarities and the resource-based view of strategy. Our solutions constitute conjectures and illustrate how different configurations of policy choices reflect differences in knowledge constructions at different points in time and we show how complex choice combinations emerge from a series of system transitions.

4 - Dynamic Capability as a Creation of Novelty: Path-creation in the Context of Nanotechnology

Krsto Pandza, Marie Curie Intra-European Fellow, The University of Leeds, Maurice Keyworth Building, Leeds, LS2 9JT, United Kingdom, kp@lubs.leeds.ac.uk

This research investigates the path-creation processes in the context of emergent technology and the role of managerial agency in shaping the creation of novel capabilities. It analyses situations in which (1) firms intentionally develop new capabilities for exploring uncertainty in order to continuously create novel knowledge and (2) firms that base their identity on an emergent technology strive to transform their expertise in different domains of application.

Tuesday, 10:00am - 11:30am

■ TB01

C-Room 602

Supply Chain Optimization III

Contributed Session

Chair: Gabriel Gutiérrez, PhD Student, Pontificia Univ Catòlica de Chile, Dept. of Industrial Eng., Vicuña Mackenna 4860, Macul, Santiago RM, Chile, gegutier@ing.puc.cl

1 - Inventory Model for a Two-product Recovery System

Ek Peng Chew, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, isecep@nus.edu.sg, Loo-Hay Lee, Pan Jie

This research deals with an inventory problem of manufacturing two products with the option of using returned items or new items. With the similarity of the two products, returned items of each product can be remanufactured to finished items of both products. Therefore, return items are differentiated by quality level instead of product type. We develop an optimal inventory policy for this type of problem.

2 - SC-Java: Unifying Service Composition Simulation and Optimization

Malak Al-Nory, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States, malnory@gmu.edu, Alexander Brodsky, Hadon Nash

Developed is the language SC-Java, which extends Java with (1) a library of supply-chain modeling components such as items, services and business metrics; and (2) the syntax of decision choices for program variables, assertions and the objective to be optimized. The SC-Java compiler provides a supply chain process simulation, and optimal instantiation of values into the choice-variables, based on automatic construction of a standard optimization model and solving it on an external solver.

3 - Impact of Quality of Advance Demand Information in Production Inventory Systems

Deng Ge, Rensselaer Polytechnic Institute, Dept. of DSES, CII-5015, 110 8th Street, Troy, NY, 12180, United States, ged@rpi.edu, Ananth Krishnamurthy

Customers are often willing to share advance demand information (ADI) with manufacturers, but expect better customer service in return. Using queuing models, we investigate the effect of different aspects of ADI, such as variable information lead times, order cancellations, and variable order quantities on inventory, service level and lead times.

4 - The P-median Problem with Construction Cost

Gabriel Gutiérrez, PhD Student, Pontificia Univ Catòlica de Chile, Dept. of Industrial Eng., Vicuña Mackenna 4860, Macul, Santiago RM, Chile, gegutier@ing.puc.cl, Vladimir Marianov, Oscar Cornejo, Carlos Obreque

A model is proposed and solved for the p-Median Problem plus Construction Costs. The goal is to minimize both construction cost of the roads and distance between facilities and demand nodes. The model can be applied to the design of a water network for fire fighting, or telecommunications networks in which both construction costs and transit time are important. An algorithm based on Lagrangean relaxation is proposed for solving this problem. Computational experience is also provided.

■ TB02

C-Room 603

Supply Chain Practice and Empirics

Contributed Session

Chair: Stella Hua, Professor, Western Washington University, Manufacturing and Supply Chain Managemen, 516 High Street, Bellingham, WA, 98225-9077, United States, stella.hua@wwu.edu

1 - Supplier Networks, Cooperation and Sourcing Efficiency

Anupam Agrawal, PhD Candidate, INSEAD, 46, Rue de La Cloche, Bat A3, Fontainebleau, 77300, France, anupam.agrawal@insead.edu, Luk Van Wassenhove, Arnoud De Meyer

In this paper, we explore how sourcing costs within a firm's supply chain can be better managed by managing the supply network of the focal firm. We discuss the results of our three year long empirical investigation in the automotive industry. We model the relationships between OEM and its suppliers, anchoring it to our empirical work, and show that OEM's can capture more value from their supply chain if they manage their supply networks.

2 - Deviant Work Behaviour in Purchasing: A Conceptual Model and Empirical Evidence on Maverick Buying

Katri Karjalainen, PhD Student, Helsinki School of Economics, P.O. Box 1210, Helsinki, Finland, kakarjal@hse.fi, Erik van Raaij, Katariina Kemppainen

Many organizations, public and private, are moving towards supply base reduction, corporate frame agreements, and improved spend transparency. These goals require contract compliance, but little research has been conducted on off-contract buying, also known as maverick buying. We identify its five forms ranging from unintentional to straightforward sabotage. New framework grounded in agency theory and theories of deviant work behaviour also identifies underlying reasons of maverick buying.

3 - Modeling Multiple Sourcing Decisions in a Supply Chain

Haitao Li, Sorrell College of Business, Troy University, Montgomery, AL, 36103, hli@troy.edu, Keith Womer

We study the multiple sourcing decisions in designing a supply chain, where a function in the supply chain network can be provided by more than one source with different suppliers/options. The capacitated supply chain configuration model is extended to model the multiple sourcing decisions. Promising solutions algorithms are discussed.

4 - Recent Developments on Dynamic Supply Chain Management

Pietro De Giovanni, PhD Student, ESSEC Business School, Foyer Cergy Le Haut Chambre HB314, Cergy Pontoise Cedex - Paris 95801, France, pietro.degiovanni@essec.fr

This paper provides a wide panoramic of the recent developments on Dynamic Supply Chain Management. In particular, SCM involves a countless of subjects treated emphasizing primarily their static state: the component time is too often forgotten, while it becomes essential in some areas as SCM. This contribution has the purpose to identify the main static SC's issues convertible in dynamic, suggesting original research ideas and proposals, and highlighting the characteristics of a Dynamic SCM.

5 - Improving Picking Operation at a Manufacturing Finished Goods Warehouse

Stella Hua, Professor, Western Washington University, Manufacturing and Supply Chain Managemen, 516 High Street, Bellingham, WA, 98225-9077, United States, stella.hua@wwu.edu

Warehouse picking operations could be challenging due to highly seasonal demand and a large number of SKUs. This paper identifies a number of research topics based on the picking operation at a manufacturing company. The research questions are presented in four areas: product characteristics, inventory location, facility layout, and information technology. The issues identified here highlight the differences among three picking methods, and the challenges in the implementation process.

■ TB03

C-Room 604

Procurement and Supply Chains

Cluster: Supply Chain

Invited Session

Chair: Damian Beil, Assistant Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States, dbeil@umich.edu

1 - Price Dispersion in Electricity Auctions: Strategic Analysis and Economic Implications

Shanshan Hu, Ross School of Business, University of Michigan, 701 Tappan Street, E0401 (PhD Office), Ann Arbor, MI, 48109, United States, husz@umich.edu, Roman Kapuscinski, William Lovejoy

High volatility of electricity prices leads to the practice of risk management and a policy debate on market design, particularly the selection between discriminatory auction and uniform auction. We show that price dispersion stems from suppliers' exercising market power through randomized bidding, and such power is characterized by capacity utilization and technological asymmetry. The two auctions are approximately revenue equivalent but discriminatory auction results in lower price volatility.

2 - On the Choice of a Contract Under Bilateral Information Asymmetry

Valery Pavlov, PhD Candidate, Supply Chain and Information Systems Department, PSU, 463A, Business Building, Smeal College of Business, University Park, PA, 16802, United States, vup112@psu.edu

As is commonly acknowledged, coordinating contracts are not nearly as widely used as the Pareto-inferior wholesale price contract. We address this issue by (i) making the choice of a contract endogenous to the model and, (ii) by relaxing assumption of the perfect information. We find that under bilateral information asymmetry a wholesale price contract can be uniformly better for the supplier than a coordinating contract.

3 - Matching Collection Channel with Collection Strategy in Reverse Supply Chains

Atalay Atasu, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, IF, 77300, France, atalay.atasu@insead.edu, Beril Toktay

We discuss the impact of the collection strategy on the reverse channel choice of a manufacturer. The manufacturer has two options for collection, either he collects used products himself or delegates the collection activity to the retailer. The collecting party can use two different approaches for used product collection: (i) drop-off (ii) pick-up. We show that manufacturer's optimal reverse channel choice depends on the collection strategy used.

4 - Capacity Reservation Contracts Using Common Agency

Feryal Erhun, Assistant Professor, Stanford University, MS&E, Stanford, CA, 94305, United States, ferhun@stanford.edu, Basak Kalkanci

We examine how the suppliers must choose their contracts in an assembly system where the components are perfectly complementary and when the manufacturer has better information on mean demand. We identify and compare optimal complex contracts and price-only contracts. We observe that although the complex contracts lead to a higher efficiency than price-only contracts, using price-only contracts can be a better option for some players in the system under certain conditions.

■ TB04

C-Room 606

Tutorial: Solving Large-scale Discrete Optimization Problems: Introduction to the Nested Partitions Method

Cluster: Tutorials

Invited Session

1 - Solving Large-scale Discrete Optimization Problems: Introduction to the Nested Partitions Method

Leyuan Shi, Professor, University of Wisconsin-Madison, 3154 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, 53706, United States, leyuan@engr.wisc.edu, Sigurdur Olafsson

The Nested Partitions (NP) method is a relatively recent metaheuristic that has been found very effective for solving large-scale discrete optimization problems. Such problems are common in a broad range of practical applications and the NP method is therefore applicable to many operational and planning problems in both manufacturing and service industries. In this tutorial we introduce how to implement the NP method, demonstrate its key convergence properties, show how to integrate other exact and heuristic optimization methods into the very general framework the NP method provides, and evaluate its performance relative to other comparable methods. We also present several case studies from application areas that include supply chain management, health care delivery, and data mining.

■ TB05

C-Room 607

Panel Discussion: The Academic Job Search

Cluster: Job Placement Committee
Invited Session

Chair: Talisa Murray,Systems Analyst, The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel MD 20723, Talisa.Murray@jhuapl.edu

1 - Panel Discussion: Academic Job Search
Moderator: Talisa Murray,Systems Analyst, The Johns Hopkins University Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel MD 20723, Talisa.Murray@jhuapl.edu, Panelist: Yahya Fathi, Archis Ghate, David Kim

The panel will lead an informal discussion concerning the academic interview process, the appropriate steps to take during the job search, and the challenges that may be faced along the way. Time will be provided for questions and answers.

■ TB06

C-Room 608

Customer Behavior in Operations Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Senthil Veeraraghavan, Asst Professor, Wharton School, Philadelphia, PA, United States, senthilv@wharton.upenn.edu,

Co-Chair: Serguei Netessine, Associate Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessine@wharton.upenn.edu

1 - The Newsvendor Model with Customer Search Costs
Xuanming Su, University of California, Haas School of Business, Berkeley, 94720, United States, xuanming@haas.berkeley.edu, Fuqiang Zhang

Customers may have to pay a search or travel cost in order to visit the store. In a newsvendor setting, the possibility of stockouts discourages patronage. We use the rational expectations paradigm to study optimal pricing and inventory decisions.

2 - The Implications of Customer Purchasing Behavior and Display Formats
Rui Yin, Assistant Professor, Arizona State University, Department of Supply Chain Management, W. P. Carey School of Business, Tempe, AZ, 85287-4706, United States, ryin@anderson.ucla.edu, Yossi Aviv, Amit Pazgal, Christopher Tang

We consider two types of customer purchasing behavior (myopic and strategic) and two types of display formats (Display All and Display One) on a retailer's pricing and ordering decisions and his expected profit. We consider a Stackelberg game between the retailer and the customers as well as the competitive sub-game between customers. The existence and uniqueness of a threshold type Nash equilibrium for the sub-game between customers are established.

3 - Advance Purchase Discounts in a Supply Chain
Karan Girotra, karan.girotra@insead.edu

In this study, we analyze the economics of an advance purchase discount scheme where an upstream tier offers downstream tiers an incentive to place orders well in advance of demand. From observing these advance orders, the upstream tier can infer and utilize the information available to the downstream tier. Such an arrangement leads to efficient risk allocation and productive sharing of information in the supply chain. This leads to Pareto-improving outcomes for all agents.

4 - Quantity Decisions Under Customer Learning Behavior
Senthil Veeraraghavan, Asst Professor, Wharton School, Philadelphia, PA, United States, senthilv@wharton.upenn.edu, Serguei Netessine

We explore pricing and quantity decisions of products whose exact specification are noisy. We analyze optimal decisions in market with strategic consumers who face trade-off between availability and possibility disutility in purchasing the product.

■ TB07

C-Room 609

Challenging Inventory Problems in After Sales Services

Cluster: Inventory
Invited Session

Chair: Geert-Jan van Houtum, Associate Professor, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, 5600MB, Netherlands, G.J.v.Houtum@tm.tue.nl

1 - Approximate Evaluation of Order Fill Rates for an Inventory System of Service Tools
Ingrid Vliegen, PhD Student, Technische Universiteit Eindhoven, Postbus 513, Pav E18, Eindhoven, NL, 5600 MB, Netherlands, I.M.H.Vliegen@tm.tue.nl, Geert-Jan van Houtum

In this talk, we deal with the analysis of a single-location, multi-item inventory model for service tools, in which coupled demands and coupled returns occur. We distinguish multiple Poisson demand streams. Per stream a given set of tools is requested per demand. We are interested in the order fill rates. Requested tools that are not on stock are delivered via an emergency channel. Delivered tools are returned to the warehouse after a deterministic return time, that is equal for all tools.

2 - Reliability or Inventory? Contracting Strategies for After-sales Product
Sang-Hyun Kim, Doctoral Student, The Wharton School, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, shkim@wharton.upenn.edu, Morris Cohen, Serguei Netessine

In traditional sourcing arrangements for after-sales support of capital-intensive products, customers' payments to service providers were based on physical resources. In recent years, we have witnessed the emergence of a new service contracting strategy called Performance Based Logistics (PBL). Under PBL, the basis of supplier compensation is actual uptime of the product. We investigate how reliability and inventory decisions are made under the traditional and the PBL contracts.

3 - An Optimal Approach to Service Differentiated Spare Parts Management
Ulrich Thonemann, Professor, Department of Supply Chain Management and Management Science, University of Cologne, Albertus-Magnus-Platz, Koeln, K, 50923, Germany, Ulrich.Thonemann@uni-koeln.de, Karin Moellering

We consider a critical level policy for a periodic review inventory system with two demand classes. Since traditional approaches cannot be used to find the optimal parameters of the policy, we use a multi-dimensional Markov chain to model the inventory system. We use a sample path approach to prove several properties of this inventory system. Although the cost function is not convex we can build on these properties to develop an approach that finds the optimal solution.

4 - Pooling of Spare Parts via Lateral Transshipments
Geert-Jan van Houtum, Associate Professor, Technische Universiteit Eindhoven, P.O. Box 513, Eindhoven, 5600MB, Netherlands, G.J.v.Houtum@tm.tue.nl, Bram Kranenburg

Spare parts of capital goods have to be at close distance of installed systems in order to realize high uptime percentages. At the same time, pooling of inventories is desired because total demand rates are low for many parts. We show how both requirements can be met via decentralized stockpoints, the use of lateral transshipments, and smart inventory control algorithms. We also show results from a case at a tools supplier in the semiconductor industry.

■ TB08

C-Room 611

Sustainable Development

Contributed Session

Chair: Ibrahim Dogan, Wayne State University, 4815 4th St, Detroit, MI, 48201, United States, dogan@wayne.edu

1 - A Game Theoretic Model of the Market Competition Between Green and Ordinary Products
Guiping Hu, PhD Candidate, Industrial Engineering, 1048 Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States, guh5@pitt.edu, Lizhi Wang, Bopaya Bidanda

Two groups of ordinary and green companies that are market competitors are considered. A game theoretic model is proposed to analyze their market competition and the dynamic equilibrium under the free entry and exit assumptions. Sensitivity analysis from the model suggests that sustainable

product design, tax reduction and public awareness of the economical and environmental advantages of green products are the key recipes for the healthy growth of green products in the market.

2 - National Intellectual Property Competitiveness Indicators and Comparative Analysis of OECD Countries

Yoo-Jin Han, Associate Research Fellow, Korea Institute of Intellectual Property, 2nd Fl., 647-9, Yeoksam-dong, Kangnam-gu, Seoul, Korea, Republic of, yjhan@kiip.re.kr, Tae-Kyu Ryu

In this study, we aim to propose various indicators regarding intellectual property (IP) and analytical frameworks for the comparisons of national IP competitiveness among OECD countries. We proposed IP indicators in four dimensions - primary resources, infrastructure, main activities and performance and the radial chart and ranking method as analytical frameworks. This research is meaningful in that it first attempts to propose national-level IP indicators with their potential applications.

3 - Modeling a Two-stage Closed-loop Remanufacturing Supply Chain

Ibrahim Dogan, Wayne State University, 4815 4th St, Detroit, MI, 48201, United States, dogan@wayne.edu, Ratna Babu Chinnam

This study models a two-stage supply chain where a supplier remanufactures product and the underlying demand distribution is not directly observable and non-stationary. We aim to provide accurate forecasting ability to the supplier for estimation of net requirements in any given period. A flexible framework to support different real-word information settings is developed and analyzed under information asymmetry.

■ TB09

C-Room 612

Joint Session Homeland/DAS: OR in Homeland Security I

Cluster: Homeland Security, Decision Analysis
Invited Session

Chair: Donald Gaver, Distinguished Professor, Naval Postgraduate School, DGaver@nps.edu

1 - Interdicting a Nuclear Weapons Project

Gerald Brown, Naval Postgraduate School, Monterey, CA, 93943, Matt Carlyle, Robert Harney, Eric Skroch, Kevin Wood

We introduce a bilevel mip-versus-mip optimization of interdiction of a project to produce a first small batch of fission weapons, where the proliferator can anticipate our actions. We find vulnerabilities in a published proliferation project. Such insights can help policy makers evaluate the effect of interdiction options at their disposal.

2 - Simulation to Assess Quarantine Station Continuity of Operations in Response to Pandemic Influenza

Robert Brigantic, Pacific Northwest National Laboratory, 902 Battelle Blvd., P.O. Box 999, Richland, WA, 99352, United States, robert.brigantic@pnl.gov, John Malone

This presentation summarizes efforts conducted for DHS to simulate the flow of aircraft and passengers arriving from international destinations under an assumed Pandemic Influenza Federal Government Response Stage 2 which activates domestic quarantine stations. Starting with the CDC Quarantine Station Seattle, this research assesses current capabilities and examines the requirements for effective quarantine and isolation of people potentially infected with a pandemic strain of influenza.

3 - Improving Biosurveillance System Performance

Ronald (Ron) Fricker, Associate Professor, Naval Postgraduate School, 1411 Cunningham Rd. Rm 239, Monterey, 93943, United States, rdfricke@nps.edu

Syndromic surveillance systems are being implemented throughout the United States. These systems use health-related data to look for possible bioterrorism events. This talk will summarize the problem and describe an approach for managing the trade-off between the aggregate system-wide false alarms and the power to detect a bioterrorism attack.

4 - Stochastic Dynamics of Capacitated Flow Matching Networks Exposed to Random Disruptions

Alex Savachkin, Assistant Professor, University of South Florida, Dep. of IMSE, Tampa, FL, 33620, United States, savachki@eng.usf.edu

Large and distributed infrastructures operate in an increasingly risk encumbered environment. The most profound influence on risk is capacity loss through man-made disasters, natural cataclysms, and property-related hazards. Modest events have the potential to propagate into cascading capacity disruptions with dramatic economic loss. We will present a modeling paradigm that captures the dynamics of capacity disruptions in feed-forward, flow matching networks. We will show how these stochastic models can be used to develop new methodologies to model network risk.

■ TB10

C-Room 613

Assemble-to-order Systems, Allocation Rules and Component Commonality

Cluster: Inventory
Invited Session

Chair: Yao Zhao, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu

1 - Order Processing and Production Planning in the Presence of Pseudo-orders

Long Gao, Smeal College of Business, The Pennsylvania State University, University Park, PA, 16802, United States, gaolong@psu.edu, Susan Xu

We develop a MDP model for dynamic order processing and production planning in an Available-To-Promise environment with highly lumpy and volatile pseudo-orders. We characterize the structure of the optimal policy and investigate the impact of system parameters. We further compare the performances of several widely used policies with that of the optimal policy under different scenarios, and provide several recommendations for the management.

2 - A Production-inventory System with Two Customer Classes and Both Backorders and Lost Sales

Saif Benjaafar, Professor & Division Director, University of Minnesota, Industrial & Systems Engineering, Department of Mechanical Engineering, Minneapolis, MN, 55455, United States, saif@umn.edu, Tingliang Huang, Mohsen Elhafsi

We consider the optimal control of a production inventory-system with a single product and two customer classes. Upon arrival, customer orders can be fulfilled from existing inventory, if there is any, backordered, or rejected. Backorder and lost sales costs vary from class to class. We formulate the problem as a Markov decision process and characterize the structure of the optimal policy.

3 - Setting Inventory Policy via Stochastic Programming with Application to the W Model

Qiong Wang, Member of Technical Staff, Bell Labs, 600 Mountain Avenue, Murray Hill, NJ, United States, chiwang@alcatel-lucent.com, Mustafa Dogru, Marty Reiman

We solve a stochastic programming model to set base-stock levels for an assemble-to-order system. We show the solution is a lower bound on the total inventory cost of all policies. For the W model, we combine the base-stock setting with a priority backlog clearing policy. We implement our approach by simple search algorithms. Numerical experiments show that within a large subset of parameter space, the outcome is close to the lower bound and converges to it as the lead time increases.

4 - Lead Time, Allocation Rules and Component Cost in the Value of Component Commonality

Yao Zhao, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu, Jeannette Song

Component commonality has been widely recognized as a key factor in achieving product variety at low cost. The existing results were built primarily on models with zero lead times. In this talk, we consider dynamic systems with positive lead times. We find that component sharing alone need not yield inventory benefits. Component costs, lead times and component allocation rules all play significant roles in determining the value of common components.

■ TB11

C-Room 614

Supply Chain Management Considering Production, Capacity, Distribution, and New Technology Effects

Cluster: Manufacturing
Invited Session

Chair: Xuying Zhao, Assistant Professor, University of Notre Dame, Notre Dame, South Bend, IN, United States, xuying.zhao@utdallas.edu

1 - Supply Chain Scheduling of Customer Orders with Two Types of Perishable Products

Nagihan Comez, Assistant Professor, Bilkent University, Ankara, Ankara, Turkey, nagihan@utdallas.edu, Chelliah Sriskandarajah, Milind Dawande, Kathryn Stecke

We study production and distribution schedules of a manufacturer producing two types of perishable products. Each customer may have orders for both products, which should be delivered at once. The time spent by an order in storage after production until delivery is concerned to ensure the product quality. We show that while individual departments determine their ideal schedules, they may omit overall system objective and significant cost savings can be obtained by a jointly optimized schedule.

2 - Designing Distribution Channels to Launch an Innovative Durable Product with Complementary Services
Xiuli He, UT-Dallas, School of Management, SM 30, Dallas, TX, 75080, United States, xiulihe@gmail.com, Genaro Gutierrez

Consider a supply chain in which a manufacturer produces an innovative durable product (IDP) with complementary services and products. We assume a Bass-type diffusion process for the demand. The manufacturer decides on whether to launch the IDP through a direct, an indirect or a competitive channel. We characterize the impact of after-sales profits and the retailer market influences on the pricing decisions of the channel members as well as the manufacturer's decisions on channel configuration.

3 - Food for Fuel? The Impact of Biofuel Supply Chain Structures
Jiong Sun, Stuart School of Business, Chicago, IL, 60661, United States, jiongs@andrew.cmu.edu, Sunder Kekre, Laurens Debo

As the oil price continues increasing, biofuel is gradually becoming a substitute to petroleum fuel. With the potential benefits of paying less for fuel, consumers however have to pay more for food because biofuel consumes grains as feedstocks. This paper studies the impact of variable costs, supply chain structures and petroleum fuel prices on the competitiveness of the biofuel supply chain and the grain prices.

4 - Capacity Planning in a Multiple Processes Supply Chain with Multiple Contract Types
Xin Huang, M.I.T., 111 Webster Ave. Apt #2, Cambridge, MA, 02141, United States, xinhuang@mit.edu, Stephen Graves

A key element to a company's success is its ability to match its supply to uncertain demand by utilizing different types of capacity contracts. We consider the design of a multi-product supply chain, for which each product requires multiple process capabilities. We present a multi-period model to determine the capacity investments in the presence of demand uncertainty and different contract types. We have developed efficient and practical algorithms to find the optimal capacity plan.

■ TB12

C-Room 615

Scheduling Potpourri

Cluster: Scheduling
Invited Session

Chair: John Fowler, Professor, Arizona State University, Dept.. of Industrial Engineering, Tempe, AZ, 85287-5906, United States, John.Fowler@asu.edu

1 - Optimal Job Splitting on a Multi-slot Machine with Applications in the Printing Industry
Ali Ekici, PhD Student, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States, aekici@isye.gatech.edu, Pinar Keskinocak, Ozlem Ergun, Michail Lagoudakis

Motivated by practices in the printing industry, our goal is to assign the demand for n items to an m-slot machine to minimize the waste and setup cost. We show that the problem is NP-hard and propose two linear integer programming formulations, several preprocessing steps, and two heuristics. Extensive tests on real life and randomly generated instances show that the heuristics are both fast and effective, finding near-optimal solutions.

2 - Bicriteria Scheduling of Equal Length Jobs with Release Dates on Identical Parallel Machines
Hari Balasubramanian, Post-doctoral Research Associate, Mayo Clinic, 200 2nd Street SW, Rochester, MN, United States, balasubramanian.hari@mayo.edu, Ahmet Keha, John Fowler

We consider parallel machine bicriteria scheduling problems for equal length jobs with release dates involving classical scheduling objectives. Our bicriteria treatment of these problems includes lexicographic optimization, minimization of a composite linear function, generation of schedules on the efficient frontier and the generation of all Pareto optimal solutions. Using single criteria algorithms proposed in the literature, we show the polynomial solvability of these problems.

3 - Interactive Evolutionary Multicriteria Scheduling
Jon Marquis, Arizona State University, Dept. of Industrial Engineering, Tempe, 85287-5906, United States, Jon.Marquis@asu.edu, Esma Gel, Pekka Korhonen, John Fowler, Murat Koksalan, Jyrki Wallenius

We describe an interactive genetic algorithm that develops solutions to multicriteria scheduling problems. Our algorithm assumes only that there exists a quasi-concave preference function of the scheduling criteria, and elicits decision maker preference information to partial order the population. We will present information about solution quality for the weighted completion time and total tardiness criteria.

4 - Multi-objective Semiconductor Manufacturing Scheduling
Mary Beth Kurz, Clemson University, 110 Freeman Hall, Clemson, SC, 29634, United States, mkurz@CLEMSON.EDU, Letitia Pohl, Scott Mason, John Fowler, Michelle Pfund

We examine a complex multiobjective semiconductor manufacturing scheduling problem with 2 batch processing steps linked by a timer constraint, which requires that any job completing the first processing step must be started on the second machine within a time limit; otherwise, the job must repeat the first step. We develop deterministic and probabilistic algorithms which are evaluated through the use of the Integrated Convex Preference measure over a wide range of experimental problem instances.

■ TB13

C-Room 616

Contemporary Issues

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Wilbert Wilhelm, Professor, Texas A&M University, TAMUS 3131, College Station, TX, 77843-3131, United States, wilhelm@tamu.edu

1 - An Analysis of the Convex Hull of Two-period Submodels of Production Planning Problems
Andrew Miller, University of Wisconsin-Madison, 3156 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, United States, amiller@engr.wisc.edu, Kerem Akartunali

Despite the significant attention they have drawn, big bucket production planning problems remain notoriously difficult to solve. We discuss results indicate that what make these problems difficult are the embedded single-machine, single-level, multi-period submodels. We therefore consider the simplest such submodel: a multi-item, two-period capacitated model. We discuss this model's polyhedral structure, and how useful knowing this structure could be in solving more complicated problems.

2 - Minimum Filter Placement for Computer Security
Cole Smith, Associate Professor, University of Florida, The University of Florida, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, j.cole.smith@gmail.com, E. Chisonge Mofya

We consider a network in which nodes communicate by exchanging information packets, whose fields include the address of the sending node and that of the destination node. In the absence of security mechanisms, an attacking node can send packets to another node using a forged origin address. We consider the problem of identifying a minimum subset of nodes on the network such that placing route-based filters on these nodes limits the number of forged address attacks to a prescribed level.

3 - Algorithms for the Design of a Relay Network in Truckload Trucking
Halit Uster, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States, uster@tamu.edu, Panitan Kewcharoenwong

In order to address the the driver turnover problem in truckload transportation at the strategic level, we consider the design of a relay network which allows drivers to mainly operate in their domiciles. We develop a mathematical model which determines the relay point locations along with the routing decisions and provide efficient algorithms for its solution. We also present computational results illustrating the efficiency of the approaches.

4 - A Branch-and-price Approach to Design a Surveillance System for Homeland Security
Wilbert Wilhelm, Professor, Texas A&M University, TAMUS 3131, College Station, TX, 77843-3131, United States, wilhelm@tamu.edu, Elif Ilke Gokce

A branch-and-price approach is presented to design a surveillance system for port and waterway security. The integer programming model represents relevant practical considerations and prescribes the types of sensors, the number of each type, and the location of each sensor to meet surveillance requirements while minimizing total cost. Computational tests are reported.

■ TB14

C-Room 617

Variational Analysis and Equilibria

Sponsor: Optimization/ Nonlinear Programming
Sponsored Session

Chair: Stephen Robinson, Professor, University of Wisconsin-Madison, ISyE/UW-MADISON, 1513 University Ave Rm 4161A, Madison, WI, 53706-1539, United States, smrobins@wisc.edu

1 - Implicit Mapping Theorems in Variational Analysis
R. Tyrrell Rockafellar, Professor Emeritus, University of Washington, Department of Mathematics, Box 354350, Seattle, WA, 98195-4350, United States, rtr@math.washington.edu

The classical implicit function concerns the way that the solution to a system of equations depends on parameters in the system, in particular whether the solution is nicely behaved function of the parameters in a local sense. This talk will describe advances that have been made in that direction when equations are replaced by generalized equations, for instance variational inequalities.

2 - Sensitivity of Variational Inequalities Over Perturbed Polyhedral Convex Sets
Shu Lu, Assistant Professor, The University of North Carolina at Chapel Hill, Dept. of Statistics & Operations Research, 210 Smith Building, CB#3260, Chapel Hill, NC, 27599-3260, United States, shulu@email.unc.edu

A variational inequality seeks a point in a given set such that the value of a given function at this point is normal to the set at this point. Sensitivity analysis studies how solutions of a variational inequality vary under perturbations of the function and the set that define the variational inequality. This talk focuses on variational inequalities over polyhedral convex sets.

3 - Parametrized Variational Inequality Approaches to the Generalized Nash Equilibrium Problem
Paul Tseng, Professor, University of Washington, Department of Mathematics, Box 354350, Seattle, WA, 98195-4350, United States, tseng@math.washington.edu, Masao Fukushima, Koichi Nabetani

The generalized Nash equilibrium (GNE) problem is a generalization of standard Nash equilibrium problem, in which each player's strategy set may depend on the rivals' strategies. For problems with shared constraints, we propose parametrized families of variational inequalities (VI) whose solutions include all GNEs. We study sufficient conditions for a solution of the parametrized VI to be a GNE, and propose price-directed and resource-directed VI approaches to search for all GNES.

■ TB15

C-Room 618

Applications of Robust Optimization

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Melvyn Sim, Professor, NUS Business School, Singapore, dscsimm@nus.edu.sg

1 - From Cvar to Uncertainty Set: Implications in Joint Chance Constrained Optimization
Melvyn Sim, Professor, NUS Business School, Singapore, dscsimm@nus.edu.sg, Chung-Piaw Teo, Jie Sun, Wenqing Chen

In this paper we review the different tractable approximations of individual chance constraint problems using robust optimization on a varieties of uncertainty set, and show their interesting connections with bounds on the condition-value-at-risk CVaR. We also propose a new formulation for approximating joint chance constrained problems, which builds on a classical worst case bound for order statistics problem.

2 - Robust Inventory Management Using Tractable Replenishment Policies
Chuen-Teck See, NUS, Singapore, Singapore, Singapore, see_chuenteck@yahoo.com.sg

We propose tractable replenishment policies for a multiperiod inventory control problem under ambiguous demands via solving a second order cone optimization problem. Our framework extends to correlated demands and is developed around a factor-based demand model, which incorporates business factors and time series forecast effects of trend, seasonality and cyclic variations.

3 - A Bayesian Approach to Stochastic and Robust Optimization
Constantine Caramanis, Assistant Professor, The University of Texas at Austin, ENS 426, Mail Code C0803, 1 University Station, Austin, TX, 78712, United States, cmcaram@ece.utexas.edu, Shie Mannor

In this talk, we consider a Bayesian approach to optimization under uncertainty, driven by data observations. We explore the complexity of such an approach, proving some negative results, while also providing a framework that yields a tractable algorithm for encorporating data in a Bayesian framework. We further consider asymptotic properties, stability properties, and relationship to traditional solution formulations from robust and stochastic optimization.

■ TB16

C-Room 619

Applications of Optimization in Finance

Cluster: Optimization (Invited)
Invited Session

Chair: Dushyant Sharma, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States, dushyant@engin.umich.edu

1 - Optimal Consumption and Portfolio Decisions with Partially Observable Real Prices
Jussi Keppo, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States, keppo@umich.edu, Alain Bensoussan, Suresh Sethi

We consider consumption/portfolio problems under a random inflation in the consumption basket prices. Both the cases when the investor observes the consumption basket prices and when he receives noisy observations on those are treated. We show that a modified Mutual Fund Theorem consisting of three funds holds in both cases. In the particular case when the investor has CRRA utilities, his optimal investment allocations into these funds are also the same in both cases.

2 - American Options under Stochastic Volatility
Kumar Muthuraman, Assistant Professor, Purdue University, 3225, Humboldt St., West Lafayette, IN, 47906, United States, kumar@purdue.edu, Arun Chockalingam

We consider the problem of pricing American options when the volatility of the underlying asset price is stochastic. We consider a canonical setup that is general enough to encompass several stochastic volatility models proposed in literature. We describe the arising free-boundary problem and present a method to efficiently solve it. Examples illustrating the generality of the method are provided, together with comparisons against existing methods to validate our numerical results.

3 - Modeling and Solving Non-convex Robust Portfolio Optimization Problems
Daniel Bienstock, Columbia University, dano@ieor.columbia.edu

Robust optimization is a technique for building 'robustness', in a qualitative sense, into solutions to optimization models. Real-world data uncertainty arising in the portfolio optimization context can exhibit non-convexities as well as hidden correlations among groups of assets. In this talk we describe continuing work in the solution of robust optimization problems with these features.

■ TB17

C-Room 620

The Dynamics of Digital Goods Markets

Sponsor: Information Systems Society
Sponsored Session

Chair: Alok Gupta, Carlson School Professor of IDSc, University of Minnesota, 321 19th Avenue South, 3-365 CSOM, Minneapolis, MN, 55455, United States, alok@umn.edu

1 - Information Strategies for Information Age: In Search of a Theory of IT-Enabled Market Transparency
Alok Gupta, Carlson School Professor of IDSc, University of Minnesota, 321 19th Avenue South, 3-365 CSOM, Minneapolis, MN, 55455, United States, alok@umn.edu, Robert Kauffman, Nelson Granados

The Internet has brought about significant changes in the availability of market information in many industries. Firms are increasingly able to design electronic selling mechanisms that reveal, conceal, bias, and distort market information. We present a research agenda on the topic of market transparency for information-intensive industries where many firms are developing in-novative technologies to implement strategies exploiting the quantity and quality of information provided to consumers.

2 - Demand Heterogeneity in IT Infrastructure Services: A Dynamic Service Level Approach
Raghu Santanam, Arizona State University, Box 874106, Arizona State University, Tempe, 85287, United States, Raghu.Santanam@asu.edu, Sagnika Sen, Ajay Vinze

A key feature of service-oriented models of IT is the promise of pre-specified quality levels enforceable via SLAs. Since variance in expectations impact service levels, effective pricing and resource allocation mechanisms are needed to deliver services at the promised quality level. An analytical model and simulation is presented and evaluated for effectiveness of a proposed dynamic priority-based pricing scheme vis-á-vis a baseline fixed-price single-quality level SLA.

3 - Alliances in Enterprise Systems Software Markets: A Social Network Approach

Ramnath Chellappa, ram@bus.emory.edu, Nilesh Saraf

Enterprise Systems Software (ESS) is a multi-billion dollar industry that produces systems components to support a variety of business functions for a wide-range of vertical industry segments. Using social network analyses as the theoretical framework, our research builds on extant findings of research in economics of standards to empirically examine ESS firm competition.

■ TB18

C-Room 201

Parallel Combinatorial Optimization

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185, United States, caphill@sandia.gov

1 - Enumeration of Near-optimal Solutions in Parallel Branch and Bound

Jonathan Eckstein, Professor, Rutgers University, 640 Bartholomew Road, RUTCOR Room 155, Piscataway, NJ, 08854, United States, jeckstei@rci.rutgers.edu, Cynthia Phillips, William Hart

Optimization model limitations or data inaccuracies may make one interested in multiple near-optimal solutions, rather than a single optimum. We discuss enhancement and generalization of the PEBBL parallel branch-and-bound package's enumeration logic, which includes relative, absolute, and cardinality tolerances. The interaction of parallelism, the cardinality tolerance, and possible duplicate solutions generated by incumbent heuristics makes for a significant implementation challenge.

2 - Solving Facility Location Problems on Massively Multi-threaded Machines

Jonathan Berry, Member of Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185, United States, jberry@sandia.gov, Cynthia Phillips

COIN contains an implementation of Barahona and Chudak's Volume algorithm (VOL). This is an improvement upon the classical subgradient algorithm for lagrangian relaxation. Although VOL is a general lp solver, it has been applied with particular success to the p-median and uncapacitated facility location problems. We have developed a modified VOL code that runs on massively multithreaded supercomputers and have generated this platform's first optimization results for a COIN-based code.

3 - Extending Recent MIP Heuristics to Parallel Environments: Architecture and Performance Analysis

Jean-Paul Watson, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185-1318, United States, jwatson@sandia.gov

Several very effective general-purpose MIP heuristics have been introduced over the last 5 years for both incumbent generation and improvement. These include the feasibility pump, local branching, and relaxation-induced neighborhood search. We investigate extensions and applications of these heuristics to parallel computing environments, specifically Sandia's PICO parallel MIP solver. We focus on performance assessment and general management of multiple MIP heuristics in parallel contexts.

4 - Fractional Decomposition Trees: A New (Parallel) Heuristic for Integer Programs

Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185, United States, caphill@sandia.gov, Robert Carr

We present a new algorithm for finding a feasible solution for a integer program that is well suited for parallel implementation. The algorithm runs in time polynomial in the input size and is guaranteed to find a feasible integer solution for any problem class that has a finite integrality gap. The algorithm is based on convex decomposition of scaled linear-programming relaxations, so in general it provides a suite of integer solutions. A faster heuristic gives only one feasible solution.

■ TB19

C-Room 203

ICS Prize Winners 2007

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: John Chinneck, Professor, Carleton University, Systems and Computer Engineering, 1125 Colonel By Drive, Ottawa, ON, K1S5B6, Canada, chinneck@sce.carleton.ca

1 - ICS Prize Winners 2007

The 2007 Prize Winners will be publicly announced at the ICS Business meeting on Monday November 5. Come and see the details of their prizewinning work!

■ TB20

C-Room 204

Dynamic Programming Applications

Sponsor: Decision Analysis
Sponsored Session

Chair: Soo-Haeng Cho, UCLA Anderson School of Management, 110 Westwood Plaza, Gold Hall, Suite B512, Box 951481, Los Angeles, CA, 90095, United States, scho@anderson.ucla.edu

1 - A Discrete-time Approach for Modeling Two-factor Mean-reverting Stochastic Processes

James Dyer, Professor, The University of Texas at Austin, CBA 5.202, Austin, TX, 78712, United States, Jim.Dyer@mccombs.utexas.edu, Warren Hahn

We generalize the recombining binomial lattice approach for valuing real options to address underlying stochastic processes that are mean-reverting. We implement this approach in two-dimensional binomial lattice format, apply it to two hypothetical real option problems, and compare the results to those from simulation- and dynamic programming-based methods.

2 - The Optimal Composition of Influenza Vaccines Subject to Random Production Yields

Soo-Haeng Cho, UCLA Anderson School of Management, 110 Westwood Plaza, Gold Hall, Suite B512, Box 951481, Los Angeles, CA, 90095, United States, scho@anderson.ucla.edu

We present a dynamic model for the annual flu vaccine composition decision. An optimal threshold policy is derived for this decision. Due to the greater uncertainty in production yields of new vaccines, the optimal thresholds are neither symmetric between retaining and updating the composition nor monotonic over time. We apply our model to past decisions using parameter values estimated from a historical case. Our analysis shows that the optimal policy can significantly improve social welfare.

3 - Repeat Purchase Decisions in Technology Adoption

Canan Ulu, University of Texas at Austin, IROM, B6500, 1 University Station, Austin, TX, 78712, United States, Canan.Ulu@mccombs.utexas.edu, James Smith

In this paper, we study when consumers should replace or upgrade a technology. The tradeoff is between using a profitable technology now and waiting for better technologies that are to come in the future. We model this problem as a dynamic programming model and study structural properties of the value function and optimal policies.

4 - Invest or Exit? Optimal Decisions in the Face of a Declining Profit Stream

Dharma Kwon, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, dharma.kwon@gmail.com

Even in the face of declining and highly volatile demand, firms often invest in aging technologies rather than discard them. We study this phenomenon by modeling the firm's profit rate as a Brownian motion with negative drift. At each point in time, the firm can (1) continue operations, (2) stop the project, or (3) boost the profit rate through one-time investment. The optimal policy is a threshold rule, and we find a counter-intuitive comparative statics result.

■ TB21

C-Room 205

Testing Decision Theories and Decision Axioms

Sponsor: Decision Analysis
Sponsored Session

Chair: Michel Regenwetter, University of Illinois at Urbana-Champaign, 603, E. Daniel, Champaign, IL, United States, regenwet@uiuc.edu

1 - Analysis of Choice Probabilities Under Inequality Constraints
Clintin Davis-Stober, University of Illinois, 603 East Daniel, Champaign, IL, United States, cstober2@cyrus.psych.uiuc.edu

Many prominent models of decision theory assume an ordinal structure on individual choice probabilities. Yet, empirically testing whether observable data could have arisen from such choice probabilities has proven to be a considerable challenge to researchers. We present a statistical methodology to test choice probabilities under linear inequality constraints. An application of this methodology provides a test of decision axioms defined by unions of convex polytopes.

2 - Testing Random Preference Models
Michel Regenwetter, University of Illinois at Urbana-Champaign, 603, E. Daniel, Champaign, IL, United States, regenwet@uiuc.edu

Loomes and Sugden (EER, 1995) discussed a random preference model of transitivity and stated that it does not place enough restrictions on data. They endorsed testing weak stochastic transitivity. Actually, there are many random preference models for transitivity, and they are more parsimonious than weak stochastic transivity. I discuss laboratory tests of these models. We circumvent a range of conceptual, modelling and statistical problems that plague the literature.

3 - Evaluating the Priority Heuristic: A Comparison of Decision Making Models
William Messner, Graduate Student, University of Illinois Department of Psychology, 603 East Daniel St., Champaign, IL, 61820, United States, wmessne2@uiuc.edu, Michel Regenwetter, Clintin Davis-Stober

In their 2006 Psychological Review paper, Brandstätter, Gigerenzer, and Hertwig propose the Priority Heuristic, a model of decision making over paired prospects. They compare the Priority Heuristic to several models of decision making (e.g. Cumulative Prospect Theory). We discuss several problems with their method and propose an alternate framework to compare decision models.

■ TB22

C-Room 206

Data Envelopment Analysis II

Contributed Session

Chair: Anthony Halog, PhD, Assistant Professor, Brock University, 500 Glenridge Avenue, St. Catharines, ON, L2S 3A1, Canada, ahalog@brocku.ca

1 - A Procedure for Determining Consistency Index in DEAHP
Subramanian Nachiappan, Dr., Visiting Scholar, University of Nottingham, Nottingham University Business School, Jubilee Campus, Wollaton Road, Nottingham, NG81BB, United Kingdom, Nachiappan.Subramanian@nottingham.ac.uk, Dr. Ramakrishnan Ramanathan

A new method combining Data Envelopment Analysis (DEA) and Analytic Hierarchy Process (AHP), called DEAHP, has been recently proposed to generate priorities from pairwise comparison matrices (PCM). In this study, a procedure is proposed for estimating consistency index of a PCM when DEAHP is employed. The proposed procedure is shown to perform well using simulation by comparing with the consistency index computed using Saaty's eigenvector method for randomly generated PCMs.

2 - Primitive DEA: The Unconscious Use of DEA for Evaluation and Assessment of Entities
Marie-Laure Bougnol, Assistant Professor of Management, Western Michigan University, Haworth College of Business, Kalamazoo, MI, 49008, United States, ml.bougnol-potter@wmich.edu, Marcos Estellita Lins, Jose Dulá, Angela Moreira da Silva

Data envelopment analysis (DEA) can be interpreted as a natural generalization of elemental practices for efficiency and performance evaluation that have evolved independently of the traditional efficiency framework of Charnes et al. We take three examples of efficiency assessment practices in retailing, finance, and social ranking schemes, to derive and motivate DEA and introduce their practitioners to a tool that has the potential to multiply the power and practical value of their analyses.

3 - A Piecewise Linear Non-convex Technology That Satisfies R. Frisch's Regular Ultra Passum Law
Ole B. Olesen, Associate Professor, University of Southern Denmark, Department of Business and Economics, Campusvej 55, Odense, DK-5230, Denmark, ole@sam.sdu.dk, Niels Christian Petersen

Data Envelopment Analysis may have some irregular properties concerning the shape of optimal scale curves and the M-locus. Imposing R. Frisch's Regular Ultra Passum (RUP) law on a DEA estimator could provide more stable properties. We propose a piecewise linear non-convex estimator of a production possibility set that satisfies the RUP law. Performance on a simulated data set from a known RUP technology is included.

4 - Performance Analysis of 'Sarva Shiksha Abhiyan' Using Data Envelopment Analysis
Sanjeet Singh, Indian Institute of Management Calcutta, D.H. Road, Joka, Kolkata, India, sanjeet@iimcal.ac.in

In this paper, We have used Data Envelopment Analysis (DEA) to evaluate the performances of various Indian States in implementing 'Sarva Shiksha Abhiyan'. Sarva Shiksha Abhiyan (SSA) is Government of India's flagship programme for achievement of Universalization of Elementary Education (UEE) in a time bound manner, as mandated by 86th amendment to the Constitution of India making fee and compulsory Education to the Children of 6-14 years age group, a Fundamental Right. For this study we have used open public domain data released by Department of School Education and Literacy. We have also identified and quantitatively analyzed the key physical indicators where a particular state is need to focus more.

5 - Assessing Sustainable Supply Chain Network Performance Using Data Envelopment Analysis
Anthony Halog, PhD, Assistant Professor, Brock University, 500 Glenridge Avenue, St. Catharines, ON, L2S 3A1, Canada, ahalog@brocku.ca

Evaluating sustainable value chain performance of a network configuration of participants is attempted using data envelopment analysis. Network efficiency (ratio of value added to environmental impacts and resource consumptions) is formulated to compare possible supply network configurations within an industrial cluster. Inputs, desirable and undesirable outputs of a network are considered. The best configuration and those which require streamlining to improve network performance are suggested.

■ TB23

C-Room 208

Operations Research in the Public Sector

Sponsor: Public Programs and Processes
Sponsored Session

Chair: Mariah Jeffery, IBM Global Business Services, 12902 Federal Systems Park Dr, Fairfax, VA, 22033, United States, mjeffery@us.ibm.com

1 - Network Design Optimization for Canada Post
Scott Sutherland, Consultant, IBM Global Business Services, 12902 Federal Systems Park Dr., Fairfax, VA, 22033, United States, ssutherland@us.ibm.com, Hua Ni, Bianica Pint

The postal operation is very complex, with time-sensitive mail products under different processing and transportation requirements. We developed an MIP model for Canada Post to determine the optimal mix of network, flow and machinery based on fixed and variable costs. The model also considers network expansion from potential facilities.

2 - IBM's Text-mining Model Powers Quick Disability Determination at the Social Security Administration
Alissa Eichinger, 12902 Federal Systems Park Dr., Fairfax, VA, 22033, United States, alissa.eichinger@us.ibm.com, Spyros Kontogiorgis, Thomas P. Hart

IBM Global Business Services and Research crafted a production solution that enables the SSA to process disability insurance applications efficiently. Our optimization engine provides state-of-the-art text classification: The trainer processes millions of records with thousands of features; the predictor offers fast response with high accuracy.

3 - The Mortgage for the House-Rich Cash-Poor Retirees: Credit Risk & Insurance for Reverse Mortgages
Gigi Yuen-Reed, Consultant, IBM Global Business Services, 12902 Federal Systems Park Dr., Fairfax, VA, 22033, United States, gigi.yuen@us.ibm.com, Edward Szymanoski, James Enriquez

Reverse mortgages (RM) provide senior citizens cash payments and/or a credit line secured by their home's equity. While the primary risk of traditional mortgage is loan default, RM's risks are borrowers' mortality, mobility, and the liquidation value at move out. To provide a more efficient financial pricing structure for RM, we formulated a loan repayment model from historical data and developed a stochastic pricing model to incorporate the impact of house price appreciation and interest rate.

4 - Scheming the Postal Service: An Algorithm for Delivery Point Sequencing
Mariah Jeffery, IBM Global Business Services, 12902 Federal Systems Park Dr, Fairfax, VA, 22033, United States, mjeffery1@us.ibm.com, Mariah Jeffery

We discuss the development of a tool for creating sort schemes for the United States Postal Service's Delivery Point Sequencing (DPS) operation. The tool uses a polynomial time algorithm to assign mail to DPS machines for sorting with an objective of minimizing the total equipment required while meeting service standards.

■ TB24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - Imagine That, Inc. - ExtendSim Demonstration
Dave Krahl, Imagine That, Inc., 6830 Via Del Oro Ste. 230, San Jose, CA, 95119, davek@extendsim.com

See how quickly you can build robust, intuitive models with the power tool for simulation - ExtendSim. Revolutionary new simulation technology and 3D animation in ExtendSim is paired with core ExtendSim features such as hierarchical model building, user interface creation and interactive modeling to make it the tool to watch in the simulation industry. Don't miss this demo!

2 - Dash Optimization - Building Optimization Applications in Xpress-MP
Gabriel Tavares, Consultant, Dash Optimization Inc, 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, gabriel.tavares@dashoptimization.com

This tutorial focuses on developing and deploying complete optimization applications using Dash's array of tools. These tools can be used for modeling, solving, analyzing, and visualizing optimization problems, and integrating them seamlessly in business applications. The proven technologies offered by Dash can be used in range of applications such as supply chain management, transportation, finance, energy, manufacturing, retail operations, manufacturing industries, etc.

■ TB25

C-Room 210

Quality Control in Nanomanufacturing

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Ave., ENB118, Tampa, FL, 33620, United States, huangq@eng.usf.edu

Co-Chair: Roshan Vengazhiyil, Assistant Professor, Georgia Tech, Groseclose 0205, Room 337, 7 65 Ferst Drive, NW, Atlanta, GA, 30332, United States, roshan@mailhost.isye.gatech.edu

1 - Nanostructure Growth Modeling for in Situ Nanomanufacturing Process Control
Qiang Huang, Assistant Professor, University of South Florida, 4202 East Fowler Ave., ENB118, Tampa, FL, 33620, United States, huangq@eng.usf.edu

Tremendous efforts have been devoted to basic nanoscience discovery, novel processes development, and concept proof of nanoscale devices. Yet much less research work has been undertaken in nanomanufacturing to improve process repeatability. Quality control of nanomanufacturing processes faces new challenges of scale effects. This talk presents a nanostructure growth modeling strategy for in situ process control.

2 - Sequential Minimum Energy Design for Synthesis of Nanostructures
Tirthankar Dasgupta, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, tdasgupt@isye.gatech.edu, Roshan Vengazhiyil, C. F. Jeff Wu

A sequential space filling design called Sequential Minimum Energy Design (SMED) is proposed for exploring best process conditions for synthesis of nanowires. The SMED is a novel approach to generate designs that are model independent, can quickly carve out regions with no observable nanostructure morphology, allow for the exploration of complex response surfaces, and can be used for sequential experimentation.

■ TB26

C-Room 211

Data Mining Applications for Productivity

Sponsor: Data Mining (Sponsored)
Sponsored Session

Chair: Jose Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Jose.Ramirez-Marquez@stevens.edu

1 - A Data Mining Approach for Multivariate Statistical Process Control
Thuntee Sukchotrat, University of Texas at Arlington, 500 W.First St.,† Box 19017,† 420K Woolf, Arlington, TX, United States, tsukchotrat@uta.edu, Seoung Bum Kim

We propose a data mining approach for multivariate statistical process control. By using classification techniques, our proposed method can utilize both the in-control and out-of-control data information to build a control chart. The probability that a data point belongs to a certain class from classification result is plotted.

2 - Network Reliability Lower Bound via Petri Nets
Jose Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Jose.Ramirez-Marquez@stevens.edu, Stuart Van Weele

Petri nets have been used for graphically representing information and material flow through a discrete system. In this research, Petri nets have been implemented for modeling classic network reliability problems. Moreover, based on the results obtained, data mining has been used to propose a lower bound for network reliability. This technique allows for the evaluation of reliability without the need to resort to simulation whenever changes in the reliability of network components occur.

3 - Symbol Clustering Techniques for Context-tree Models of Distributed Systems for Fault Isolation
Pierre Brice, Stevens Institute of Technology, 207 Normandy Road, Edison, NJ, 08820, United States, mgi548@motorola.com, Wei Jiang

Distributed systems tend to exhibit context-dependent behavior. We model such systems using context trees. For practical applications with a large set of variables that need to be monitored for fault isolation, the set of symbols that are needed to represent the tree is extremely large. This presentation describes an information-theoretic based method to cluster these symbols and reduce the set to a manageable size.

4 - Applications of Data Mining in Healthcare Research
Samuel Hohmann, Senior Research Specialist, University Health System Consortium, 2001 Spring Road, Suite 7000, Oak Brook, IL, 60523, United States, hohmann@uhc.edu, Shital Shah

UHC is a rich repository of administrative, clinical, and operations data for academic medical centers. Data mining opportunities are investigated to address financial and operational performance including cost of service, length of stay, diseases patterns, etc. An application using above data is presented to illustrate the endless possibilities of data mining in healthcare research.

■ TB27

C-Room 212

Data Mining Methods

Contributed Session

Chair: Oliver Hedgepeth, Associate Professor of Logistics, University of Alaska Anchorage, College of Business, 3211 Providence Drive, Anchorage, AK, 99508, United States, ohedgep477@aol.com

1 - A Framework of Customer Profile Acquisition Based on Transactions Mining
Minghua Zhu, R&D Engineer, IBM China Research Lab, tower A, 19 DIA, ZGC softpark, Haidian, Beijing, 100094, China, zhumingh@cn.ibm.com, Zhonglin Lin, Wenjun Yin, Bin Zhang, Jin Dong

A customer profile is the foundation of customer management. However, there remains a large number of non-identified customers, especially in developing countries where membership systems are not prevalent cur-rently. To acquire the profiles of them, we present a framework based on transactions mining. It includes two steps: semi-supervisory classification based on training typical transactions with right customer profiles and cus-tomer profile ranking by correlation analysis.

2 - Discrete Support Vector Machines: A Classification Method Based on Mixed Integer Programming
Carlo Vercellis, Politecnico di Milano, Plza Leonardo da Vinci 32, Milano, 20133, Italy, carlo.vercellis@polimi.it, Carlotta Orsenigo

Discrete support vector machines are classification methods based on mixed integer programming. Whereas traditional SVM consider a continuous proxy of the empirical error, discrete SVM properly count the number of misclassified examples according to SRM principle. Discrete SVM have been applied on several well-known classification problems in the context of medical diagnosis, marketing and biolife sciences, with excellent performances in terms of accuracy and generalization capability.

3 - A Bump Hunting Method and Its Accuracy Using the Decision Tree with the Genetic Algorithm

Hideo Hirose, Professor, Kyushu Institute of Technology, 680-4, Kawazu, Iizuka, Fukuoka, Japan, hirose@ces.kyutech.ac.jp, Takahiro Yukizane, Takuya Deguchi

Finding denser regions for response 1 among regions for responses 0 and 1 mixed is an alternative to classification methods in messy customer databases, providing that response 1 points are hardly separable from response 0 points in any regions. To overcome such a case, we have developed a new method to find a trade-off curve between the pureness rate of response 1 in target regions and the capture rate of response 1 to the total. The accuracy for the trade-off curve is also considered.

4 - Least Angle Regression for Large Data

Tim Hesterberg, Insightful Corp, 1700 Westlake Ave N, Suite 500, Seattle WA 98199, timh@insightful.com, Chris Fraley

Least Angle Regression is a promising new technique for variable selection applications, offering a nice alternative to stepwise regression. It provides an explanation for the similar behavior of Lasso (L1-penalized regression) and forward stagewise regression, and provides a fast implementation of both. We'll demonstrate a prototype open-source S-PLUS/R package "glars" for generalized least angle regression, extending the work by outside collaborators, and a one-pass algorithm for handling massive data sets.

5 - RFID Metrics Forecast for Post Implementation

Oliver Hedgepeth, Associate Professor of Logistics, University of Alaska Anchorage, College of Business, 3211 Providence Drive, Anchorage, AK, 99508, United States, ohedgep477@aol.com, Morgan Henrie

RFID technology is another step in the evolution of the computer . The rapid implementation of RFID technology into the supply chain has started evolutionary change in traditional metrics for logistics operations, project management, and operations research methods of forecasting trends. Hypotheses to define a new generation of problems, new metrics, and forecasting issues are offered.

■ TB28

C-Room 213

Uncertainty in Combinatorial Optimization

Sponsor: INFORMS Computing Society/Constraint Programming and Optimization
Sponsored Session

Chair: Pascal Van Hentenryck, Brown University, Box 1910, Providence, RI, United States, pvh@cs.brown.edu

1 - Using Constraint Programming for Queue Design and Optimization

Chris Beck, University of Toronto, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, jcb@mie.utoronto.ca, Daria Terekhov

We investigate links between queueing theory and constraint programming (CP) by solving a queueing design and optimization problem using CP. A facility with front and back room operations can hire specialized or cross-trained workers. Assuming stochastic arrival and service times, we develop a CP approach to find the smallest-cost combination of cross-trained and specialized workers satisfying constraints on the expected customer waiting time and expected number of workers in the back room.

2 - Amsaa: Solving Almost Optimally Large Multistage Stochastic Combinatorial Problems

Luc Mercier, Brown University, Box 1910, Providence, RI, 02912, United States, mercier@cs.brown.edu, Pascal Van Hentenryck

Stochastic Programming, Dynamic Programming, and Anticipatory Algorithms all aim at maximizing the expected value of a decision process, but all three fail at reaching optimality in practice on large highly combinatorial stochastic problems. We introduce Amsaa, a novel algorithm that takes the best of these three approaches. Benchmarks on a stochastic project scheduling problem show that the obtained expected values are significantly higher than with alternative state-of-the-art techniques.

3 - Anticipatory Algorithms for Online Stochastic Optimization

Pascal Van Hentenryck, Brown University, Box 1910, Providence, RI, United States, pvh@cs.brown.edu

This talk describes the theoretical and algorithmic foundations of anticipatory algorithms for online stochastic combinatorial optimization and describe their applications to various scheduling, routing, and resource allocation problems.

■ TB29

C-Room 214

Joint Session OS/ICS: Decomposition Methods in Integer Programming II

Cluster: Optimization /Computational Optimization and Software, INFORMS Computing Society
Invited Session

Chair: Matthew Galati, Optimization Interface Lead, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513-2414, United States, Matthew.Galati@sas.com

1 - A Lagrangian Inspired Discriminatory Pricing Algorithm

Steven Harrod, Assistant Professor, University of Dayton, School of Business Administration, 300 College Park, Dayton, OH, 45469, United States, a2soft@aol.com

A Lagrangian relaxation where multipliers are decomposed by variable class as well as constraint, and updated by a discriminatory pricing algorithm, can produce feasible solutions to problems which would otherwise be very hard to solve. Lagrangian multipliers are indexed both by the constraints to be relaxed and the separable classes of conflicting variables. The algorithm is demonstated on a railway scheduling problem, a form of binary multicommodity flow.

2 - An Integer Stochastic Programming Problem with Linear Fractional Objective Function

Alexandre Belloni, Duke University, The Fuqua School of Business, Durham, NC, United States, belloni@mit.edu

In this work we address an integer stochastic programming problem whose objective function is the expectation of the sum of linear fractional functions. The problem is motivated by real applications. The approach is to use Lagrangian Relaxation to decompose the problem by scenarios which can be solved efficiently. Statistical techniques are used to provide guidance on the necessary number of scenarios. In preliminary computational experiments reliable bounds on the duality gap were obtained.

3 - Logic-based Multi-objective Optimization for Restoration Planning

Jing Gong, PhD Candidate, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, 12180, United States, gongj@rpi.edu, Earl Rusty Lee, John E. Mitchell, William Wallace

We present a Benders decomposition approach to schedule the tasks that need to be completed in order to restore services following a major disruption. Efficient solutions for the multiple objective function problem are determined using convex combinations of the three (classical) objectives involved in scheduling problems: cost, tardiness and makespan.

4 - 0-1 Reformulations of the Multicommodity Capacitated Network Design Problem

Bernard Gendron, Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal, QC, Canada, gendron@iro.umontreal.ca, Antonio Frangioni

We study 0-1 reformulations of the multicommodity capacitated network design problem modeled with general integer variables to represent design decisions. We compare two cutting-plane algorithms to compute the same lower bound: one based on the generation of residual capacity inequalities within the model with general integer variables, and another based on the addition of extended linking inequalities to the 0-1 reformulation.

■ TB30

C-Room 2A

Panel Discussion: Meet the Program Managers

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53711, United States, szhou@engr.wisc.edu

1 - Panel Discussion: Meet the Program Managers

Moderator: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53711, United States, szhou@engr.wisc.edu, Panelist: Stephen Nash, John Ramthun, Debo Aichbhaumik, Wendy Martinez

In this panel discussion, program managers from several funding agencies will present the current research trend and priorities in federal government and private industries. After brief presentations by the panelists, an interactive discussion with audience will follow.

■ TB31

C-Room 2B

Design and Analysis of Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: James Delaney, Visiting Assistant Professor, Department of Statistics, Carnegie Mellon University, Baker/Porter Hall 132B, Pittsburgh, PA, 15213-3890, United States, jdelaney@cmu.edu

1 - Design and Analysis of Experiments with Nested Factors
Ying Hung, PhD Student, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States, gtg412v@mail.gatech.edu, Shreyes Melkote, Roshan Vengazhiyil

In many applications, some of the factors can change with respect to the level of another factor. Such factors are often called nested factors. A factor within which other factors are nested is called a branching factor. Design and analysis of experiments with branching and nested factors have not received much attention. In this paper, a new class of designs and a modified kriging model are proposed. This method is illustrated using a computer experiment on hard turning operation.

2 - Bayesian Analysis of Linear Models with Related Predictors
James Delaney, Visiting Assistant Professor, Department of Statistics, Carnegie Mellon University, Baker/Porter Hall 132B, Pittsburgh, PA, 15213-3890, United States, jdelaney@cmu.edu, Roshan Vengazhiyil

In fitting linear models often interaction and polynomial terms of the original predictors are used. This can substantially increase the total number of predictors and can cause problems with frequentist estimation. A Bayesian approach can overcome these. Because the predictors are related, specifying a prior for the parameters in the linear model is not easy. In this work, we propose a simple approach to prior specification. The advantage of the approach is illustrated with real examples.

3 - A Multi-stage Experiment Design in a Nano-enabled Medical Instrument Production Process
Chumpol Yuangyai, Penn State, 310 Leohnard Building, University Park, PA, 16802, United States, cuy113@psu.edu, Harriet Nembhard

As many industrial experiments involve several processes in series, it becomes both prohibitively expensive and difficult to use a factorial design due to the complete randomization requirements of all treatments. In this paper, an efficient-modified split plot design concept is proposed and then applied to the four-stage production process of nano-enabled zirconia parts for surgical instrument.

4 - Mixture-process Experiments Within a Split-plot Structure
Connie Borror, Associate Professor, Arizona State University West, 4506 W. Kaler Circle, Glendale, AZ, United States, conni@asu.edu

Mixture experiments involve factors that are components of a mixture or ingredients. The levels of the mixture components cannot be set independently of one other. Process variables are factors whose levels can be set independently of one another. In some experimental situations, mixture components may be affected by changes in the process variables. Analysis of mixture-process experiments when some process variable levels are hard to change (producing a split-plot structure) will be discussed.

■ TB32

C-Room 302

Vehicle Routing II

Contributed Session

Chair: Renato Werneck, Researcher, Microsoft Research Silicon Valley, 1065 La Avenida, Mountain View, CA, 94043, United States, renatow@microsoft.com

1 - A Guided Local Search Procedure for the Multi-compartment Vehicle Routing Problem
Luc Muyldermans, Dr, Nottingham University, Business School, Jubilee Campus, Wollaton Road, Nottingham, NG8 1BB, United Kingdom, luc.muyldermans@nottingham.ac.uk, Gu Pang

The multi-compartment vehicle routing problem involves clients with a demand for different products and multi-compartment vehicles to co-transport these commodities. We present a local search procedure that exploits well-known moves (2-opt, cross, exchange, relocate) and uses neighbour lists and vertex marking to speed up the searches. We report on extensive computational results to uncover when co-distribution is better than separate distribution.

2 - Mixed Integer Programs for Fuel Optimal En Route Conflict Resolution
Adan Vela, Georgia Institute of Technology, 270 Ferst Drive NW, Atlanta, GA, 30332, United States, aevela@gatech.edu, William Singhose, John-Paul Clarke, Senay Solak

We introduce two Mixed Integer Linear Program formulations for air traffic conflict resolution in a shared airspace. The first formulation allows for both aircraft heading and speed changes to ensure separation safety constraints under free flight. The second optimization formulation focuses on optimizing over jet routes within the current NAS framework. In spite of the nonlinear and nonconvex nature of the problem, each formulation presents an efficient solution to aircraft routing.

3 - Robustness in Time Dependent Vehicle Routing Problems
Ola Jabali, TUE, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, O.Gabali@tue.nl, Ton de Kok, Tom van Woensel

Vehicle routing problems have been studied mainly in a static environment, assuming travel times are constant during the day. We work with a time dependent setting of the problem, where the stochastic dimension of travel time is incorporated by a queuing model. We investigate solution robustness by randomly inserting perturbations into routes. We exhibit the added value in terms of immunity to uncertainty. This is tested on a variety of problems with a range of customers and road conditions.

4 - Latency Problems with Profits
Sofie Coene, PhD-Student, KULeuven, Naamsestraat 69, Leuven, 3000, Belgium, sofiecoene@econ.kuleuven.be, Frits Spieksma

In the latency problem with profits, a server and a set of clients, each with corresponding profit pi, are given. When visiting a client, the server receives a revenue of pi-t, with t the time at which the server reaches client i. The goal is to find a route for the server such that total collected revenue is maximized. We establish complexity of this problem and some related problems.

5 - Reach for A*: Fast Driving Directions on Road Networks
Renato Werneck, Researcher, Microsoft Research Silicon Valley, 1065 La Avenida, Mountain View, CA, 94043, United States, renatow@microsoft.com, Andrew Goldberg, Haim Kaplan

We present fast algorithms for computing exact point-to-point shortest paths (driving directions) on road networks. We use a combination of two recent techniques: reach-based pruning eliminates local intersections, while landmark-based A* search directs the search towards the goal. On the road networks of the USA and Western Europe, an average query visits no more than a thousand road intersections (out of roughly 20 million), which is four orders of magnitude better than Dijkstra's algorithm.

■ TB33

C-Room 303

Containerization Mini Cluster: Intermodal Systems

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Gene Tyworth, Professor Supply Chain Management, Penn State University, 454B Business Bldg, University Park, PA, 16802, United States, jet@psu.edu

1 - New Railroad Intermodal Systems: Models and Algorithms
Teodor Gabriel Crainic, University of Quebec in Montreal, Ecole des sciences de la gestion, C.P. 8888, succ. Centre-Ville, Montreal, QC, H3C3P8, Canada, theo@crt.umontreal.ca

Railroads face the challenge of providing high quality service at relatively low cost while generating an adequate level of profit. Within the intermodal transportation context, railroads are responding by proposing innovative operating policies. We discuss some of these systems and issues and present models and algorithms aimed at planning services, schedules, and the management of the fleet.

2 - Port and Modal Allocation of Waterborne Containerized Imports from Asia to the United States
Rob Leachman, Professor, UC Berkeley, Dept. of Indus Eng & Oper Res, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, leachman@ieor.berkeley.edu

This economic optimization model allocates imports to alternative ports and logistics channels so as to minimize total transportation and inventory costs for each importer. Logistics channels include direct shipment of marine containers as well as warehousing and trans-loading in the hinterlands of the ports of entry. The model has been applied by West Coast policymakers to predict changes in container flows resulting from potential infrastructure improvements and user fees.

3 - Modeling Diversion From Truck to Rail Intermodal Service
Gene Tyworth, Professor Supply Chain Management, Penn State University, 454B Business Bldg, University Park, PA, 16802, United States, jet@psu.edu

The U.S. DOT developed the Intermodal Transportation and Inventory Model (ITIC) for policy analysis concerning long-haul freight traffic in its Comprehensive Truck Size and Weight Study submitted to Congress in 2000. A recently released version for estimating potential truck diversion to rail intermodal service is critically reviewed.

4 - Maritime Repositioning of Empty Containers Under Uncertainty and Data Shortage
Massimo Di Francesco, University of Cagliary, University of Cagliary, Cagliari, NA, Italy, mdifrance@unica.it, Teodor Gabriel Crainic, Paola Zuddas

We study a maritime empty container repositioning problem where distances are short, some port terminals do not offer holding space for empty container, and information becomes available close to decision time. Decisions are thus taken based on limited and unreliable data. We present a time-dependent optimization model where uncertainty is represented through expert-based scenarios and discuss results.

■ TB34

C-Room 304

Advances in Dynamic Traffic Network Methodologies

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Satish Ukkusuri, Assistant Professor, Rensselaer Polytechnic Institute, 4032 JEC, Troy, NY, 12180, United States, ukkuss@rpi.edu

1 - The Development and Field Testing of Freeway Point-to-point Travel Time Prediction Model
Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. 2nd St., Tucson, AZ, United States, chiu@email.arizona.edu, Brenda Bustillos

In this talk, we present the development and field testing of an N-Curve-based approach for freeway point-to-pint travel time prediction. The main modeling challenges including the consideration of on and off ramps and the prediction accuracy under a variety of traffic congestion levels will discussed. Field testing was conducted using data collected from 10 RTMS detector data on a 7-mile long highway segment.

2 - Complementarity Formulations for Dynamic Equilibrium in Single Bottleneck Models
Gitakrishnan Ramadurai, PhD Student, Rensselaer Polytechnic Institute, JEC 4002 Dept.. of Civil and Env Engg., 110, 8th Street, Troy, NY, 12180, United States, ramadg@rpi.edu, Satish Ukkusuri, Jong-Shi Pang, Jinye Zhao

Past studies have enriched our understanding of dynamic equilibrium in single bottleneck models significantly. However, none of them provide a rigorous game theoretic basis. Such a basis allows us to characterize theoretical results on equilibrium existence, uniqueness, and stability and provides new computational algorithms for computing equilibrium solutions efficiently. In this talk, we present complementarity formulations for the single and multiple user class single bottleneck models.

3 - A Simple Mathematical Formulation for Maximum Coverage Routing Without Cycles
Srinivas Peeta, Professor, Purdue University, Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, peeta@purdue.edu, Georgios Kalafatas

In a maximum coverage problem, cyclical routes are mostly meaningless or unwanted, depending on the physical interpretation of the routing scheme. In the context of the reinforcement of a seismically prone network for minimum cost and maximum coverage routing of emergency responders, a typical set of constraints for handling the unwanted cycles explode the problem size. We propose a significantly smaller set of constraints for handling the unwanted cycles based on a simple graph concept.

4 - Online DTA and Anticipatory Pricing for Real-time Traffic Management
Hani Mahmassani, Professor, The University of Maryland at College Park, Department of Civil & Environmental Engi, College Park, MD, 20742-3021, United States, masmah@umd.edu, Chung-Cheng Lu, Sevgi Erdogan, Jing Dong

To avoid breakdown on managed lanes, we show how to set anticipatory prices on the basis of short-term predictions generated by an on-line DTA-based traffic estimation and prediction system. The effectiveness of the approach is illustrated using the Washington-Baltimore corridor network.

■ TB35

C-Room 305

Models and Algorithms for Aircraft Routing

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Johannes Royset, Assistant Professor, Naval Postgraduate School, Operations Research Department, Monterey, CA, 93943, United States, joroyset@nps.edu

1 - Anisotropic Shortest-path for Aircraft Routing
Joao Hespanha, Professor, University California, Santa Barbara, Frank Harold Hall, room 5157, Santa Barbara, CA, 93106, United States, hespanha@ece.ucsb.edu, James Riehl

This talk addresses the weighted anisotropic shortest-path problem on a continuous domain. The cost-weighting depends both on the instantaneous position and direction of motion. We propose an algorithm for the computation of shortest-path that reduces the problem to an optimization over a finite graph. This methodology is applied to the computation of paths for aircraft that minimize the risk of being destroyed by ground defenses.

2 - Priority-based Assignment and Routing of a Fleet of Unmanned Combat Aerial Vehicles
Rakesh Nagi, Professor and Chair, University at Buffalo, 438 Bell Hall, Department of Industrial and Systems Eng, Buffalo, NY, 14260, United States, nagi@buffalo.edu, Vijay Shetty, Moises Sudit

The strategic routing of a fleet of Unmanned Combat Aerial Vehicles (UCAVs) to service a set of predetermined targets from a prior surveillance mission is considered. Targets are characterized by their priority level and min/max service levels, and payload capacities of UCAVs and the range have to be respected. A Tabu Search Heuristic is developed to coordinate two problems: A target assignment problem and a vehicle routing problem, which in turn splits into multiple decision TSPs.

3 - Aircraft Routing Under the Risk of Detection
Michael Zabarankin, Assistant Professor, Stevens Instiute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Michael.Zabarankin@stevens.edu

The deterministic problem for finding an aircraft's optimal risk trajectory under the risk of detection by radars or similar sensors has been formulated. The model considers an aircraft's trajectory in 3D space and represents the aircraft by a symmetrical ellipsoid with the axis of symmetry directing the trajectory. Analytical and discrete optimization approaches for routing an aircraft with variable radar cross-section subject to a constraint on the trajectory length have been developed.

4 - Pathfinding Problems with Uncertainty
Hiroyuki Sato, PhD Candidate, Naval Postgraduate School, Operations Research Department, Monterey, CA, 93940, United States, hsato@nps.edu, Johannes Royset

We study pathfinding problems where objective and constraint functions are subject to uncertainty. The vehicle traveling along the path may also be subject to attrition. Our solution approach is based on Lagrangian relaxation and a specialized branch-and-bound technique. We illustrate our approach with several examples from military route planning.

■ TB37

C-Room 307

Defense Logistics Analysis

Sponsor: Military Applications
Sponsored Session

Chair: Alan Johnson, Associate Prof of Logistics, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, W-P AFB, OH, 45433-7765, United States, alan.johnson@afit.edu

1 - Peak Policy for Reparable Parts
Carol DeZwarte, Logistics Management Institute, 2000 Corporate Ridge, McLean VA 22102-7805, United States of America, cdezwarte@lmi.org, Tovey Bachman

Some repair parts with sporadic demand are vital to maintaining weapon systems, but their demand uncertainty makes buy and repair decisions hard. Our Peak Policy for buying consumable parts reduces wholesale delay 20 to 50% for a given inventory investment. We now extend Peak Policy to reparable items with sporadic demand. We discuss the challenges, show how we adapted the Peak Policy to improve support for these items, and conclude with management insights. Peak Policy is a trademark of LMI.

2 - Supporting Navy Forward Stock Positioning Using an Optimization Heuristic Approach
Norman Reitter, Director, Operations Research, CTC, 100 CTC Drive, Johnstown, PA, 15904, United States, reittern@ctc.com, Walt DeGrange

The Navy Operational Logistics Support Center coordinates multi-modal shipment policies that directly impact readiness of deployed Naval forces. In this paper, we show a method for the NOLSC to determine the best mix of products to forward position in Combatant Commander Areas of Responsibility. This presentation will introduce the audience to the Navy's forward stocking problem, a multi-objective solution technique, and initial results.

3 - Modeling Predator UAV Operations
Alan Johnson, Associate Prof of Logistics, Air Force Institute of Technology, AFIT/ENS, 2950 Hobson Way, Bldg 641, W-P AFB, OH, 45433-7765, United States, alan.johnson@afit.edu, Michael Kretser

Operation Iraqi Freedom accelerated the Predator Unmanned Aerial Vehicle's transition from development to operations, which precluded normal testing and capabilities refinement before use. As such, the interrelationships of Predator vehicle, logistics support, and ground control system componentry are not well understood. We present our progress and plans for simulating Predator flight operations and ground regeneration activities.

4 - Using Decision Analysis Modeling to Improve Navy Infrastructure Planning
Ronald (Fred) Woodaman, Principal Operations Research Specialist, CTC, 17 Planters Place, Stafford, VA, 22554, United States, woodamar@ctc.com, Norman Reitter, Lisa Moss

The Navy is focused on improving the efficiency of its shore infrastructure, facilities, and services. We describe efforts to improve Base Support Vehicle and Equipment (BSV&E) fueling operation and management. This capability is not operated and managed at an enterprise level, with a patchwork of providers, reporting and accounting practices, regional and national stakeholders. The authors describe how decision analysis methods were used to illuminate a path forward.

■ TB38

C-Room 308

Game Theory

Contributed Session

Chair: Bill Corley, Professor, IMSE Dept., The University of Texas at Arlington, Box 19017, Arlington, TX, 76019, United States, corley@uta.edu

1 - False-name-proofness in Social Choice, and Limited Verification of Identities
Vincent Conitzer, Assistant Professor, Duke University, LSRC, Box 90129, Duke University, Durham, NC, 27708, United States, conitzer@cs.duke.edu

A mechanism is false-name-proof if no agent can benefit from using multiple identifiers (e.g. e-mail addresses). We show that the best false-name-proof voting rule satisfying participation is to draw two alternatives at random; if all votes prefer the same one, choose that one, otherwise flip a coin. To address this and other impossibility results, we show how to verify the identities of some agents so that the mechanism and the verification protocol together are false-name-proof.

2 - Totally Monotonic Games and Flow Games
Jayavel Sounderpandian, University of Wisconsin-Parkside, 900 Wood Road, Kenosha, WI, 53144, United States, sounderp@uwp.edu

Equivalence between totally balanced games and flow games is well known. In this paper, equivalence between totally monotonic games and flow games is demonstrated. The result can be potentially applied to supply chain partner selection problems. The flow games constructed in this paper have fewer branches than those constructed for comparable totally balanced games.

3 - The Birthday Celebration Selection Process Problem
Xiaoning Shi, University of Hamburg (IWI), Institute of Information Systems, Von-Melle-Park 5, Hamburg, 20146, Germany, shi@econ.uni-hamburg.de, Stefan Voss

Sometimes a birthday party might be influenced by various serious side constraints and conflicting interests. For instance, should one attend an INFORMS conference or stay at home for the celebration? And if several parties arise, which one to choose if any? Proper problem formulations are given and some game theoretical approaches to provide decision support are presented.

4 - A Study of Collaboration and Competition Among Humanitarian Relief Organizations
Clarence Wardell III, Georgia Institute of Technology, 238 Walker St. #26, Atlanta, GA, 30313, United States, cwardell@isye.gatech.edu

Since the end of the Cold War competition among humanitarian relief organizations has increased rapidly, often times compromising primary relief objectives. We examine this notion of sub-optimality in relief work through simulation design and game theoretical analysis. The impetus behind organizational reluctance to collaborate is examined, along with the exploration of policies which may improve primary objective results.

5 - A New, Non-Nash Equilibrium for Noncooperative Games
Bill Corley, Professor, IMSE Dept., The University of Texas at Arlington, Box 19017, Arlington, TX, 76019, United States, corley@uta.edu, Phantipa Insuwan

A new equilibrium embodying an intrinsic cooperative aspect is presented for noncooperative games. It addresses some well-known issues in game theory. For example, in contrast to the Nash equilibrium, it provides a one-time solution for Prisoner's Dilemma agreeing with long-run experiments. Existence of the new equilibrium is established, its implications are discussed, and some examples are presented.

■ TB39

C-Room 309

The Congested Emergency Department

Sponsor: Health Applications Section
Sponsored Session

Chair: Murray Côté, Associate Professor, UCDHSC, Health Care Policy and Research, Department of Medicine, Aurora, CO, 80045, United States, murray.cote@uchsc.edu

1 - Emergency Department Congestion - A Physician's Viewpoint
Dave Eitel, York Hospital, Emergency Medicine, YH-1001 S. George St., York, PA, 17403, United States, daveitel@comcast.net

Across the US, many patients who have been worked up and admitted to hospitals often have to remain in the Emergency Department for as long as 24 hours or longer on gurneys in ED hallways waiting for an available hospital bed. Unfortunately, this problem is worsening. As a practicing ED physician, I will share my perspective on how and why the ED has become a challenge to manage and provide insight into how we may improve the delivery of care in the ED and throughout the hospital setting.

2 - Forecasting the Demand for Emergency Department Services
Murray Côté, Associate Professor, UCDHSC, Health Care Policy and Research, Department of Medicine, Aurora, CO, 80045, United States, murray.cote@uchsc.edu, Dave Eitel, Elif Akcali

The first step in understanding why emergency departments become congested is an examination of the demand for services. Using hourly arrival data to an emergency department in Pennsylvania, we develop a set of forecasting models to show health care decision makers how this hourly demand translates into operational, tactical, and strategic capacity issues.

3 - Flow Matters: Improving Saskatchewan Emergency Departments
Keith Willoughby, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, kwilloughby@hqc.sk.ca, Ben Chan

Emergency Departments (ED) are an important hub in our health care system. Data gathering in five major hospitals revealed typical lengths of stay of nearly 5 hours. Waiting for an inpatient bed – for those patients admitted through the ED – took 211 minutes. Specialist consult waits took 112 minutes. Using these findings and such tools as simulation modeling, quality improvement science and lean system analysis, we are working with health care professionals to alleviate flow problems.

■ TB40

C-Room 310

OR in Public Health

Sponsor: Health Applications Section
Sponsored Session

Chair: Arielle Lasry, CDC, 1600 Clifton Rd, MS-E48, Atlanta, GA, 30333, United States, alasry@cdc.gov

1 - Dynamic Models, Infectious Diseases and Operations Research
Ping Yan, Manager, Modelling and Projection, Public Health Agency of Canada, Building 6, AL0602B, Tunney's Pasture, Ottawa, ON, K1A0K9, Canada, Ping_Yan@phac-aspc.gc.ca, Fan Zhang

Models on transmission of infectious diseases are growing in quantity, complexity and variety. Strategies are aimed at reducing: (1) the initial growth of the epidemic curve; (2) the peak burden by altering the shape of the curve; (3) the final outbreak size as the area under the curve. These goals can be weighted to formulate specific objectives. Control measures are challenged by constraints. By synthesizing, we show the interplay between mathematical epidemiology and operations research.

2 - A Model to Estimate the Effects of Behavioral Change and Subsequent Relapse in HIV Prevention

Stephen Sorensen, Operations Research Analyst, Centers for Disease Control, 1600 Clifton Road, Mail Stop E48, Atlanta, GA, 30333, United States, ssorensen@cdc.gov, Stephanie Sansom L

Many interventions for HIV prevention apply behavioral modification programs to promote barrier protection with condoms. We constructed a dynamic model to estimate the long-term effects of these behavioral modification programs. We included an estimate of long-term benefits even when behavioral relapse occurs after the end of the program.

3 - Evaluating Pediatric Access to Proton Therapy Using Discrete Event Simulation

Lauren Cipriano, Research Scientist, Institute for Technology Assessment, 101 Merrimac Street, 10th floor, Boston, MA, 02114, United States, Lauren@mgh-ita.org, Paul Nguyen, James Stahl

Proton beam radiation has proven a useful therapy for treating rare diseases such as sarcomas, eye tumors, and select head and neck and pediatric cancers. There is growing evidence that it may also be useful for treating more common cancers such as those of the prostate. We consider the potential demand from pediatric cancer patients in New England. We present a discrete event simulation for evaluating access to this limited medical resource.

4 - Optimal Investment in HIV Prevention Programs

Arielle Lasry, CDC, 1600 Clifton Rd, MS-E48, Atlanta, GA, 30333, United States, alasry@cdc.gov, Stephanie Sansom L, Katherine A Hicks

We evaluate the optimal allocation of HIV prevention funds to three high prevalence core populations and to the general adult population in the US. We allocate an annual budget to three targeted prevention interventions and two broad prevention interventions. Results suggest that targeting high prevalence core groups is not necessarily optimal when prevalence across core groups differs widely and the outreach effort associated with targeted interventions is costly.

■ TB41

C-Room 3A

Operations Research in Nurse Planning

Sponsor: Health Applications Section
Sponsored Session

Chair: Durai Sundaramoorthi, The University of Texas at Arlington, Campus Box 19017, Arlington, TX, 76019-0017, United States, dxs7400@omega.uta.edu

1 - A Stochastic Programming Approach for Integrated Nurse Staffing and Assignment

Prattana Punnakitikashem, PhD Candidate, Department of Industrial Engineering, The University of Texas at Arlington, Campus Box 19017, Arlington, TX, 76019-0017, United States, prattana_p@yahoo.com, Jay Rosenberger, Deborah Behan

We develop a new stochastic programming model that integrates short-term nurse staffing and nurse-to-patient assignment under patient care uncertainty with an objective to minimize excess workload on nurses. Three solution approaches are presented to solve the problem, which are Benders' decomposition, Benders' decomposition with Lagrangian relaxation, and nested decomposition. Computational results are provided based upon real data from the Baylor Regional Medical Center Grapevine, Texas.

2 - A Lagrangian-based Procedure for Cyclic Nurse Scheduling

Jonathan Bard, Professor, The University of Texas, 1 University Station C2200, Mechanical Engineering, Austin, TX, 78712-0292, United States, jbard@mail.utexas.edu, Hadi Purnomo

This talk addresses the problem of developing cyclic schedules for nurses while taking into account individual preferences. An integer programming formulation is given and then decomposed using Lagrangian relaxation. After the Lagrangian dual was solved, there was no clear way to perform branch and bound so a variable fixing scheme was introduced to improve the results. The full algorithm was tested on instances with up to 100 nurses and 20 rotational profiles.

3 - A Data-integrated Nurse-patient Assignment Simulation: Development and Validation

Durai Sundaramoorthi, The University of Texas at Arlington, Campus Box 19017, Arlington, TX, 76019-0017, United States, dxs7400@omega.uta.edu, Jay Rosenberger, Victoria Chen, Seoung Bum Kim

This research develops and validates a novel data-integrated simulation to evaluate nurse-patient assignments (SIMNA) based on a real data set provided by Baylor Regional Medical Center (Baylor) in Grapevine, Texas. Data mining methods were utilized to extract important knowledge from the data for the simulation. A simulation-based optimization technique was developed to assign the incoming patient during a given shift.

4 - Joint Bed Capacity Planning and Nurse Staffing in Medical Units

Francis de Vericourt, Professor, European School of Management and Technology, devericourt@esmt.org, Otis Jennings

Using many-server queuing models, we jointly determine the number of nurses and beds in hospital units to guaranty specified levels of quality of care and bed availability. In our system patients arrive exogenously and, once space is available, are assigned beds. Admitted patients may become needy and require a nurse to restore them to a content state. Content patients either become needy again or are discharged.

■ TB42

C-Room 3B

Healthcare Delivery

Contributed Session

Chair: Michelle Cowing, Associate Professor, Pacific University, Department of Business, 2043 College Way, Forest Grove, OR, 97116, United States, cowing@pacificu.edu

1 - Reducing Patient Waiting Time in a Health Evaluation Center Using the Six Sigma Method

Hsueh-Ming Wang, Assistant Professor, University of Alaska, 3211 Providence Dr., Anchorage, AK, 99508-4614, United States, hsuehmingwang@yahoo.com

An empirical case for re-engineering in a medical center is illustrated. We collected data of the period for each station, identified the key factors, simulated the model by different scenarios through utilizing Design for Six Sigma method, and analyzed alternatives to improve the process and proposed a method for the new capable process. The results show that the health evaluation center reduced its patients' waiting time and total cycle time by about 56% and 40% respectively.

2 - Social Network and Technology Adoption: A Study in Ambulatory Healthcare

Rema Padman, Professor, Carnegie Mellon University, The Heinz School, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, rpadman@cmu.edu, David Krackhardt, Herbert Diamond, Kai Zheng, Michael Johnson

This research applies social network analysis to study point-of-care technology adoption by clinicians. The empirical study was conducted in an ambulatory, primary care clinic where clinicians used an evidence-based decision support system to treat patients. Strong evidence of interpersonal influence is found in the structural equivalence of friendship network.

3 - Modeling the Trade-offs in Defining the Role of Family Doctors

Evrim Didem Gunes, Assistant Professor, Koc University, Rumeli Feneri Yolu, Istanbul, 34450, Turkey, egunes@ku.edu.tr

Motivated from the family medicine practice, this work focuses on the job definition of family doctors, and its effects on the larger health care system as well as the health of the population. We present a general model of a two-tier service system, where the job definition of the first tier influences the arrival rate to the second tier service provider via direct referrals and by influencing the future demand patterns, and investigate the optimum portfolio of services at the first tier.

4 - Innovation and Corporate Responsibility: A Portuguese University Hospital Case

Maria Veludo, Assistant Professor, Bordeaux Business School, Domaine de raba, 680 Cours de la Liberat, Talence, 33 405, France, maria.veludo@bordeaux-bs.edu, Satyaveer Chauhan, Paulo Kuteev Moreira

This study intends to describe the nature of an organisational innovation occurred in a Portuguese University Hospital. The study explores the changes introduced in resources management in a Portuguese University Hospital through the critical analysis of its value chain as a dimension of a change management approach and its potential impact on organisational values.

5 - Patient Satisfaction and Health Care Delivery: Service, Quality and Outcomes

Michelle Cowing, Associate Professor, Pacific University, Department of Business, 2043 College Way, Forest Grove, OR, 97116, United States, cowing@pacificu.edu, Carrie Davino-Ramaya, Joseph Szmerekovsky, Krishnan Ramaya

As competition intensifies within the healthcare industry, patient satisfaction and service quality are providing the evidence basis for patient outcomes. We propose a conceptual model of three inter-related areas: service; quality; resource stewardship; all converging on the clinician-member relationship and its impact on patient outcome. Critical aspects of these relationships are tested using survey data. Research and managerial aspects including implementation are discussed.

■ TB43

S-Grand Ball. A (Lev. 2)

Panel Discussion: Internships, Co-ops and Student Projects: How Can You Get Real World Experience Before Leaving the Graduate School Womb?

Sponsor: CPMS, The Practice Section of INFORMS
Sponsored Session

Chair: Stephen Strauss, PTSM, AT&T Labs, 180 Park Avenue, Building 103 Room A009, Florham Park, NJ, 07932-1003, United States, sstrauss@att.com

1 - Internships, Co-ops and Student Projects: How Can You Get Real World Experience before Leaving the Graduate School Womb?

Moderator: Stephen Strauss, PTSM, AT&T Labs, 180 Park Avenue, Building 103 Room A009, Florham Park, NJ, 07932-1003, United States, sstrauss@att.com, Panelist: Peter Norden, Jeff Camm, Jeffrey Alden, Michael Grant, Hena Bar

There are multiple benefits for getting real world experience before leaving graduate school. They include getting experience for your resume, sources for thesis and/or dissertation topics, help finding a job and information gathering for career decisions. Come and find out more.

■ TB44

S-Grand Ball. B (Lev. 2)

Pedagogical Research: How to Get Started

Sponsor: INFORM-ED
Sponsored Session

Chair: Donna Llewellyn, Director, Georgia Tech, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@cetl.gatech.edu

1 - Pedagogical Research – How to Get Started

Donna Llewellyn, Director, Georgia Tech, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@cetl.gatech.edu

This will be an interactive session devoted to how to get started doing your own educational research project. What are the basic steps, who can help you along the way, and what are your goals? We will talk about where some common pitfalls occur, and how to avoid them. And we will discuss some of the common techniques used in educational research. This is the second in a series of four sessions at this conference on pedagogical research. Feel free to come even if you missed the first one!

■ TB45

S-Capitol Hill (Lev. 3)

Market Risk and Credit Risk

Cluster: Financial Engineering
Invited Session

Chair: Vadim Linetsky, Professor, Northwestern University, Industrial Eng and Management Sciences, 2145 Sheridan Rd, Evanston, IL, 60202, United States, linetsky@iems.northwestern.edu

1 - What Is a Good External Risk Measure?

Steven Kou, Columbia University, 312 Mudd Building, Dept.. of IEOR, 500 West 120th Street, New York, NY, 10027, United States, sk75@columbia.edu, Chris Heyde, Xianhua Peng

Instead of the coherent risk measure, which assumes subadditivity, we propose a data-based external risk measure, called natural risk statistic, that is characterized by a new set of axioms based on subadditivity only for comonotonic random variables, which is consistent with the prospect theory in psychology. The natural risk statistic includes the VaR as a special case and therefore shows that VaR, though simple, is not irrational.

2 - Time Changed Markov Processes in Credit-equity Modeling

Vadim Linetsky, Professor, Northwestern University, Industrial Eng and Management Sciences, 2145 Sheridan Rd, Evanston, IL, 60202, United States, linetsky@iems.northwestern.edu

The procedure of time changing a stochastic process allows one to construct new processes from a given process by running it on a new clock that can itself be a non-decreasing stochastic process. Using time changes, we build a new class of analytically tractable credit-equity models that incorporate stochastic volatility, state-dependent jumps, and state-dependent default intensities.

3 - Dealing with Supplier Bankruptcy: Costs and Benefits of Financial Subsidies

Volodymyr Babich, Assistant Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States, babich@umich.edu

Using a firm-value model for the supplier's bankruptcy and a dynamic, stochastic, periodic-review model for the manufacturer's joint capacity reservation and financial subsidies decisions, we quantify the benefits the manufacturer derives by subsidizing the supplier. We provide general conditions under which the manufacturer can make capacity decisions independently from subsidy decisions and prove that the optimal subsidy policy has the subsidize-up-to structure.

4 - Aircraft Leasing with Credit Risk

Vadim Linetsky, Professor, Northwestern University, Industrial Eng and Management Sciences, 2145 Sheridan Rd, Evanston, IL, 60202, United States, linetsky@iems.northwestern.edu

Aircraft sales require long-term financing, such as leasing. If a customer defaults on its lease, the manufacturer will have to resell the used aircraft in the secondary market. The manufacturer is thus exposed to the risk of declining prices for used equipment, as well as credit risk. The manufacturer is also exposed to the interest rate risk. We develop a three-factor model to value and risk manage aircraft leases subject to credit, asset, and interest rate risk.

■ TB46

S-Ballard (Lev. 3)

Energy Models and Methods

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Steve Gabriel, Associate Professor, University of Maryland, 1143 Martin Hall, Dept.. of Civil & Env. Eng., College Park, MD, 20742, United States, sgabriel@umd.edu

1 - A Benders Decomposition Method for Discretely-constrained MPECs in Energy Planning

Steve Gabriel, Associate Professor, University of Maryland, 1143 Martin Hall, Dept.. of Civil & Env. Eng., College Park, MD, 20742, United States, sgabriel@umd.edu, Antonio J. Conejo, Yohan Shim, Raquel Garcia-Bertrand, Sebastian de la Torre

We present a new method to solve discretely-constrained mathematical programs with equilibrium constraints (DC-MPECs) where the upper-level problems have integer variables. These sorts of problems are important in energy and other critical infrastructure planning and we highlight some applications as well as demonstrate the new methodology.

2 - Dantzig-Wolfe-Jacobi Decomposition of Equilibrium Models: Algorithm, and Formulation Aid

David Fuller, Professor, Univesity of Waterloo, Dept.. of Management Science, Waterloo, On, N2L3G1, Canada, dfuller@engmail.uwaterloo.ca

Equilibrium models contain submodels linked by constraints and by the influence of one submodel's variables on another submodel's function values, e.g., competitive multicommodity models, and Nash-Cournot models. Dantzig-Wolfe decomposition relaxes linking constraints, and the Jacobi idea fixes other variables in functions, to produce optimization subproblems and an equilibrium master problem. In addition to potential computational efficiencies, decomposition can help in model formulation.

3 - Bidding Strategies for Generators in Electricity Markets Using an Endogenous Treatment of Prices

Sebastian de la Torre, Assistant Professor, Universidad de Málaga, Departamento de Tecnologìa Electrònica, Universidad de Málaga, Màlaga, 29071, Spain, storre@uma.es, Antonio J. Conejo, Steve Gabriel, Yohan Shim, Raquel Garcia-Bertrand

To maximize their profits, generators need to derive bidding strategies to participate in electricity markets. This presentation describes a procedure to derive such strategies for the day-ahead market, treating the clearing price as an endogenous variable. The proposed modeling results in a three-level mathematical programming problem; it is attacked using a novel Benders-based algorithm that considers the non-convexity of the problem. Market clearing is represented using KKT conditions.

4 - Dynamic Modeling of Network Expansion – The Case of European Natural Gas Infrastructure

Franziska Holz, DIW Berlin, Mohrenstr. 58, Berlin, 10117, Germany, fholz@diw.de

We develop a complementarity model of the European natural gas market and network, with a two-stage structure of successive imports and wholesale trade that use the same pipeline network in Europe. Each country is taken as one node, and there are aggregated pipeline and LNG links between the countries. The gas flows along arcs in a directed graph that is integrated in the market players' problem. We then introduce investments in the constrained transport links, with a NPV optimization approach.

■ TB47

S-Admiral (Lev. 3)

OR Models in Agricultural Planning

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: J Rene Villalobos, Associate Professor, Arizona State University, Department of Industrial Engineering, Arizona State University, Tempe, AZ, 85281, United States, rene.villalobos@asu.edu

1 - Development of Planning Tools for the Supply Chain of Fresh Produce

Omar Ahumada, Research Associate, ASU, Dept.. of Industrial Eng., P.O. Box 1906, Tempe, AZ, 85202, United States, omar.ahumada@asu.edu, J Rene Villalobos

We discuss an analytical planning tool for the fresh produce industry that will use relevant information to render a plan for growing, harvesting and distributing the products in an agricultural cycle. The objectives is to help the farmer make decisions based on traditional factors such historical price information and resource availability, but also on those factors that are usually not considered by the farmers such as price dynamics, transportation and inventory costs.

2 - Harvest Risk: An Introduction to Quantitative Modeling and Optimization in Agriculture

Edmund Schuster, MIT, edmund_w@mit.edu

Since the dawn of agriculture about 12,000 years ago, farmers have dealt with several categories of risk in producing the food needed to sustain their lives and to build urban centers of industry and learning. In this presentation, we examine quantitative methods for modeling the risk associated with the harvest of Concord grapes. The technique involves a real-world problem in capacity planning and was implemented at a large agricultural cooperative.

3 - Economic Hysteresis and Hydroponic Investments in Agriculture

Timothy Richards, Arizona State University, trichards@asu.edu, Ram Acharya

Rising fuel prices cause higher prices for fresh produce on the U.S. East Coast. At some point, investing in local hydroponic production will become viable. Fuel price volatility creates a significant embedded real option value. This paper estimates the resulting hysteretic effect and develops a real-option investment-evaluation model. The real option value is nearly 25% of the investment amount, so fuel prices will have to rise further to make investments worthwhile.

4 - Design of a Logistics Platform for the Distribution of Fresh Produce

Octavio Sanchez, Research Assistant, Arizona State University, Dept.. of Industrial Eng., Tempe, az, 85287, United States, octavio.sanchez@asu.edu, J Rene Villalobos

In this presentation we discuss a case study of the design of a single logistics platform for fresh produce that has as its main objective the maximization of revenues of the farmer. One of the design factors to be discussed is the location of the platform in such a way that the most revenue can be realized subject to maximal driving constraints.

■ TB48

S-Fremont (Lev. 3)

Stochastic Processes/Optimization I

Contributed Session

Chair: Luz Sotomayor, University of Alberta, 632 Central Academic Building, University of Alberta, Edmonton, AB, T6G2G1, Canada, rsotomayor@math.ualberta.ca

1 - A Knowledge Gradient Policy for Sequential Bayesian Ranking and Selection

Warren Powell, Professor, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, powell@princeton.edu, Savas Dayanik, Peter Frazier

We propose a new sequential Bayesian ranking and selection procedure, the knowledge-gradient policy, for determining the best of a discrete set of noisy options subject to a constraint on the number of samples taken. The Bayesian prior is assumed to have a normal distribution with independent components. The knowledge-gradient policy is provably optimal in several cases, has bounded sub-optimality in general, and compares well experimentally with other information-collection algorithms.

2 - On the Form of Dependence of a Completely Randomized Infinite-Variance Stationary Sequence

Joshua Levy, The University of Texas of the Permian Basin, 4901 E. University Blvd., Odessa, TX, 79762, United States, levy_j@utpb.edu

A complete random permutation (CRP) is uniformly distributed on a finite set of integers. When the variances are infinite, the covariation or codifference - suitable alternatives to the covariance - are equalized after a CRP is applied. We use these measures to examine the dependence structure of a completely randomized stationary sequence of alpha-stable variables as the length of the sequence increases. This partially extends work by Zhou and Taqqu (2005) in the finite-variance case.

3 - Blood Glucose Regulation with Stochastic Optimal Control for Insulin Dependent Diabetic Patients

Saadet Ulas Acikgoz, Research Assistant, Univ of Illinois at Chicago, Dept. of Bioeng & Vishwamitra Research Institute, 851 S Morgan St., Science and Engineering Offices, Chicago, IL, United States, saadetulas@gmail.com, Urmila Diwekar

A novel methodology is developed based on stochastic processes and stochastic optimal control originating from finance literature to model the time-dependent uncertainties in diabetic patient parameters to compute optimal insulin delivery profiles. The results show that the stochastic profile results in fewer variations in blood glucose from the reference value. This method can potentially be useful in reducing the wide swings of blood glucose and preventing possible complications of diabetes.

4 - Capacity Rationing in Stochastic Rental Systems with Advance Demand Information

Felix Papier, Department of Supply Chain Management and Management Science, University of Cologne, Albertus-Magnus-Platz, Koeln, 50923, Germany, felix.papier@uni-koeln.de, Ulrich Thonemann

We present a model of a stochastic rental system with two customer classes under Advance Demand Information (ADI) that was motivated by the operations of Europe's leading cargo rail company. Under ADI, customers of one class place their demand a certain time in advance. We derive a policy for allocating capacity and analyze its performance. Numerical results indicate that this policy significantly outperforms traditional admission policies of rental systems with two customer classes.

5 - Optimal Dividend Policy in the Presence of Business Cycles

Luz Sotomayor, University of Alberta, 632 Central Academic Building, University of Alberta, Edmonton, AB, T6G2G1, Canada, rsotomayor@math.ualberta.ca, Abel Cadenillas

We consider a dividend payment problem when macroeconomic conditions affect the cash reservoir of the company, which is modeled as a Brownian motion with drift modulated by an observable Markov chain representing the regimes of the economy. We study unbounded dividend rates (singular stochastic control with regime switching problem) and show that the optimal dividend policy depends strongly on macroeconomic conditions.

■ TB49

S-Greenwood (Lev. 3)

New Directions in Revenue Management and Pricing

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Ozge Sahin, Assistant Professor of OMS, Ross School of Business, University of Michigan, Ann Arbor, MI, 48109, United States, ozge@bus.umich.edu

Co-Chair: Hyun-Soo Ahn, Assistant Professor, University of Michigan, Stephen M. Ross School of Business, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109-1234, United States, hsahn@bus.umich.edu

1 - Efficient Channel Contracting in Vertically Differentiated Environments

Mehmet Sekip Altug, PhD Candidate, Columbia University, 3022 Broadway, Uris Hall 4J, New York, NY, 10027, United States, msa2104@columbia.edu, Garrett van Ryzin

We model a manufacturer that supplies high and low quality versions of a product to a retailer. In this vertically differentiated environment all consumers prefer higher quality, though they have different valuations for quality. We analyze contracts the supplier can offer to achieve channel coordination. We also analyze coordination with competing retailers.

2 - To Negotiate or Not: The Effect of Capacity
Chia-Wei Kuo, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States, cwkuo@umich.edu, Goker Aydin, Hyun-Soo Ahn

We consider a supply chain where the manufacturer has limited capacity and the retailer chooses one of two pricing regimes, posting a fixed price or negotiating, when selling to customers who are heterogeneous in their willingness-to-pay. We analyze the retailer's quantity and pricing regime decisions as well as the manufacturer's inducement of a pricing regime via the wholesale price. We show how capacity influences the manufacturer's wholesale price decision and the resultant pricing regime.

3 - Competitive Revenue Management of Perishable Assets with Multiple Predetermined Options
Ming Hu, Columbia University, mh2252@columbia.edu

We study a continuous-time revenue management model under competition. Under the assumption that the available menu of sales targets(prices) is given for Cournot competition with substitutable products(Bertrand competition with complementary products), we obtain an threshold-type optimal control policy for each player to switch sales target(price) in closed form that can be sustained as a Nash equilibrium. Such a policy can be computed in a reasonable computation effort.

4 - Category Pricing in the Presence of Reference Price Effects
Soulaymane Kachani, Professor, Columbia University, 334 Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States, kachani@ieor.columbia.edu, Attakrit Asvanunt

We examine the effects of reference prices on a firm's dynamic pricing policy. We provide closed-form solutions of optimal pricing policies for a single-product and for multiple products within the same category. We extend our results to the competitive setting and study the price of anarchy.

■ TB50

S-Issaquah A & B (Lev. 3)

Product Strategy

Cluster: New Product Development
Invited Session

Chair: Aydin Alptekinoglu, Assistant Professor, University of Florida, 358 Stuzin Hall, Gainesville, FL, 32611-7169, United States, aalp@ufl.edu

1 - Retail Assortment and Price Competition with Effect of Brand Reputation
Nan Xia, PhD Candidate, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States, Nan.Xia.2008@marshall.usc.edu, Raj Rajagopalan

We propose a modeling framework to analyze the assortment and price competition between two retailers. Our framework incorporates several important factors influencing customers' purchasing behaviors: assortment, price, firm differentiation, product substitution and brand reputation. We provide insights into equilibrium pricing and assortment decisions and analyze the effects of important factors on the equilibrium decisions.

2 - The Effect of Alignment of Product Architecture and Organization Structure on Product Performance
Jin-Kyu Park, Assitant Professor, Florida International University, Industrial & Systems Engineering, 10555 West Flagler St. / EC 3100, Miami, FL, 33174, United States, kyupark@fiu.edu, Sebastian Fixson

This research is to test the hypotheses that product architecture and firm boundary are highly interrelated and that their joint effect plays a critical role for product performance. We use a distinctive measurement of product architecture and unique research setting: the U.S. bicycle component industry from 1980 to 1992, to test the hypotheses. This study shows that only when product architecture changed from modular to integral, organizational structure is critical for product performance.

3 - Value Chain Strategy for Product Development
Korhan Gurkan, Carnegie Mellon University, Tepper School of Business, Pittsburgh, United States, kgurkan@cmu.edu

We explore whether integrating manufacturing and development activities results in more innovation and higher profits across the value chain. While competition between coordinated supply chains has recently been studied in the literature, we study competition both between disintegrated value chains with specialized firms and between integrated value chains. We also compare the performance of the two value chain structures.

4 - Product Introduction Against a Predator: A Bilevel Mixed-Integer Programming Approach
Churlzu Lim, Assistant Professor, UNC-Charlotte, 9201 University City Blvd., College of Engineering, Charlotte, NC, 28223, United States, clim2@uncc.edu, J. Cole Smith, Aydin Alptekinoglu

Consider a Stackelberg game in which two firms, a leader and a follower, sequentially determine subsets of potentially marketable products. The market is assumed to be segmented so that each segment has its own preference list. The objective is to maximize the leader's profit under the follower's predatory strategy. We formulate this problem as an integer program, propose cutting plane algorithms and heuristics, and derive insights from solutions of test instances.

■ TB51

S-Kirkland (Lev. 3)

Queueing Systems - Performance Analysis

Cluster: Queueing Models
Invited Session

Chair: Douglas Down, McMaster University, 1280 Main Street West, Hamilton, ON, Canada, downd@mcmaster.ca,

Co-Chair: Hayriye Ayhan, Georgia Tech, Stewart School of ISyE, Atlanta, GA, United States, hayhan@isye.gatech.edu

1 - A General Class of Closed Fork and Join Queues with Subexponential Service Times
Hayriye Ayhan, Georgia Tech, Stewart School of ISyE, Atlanta, GA, United States, hayhan@isye.gatech.edu, Jung-Kyung Kim

For a general class of closed fork and join queueing networks, we derive the tail asymptotics of transient cycle times and waiting times under the assumption that the service time distribution of at least one station is subexponential. We also argue that under certain conditions the asymptotic tail distributions remain the same for stationary cycle times and waiting times.

2 - Finite First Moment Conditions for the Workload Components in FIFO Multiserver Queues
Alan Scheller-Wolf, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States, awolf@andrew.cmu.edu, Rein Vesilo

We derive first moment results for all the components of the stationary workload vector in stable FIFO GI/GI/k queues (previous work has dealt only with the smallest component, delay). Our conditions incorporate the interaction between service time distribution, traffic intensity and the number of servers in the queue. Sufficient conditions for finite mean of the i'th smallest component of the workload vector depend on the relationship between the load and the actual index of the component.

3 - M/G/Infinity Polling Systems with Random Visit Times
Maria Vlasiou, Research Engineer II, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, vlasiou@gatech.edu

We study a polling system where an infinite group of servers visits a set of queues. Each of the queues is in isolation an M/G/infinity-type queue. To the best of our knowledge, this work is the first where such a polling system is analysed. We derive the queue lengths at polling instants, the sojourn time of a customer, and identify the policy that maximises the throughput per cycle. We conclude that additional information regarding the state of the system does not improve the optimal policy.

4 - Heavy Traffic Optimality of Balanced Routing
Hengqing Ye, Dept. of Logistics, Faculty of Business, Hong Kong Polytechnic University, Hong Kong, China, lgtyehq@inet.polyu.edu.hk, Hong Chen

We study a system with many parallel service stations. Upon arrival, a job is routed to the queue of a station following a balanced routing scheme: choose a few stations with specific probabilities and then send the job to the one with shortest queue. We show that this routing control is asymptotic optimal in the sense that it minimizes the workload over all time in the heavy traffic regime.

■ TB52

S-Leschi (Lev. 3)

Joint Session AI/ICS: AI Applications in Finance and OR

Sponsor: Artificial Intelligence, INFORMS Computing Society
Sponsored Session

Chair: Jackie Rees, Associate Professor of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47907, United States, jrees@purdue.edu

1 - Text Mining: Major Factors of Information Security Risks Disclosed in Financial Reports

Ta-Wei Wang, Doctoral Student, Purdue University, 403 West State Street, West Lafayette, IN, 47907, United States, wang131@purdue.edu, Jackie Rees

Our paper tries to explore the major factors of information security related risks disclosed in financial reports. From the dataset (1997-2006), we can identify the factors and the structural change of the types of information security risks disclosed in financial reports using a text mining tool. These factors can be further applied to cross-sectional analyses to examine whether financial reporting disclosures can mitigate the impact of information security incidents on business value.

2 - Bayesian Methods for Understanding Security and Privacy

Ye Chen, Sr. Scientist, Yahoo! Inc. & University of Wisconsin-Madison, 701 First Avenue, Sunnyvale, CA, 94089, United States, yechen@yahoo-inc.com

We study the security and privacy implications of personal knowledge, especially in the context of social computing. First, we present a non-parametric Bayesian model of knowledge-based authentication. Second, we propose a maximum entropy approach to selecting secure factoids of personal knowledge. Third, we report our empirical results, which are comprised of a pilot study with human subjects and a large-scale experiment with online social networking data.

3 - A Neurogenetic Approach for Optimization Problems

Anurag Agarwal, Assistant Professor, University of Florida, P.O. Box 117169, Gainesville, FL, 32611, United States, anurag.agarwal@cba.ufl.edu, Selcuk Colak, Jason Deane

We propose a hybrid metaheuristic approach for solving discrete optimization problems in which the Genetic Algorithm (GA) approach and a Neural Network (NN) approach are interleaved to provide near-optimal solutions. The GA and NN approaches have complimentary advantages and disadvantages and therefore are good candidates for hybridizing. The interleaving requires ways to interchange the coding schemes from one approach to another and we propose some ideas for such interchange.

4 - Beyond Optimization: Integrating Knowledge Representation into Intelligent Service Oriented Systems

Robin Burk, Assistant Professor, US Military Academy, D/EECS, West Point, NY, 10996, United States, robin.burk@usma.edu, Niki Goerger, Buhrman Gates, Curt Blais, Joyce Nagle, LTC Robert Kewley

The rise of service oriented software architectures and formal ontologies presents an opportunity for integration of previously standalone optimization and other models into enterprise-wide systems. This paper describes a service which links the Army's Mobility Common Operational Picture data model and ontology with a network flow optimization application, a command and control system, and a discrete event simulation to explore intelligent route finding in response to unexpected events.

■ TB53

S-Medina (Lev. 3)

Location Applications

Contributed Session

Chair: Cem Iyigun, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, iyigun@rbs.rutgers.edu

1 - Facility Location Planning for Biomass-to-liquid Fuel Producation

Magnus Froehling, Dr., Universität Karlsruhe (TH), Institute for Industrial Production (IIP), Hertzstrafle 16, Karlsruhe, D-76187, Germany, magnus.froehling@wiwi.uni-karlsruhe.de, Pierre Kerdoncuff, Otto Rentz

Second generation biofuels are a widely discussed option to reduce CO2-emissions and the dependency on scarce oil resources. Due to the low energy density of biomass long distance transports are problematic and regional concepts are needed for industrial realisations. Thus, the questions of the facility's location and the raw material supply have to be answered. We present a facility location model for this problem and give an exemplary application to the German state of Baden-Wuerttemberg.

2 - An Area to Population-mean-square-distance Compactness Measure for Electoral Redistricting Plans

Robert Enders, Principal Engineer, The MITRE Coporation, 202 Burlington Road, MS E050, Bedford, MA, 01730-1420, United States, renders@mitre.org

The ratio of district area to population mean-square distance provides a measure of compactness for a populated district. An extension of the measure to partitions, related to k-clustering under an equal population restriction, measures electoral redistricting plans. Counter-gerrymandering properties of the measure, gaming considerations, and algorithmic issues provide the motivational background for the proposed use of this compactness measure in an open redistricting competition.

3 - Probabilistic Distance Clustering

Cem Iyigun, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States, iyigun@rbs.rutgers.edu, Adi Ben-Israel

We report on a new (iterative, batch) method of probabilistic (soft) clustering that is proving fast and accurate. The method uses cluster memberships that depend on distances from cluster centers, and on the cluster sizes. The cluster sizes are known in some applications and unknowns to be estimated in other applications. The method is based on the Joint Distance Function (JDF), a weighted harmonic mean of the distances in question, that approximates the data in its lowest contours.

■ TB54

S-Queen Anne (Lev. 3)

Pricing and Auction Applications

Sponsor: Applied Probability
Sponsored Session

Chair: Zeynep Aksin, Koc University, Rumeli Feneri Yolu, Istanbul, Is, Turkey, zaksin@ku.edu.tr

1 - Monotonicity Results for a Class of Dynamic Pricing Problems in Queueing Models

Fikri Karaesmen, Koc University, Dept.. of Industrial Eng., Istanbul, TR, Turkey, fkaraesmen@ku.edu.tr, Lerzan Ormeci, Eren Cil

We present a framework to investigate the monotonicity of the optimal actions with respect to system parameters for a class of queueing-based Markov Decision Processes. We provide examples from dynamic pricing in the context of queueing and inventory-based models focusing on the monotonicity of the optimal price.

2 - Designing Service Competition among Heterogeneous Suppliers

Ehsan Elahi, University of Minnesota, Graduate Program in Industrial & Systems, Minneapolis, MN, 55455, elahi@me.umn.edu, Karen Donohue, Saif Benjaafar

We consider a setting where a buyer orchestrates a competition among a set of potential suppliers based on the service quality the suppliers provide. The fraction of demand allocated to each supplier is calculated using an allocation function. We show how the buyer can construct allocation functions to maximize the quality service received from the suppliers and induce suppliers to offer the maximum feasible service level.

3 - Joint Pricing and Ordering Decisions Under Satisfaction Guaranteed Sales

Yalcin Akcay, Koc University, Rumeli Feneri Yolu, Sariyer, Istanbul, 34450, Turkey, yakcay@ku.edu.tr, Tamer Boyaci

Satisfaction Guaranteed (SG) is a returns policy in which customers can take products that do not meet their expectations back to the seller for refund. We show that SG policy is not simply a marketing gimmick. By re-selling returned items as open-box products at discount prices, the firm can tap in the segment of more price-sensitive customers, allowing the firm to price-discriminate consumers. We develop a framework of SG sales that jointly optimizes product prices and order quantities.

4 - Competitive Newsboy Problem with Non-identical Retailers and Asymmetric Information

Evren Korpeoglu, Bilkent University, Industrial Engineering Dept., Ankara, 06800, Turkey, evrenko@bilkent.edu.tr, Alper Sen, Kemal Guler

We consider the competitive newsboy problem with two non-identical firms under asymmetric cost information. The market demand is initially allocated to two firms and the excess demand is re-allocated to the firm with remaining inventory. We examine the role of competition and private information on inventory decisions and the total inventory. When the costs of two firms have non-overlapping support, we show that the asymmetric and full information cases lead to the same total inventory.

■ TB55

S-Ravenna (Lev. 3)

Air-traveler Behavior

Sponsor: Aviation Applications
Sponsored Session

Chair: Gregory Coldren, President, Coldren Choice Consulting Ltd., 123 South Adams St., Rockville, MD, 20850, United States, gregorycoldren@yahoo.com

1 - Air-travel Passenger Time-of-day and Day-of-week Preferences
Gregory Coldren, President, Coldren Choice Consulting Ltd., 12 3 South Adams St., Rockville, MD, 20850, United States, gregorycoldren@yahoo.com

This talk estimates air-travel itinerary share models focusing on passenger time-of-day and day-of-week preferences. Models using continuous time-of-day utility curves gotten from trigonometric functions are shown to be superior to models using time period constants. The models differentiate between outbound vs. inbound passengers and different days of the week. Finally, advanced GEV models are estimated allowing for increased inter-itinerary competition among time periods and carriers.

2 - Optimizing Flexible Products Over the Internet
David Post, SigmaZen GmbH, Bommersheimerweg 31, Bad Homburg, 61348, Germany, davidpost@mac.com

Flexible products have attracted interest in industries where the product/service is perishable and where there is a high degree of price transparency. In the online world, suppliers have less power as information is put into consumers' hands. The cost-effective interactivity functionality of the Internet has been suggested as a method to involve consumers in the price-product determination process. This presentation discusses the optimization of the price-product mix for flexible products.

3 - Airline Passengers' Cancellation Behavior
Laurie Garrow, Assistant Professor, Georgia Institute of Technology, School of Civil & Envr Engineering, 790 Atlantic Drive, Atlanta, GA, 30332-0355, United States, laurie.garrow@ce.gatech.edu, Dan Iliescu, Roger A Parker

We analyze airline passengers' exchange and refund behavior for multiple airlines using 2004 ticketing and void data. Hazard models are used to predict if and when a ticket will be exchanged or refunded. Empirical results indicate cancellations are most likely to occur right after they are purchased or right before the flight departs. This points to two underlying behavioral phenomena: initial searching for flights, and rescheduling close to departure as travel plans become more certain.

■ TB56

S-Wallingford (Lev. 3)

Tactical Logistics Optimization: Inventory, Transportation and Location

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Valerie Tardif, SmartOps, 12 Federal Street, Suite 400, Pittsburgh, PA, 15212, United States, VTardif@smartops.com

1 - An Integrated Location, Inventory and Service Model
Mark Daskin, Professor, Northwestern University, Department of IE/MS, Northwestern University, Evanston, IL, 60208, United States, m-daskin@northwestern.edu, Max Shen

We formulate a multi-objective facility location model that integrates location, transportation and inventory costs with customer service considerations. We discuss a genetic algorithm that identifies the cost-service tradeoff curve. Computational results comparing the algorithm to an exact approach are presented using a variety of test datasets.

2 - Location-inventory Model with Milk-runs
Leyla Ozsen, Purdue University, 315 Grant St, West Lafayette, IN, 47907, United States, lozsen@purdue.edu, Abdulrahman Alenezi

We introduce a Location-Routing-Inventory Model (LRIP) in which each chosen distribution center (DC) maintains safety stock for designated set of customers, each facing stochastic demand. Multiple customers can be served by one vehicle. The objective of the LRIP is to minimize location, routing, and inventory costs. We develop a two-phase heuristic, location- clustering first and routing second, to solve the LRIP. The first phase is formulated as a two-echelon location problem with risk-pooling.

3 - Solving Facility Location-allocation Problems That Account for Scale-dependent Logistics Costs
Michael Bucci, Doctoral Candidate, North Carolina State University, CB # 7906, Daniels Hall, Raleigh, NC, 27695, United States, mbucci@nc.rr.com, Don Warsing, Michael Kay

We present a formulation of the facility location-allocation problem that accounts for nonlinear, scale-dependent marginal costs of operating facilities, holding inventory, and transporting goods. We compare several meta-heuristic solution approaches that account for these cost complexities, and compare them to best-available bounds or optimal solutions. We use our results to identify key principles regarding scale effects on network design and to motivate further extensions of the formulation.

4 - Design of Inventory Networks with Dynamic Sourcing
Ho-Yin Mak, University of California, Berkeley, 1117 Etcheverry Hall, University of California, Berkeley, Berkeley, CA, 94720, United States, makho@calmail.berkeley.edu, Max Shen

We study the problem of designing an inventory network in which sourcing decisions are made dynamically over time. This class of networks allows inventory sharing (risk-pooling) through sourcing flexibility. The main focus is on the trade-off between the cost and benefit of adding flexibility (i.e. sourcing options) to the system.

5 - Tailoring Logistics Strategies to Demand
Valerie Tardif, SmartOps, 12 Federal Street, Suite 400, Pittsburgh, PA, 15212, United States, VTardif@smartops.com, Sridhar Tayur

Given the agility of current distribution networks, logistics optimization has become a tactical planning activity for many companies. Since 2005, Deere's C&CE Division has been dynamically aligning its downstream logistics to its seasonal demand pattern. Using optimization models developed by SmartOps, Deere optimally redesigns its network twice a year, and executes optimized replenishment decisions to its dealers daily, achieving overall improved service while significantly reducing cost.

■ TB57

S-Columbia (Lev. 4)

Ethics in OR

Contributed Session

Chair: George Geistauts, Professor of Business Administration, University of Alaska Anchorage, College of Business & Public Policy, 3211 Providence Drive, Anchorage, AK, 99508, United States, afgag@uaa.alaska.edu

1 - Fuel Efficiency Model for Vehicles
Anita Soni, Asst. Professor, Technocrats Institute Technology, Infront Hathikhadam, Anand Nagar, Bhopal, IN, 462021, India, anita_alghare@yahoo.com, Pradeep Khot

Life would once again become as it was in the Stone Age, if there would be no petroleum. It is the magic substance that drives the engine of modern civilization. Petroleum popularly known as Black Gold or Liquid Gold is very important for the over all industrialization and development of any economy. Consumption of Petrol is effects by some parameters. I have tried to eliminate problem of petrol by using Sensor & by applying Model.

2 - A New Test of Moral Reasoning for Engineers and Scientists
Matt Drake, Assistant Professor, Duquesne University, School of Business, Pittsburgh, PA, United States, drake987@duq.edu, Julie Swann

The Defining Issues Test, developed in accordance with Kohlberg's stages of moral reasoning, requires subjects to consider general moral dilemmas and identify the important issues in resolving them. We have developed a new test called the Engineering and Science Issues Test that includes moral dilemmas based on technical professional and research dilemmas. We will also discuss experimental results using the test to measure the impact of several pedagogical methods on moral reasoning ability.

3 - Sheep, Dogs and Wolves: The Problem of Modelling Corruption
Juan Camilo Bohorquez, Doctoral Candidate, Universidad de los Andes, Kr 50 #137-59, Bogota, DC, 00000, Colombia, jua-boho@uniandes.edu.co, Roberto Zarama, Neil Johnson

Guarding public resources from corruption is a complex problem. We approach the problem using a metaphor to model a social system. We designed a multiagent model where sheep represent public resources, wolves represent corrupt agents that predate sheep, and dogs are public agents. We tested two different strategies for dogs. A care strategy where dogs guard sheep, and an attacking strategy where dogs pursue wolves.We discuss whether this type of analysis is valid when observing Public systems.

4 - The Sustainable Supply Chain: Integrating Social Practices
Amrou Awaysheh, University of Western Ontario, 1151 Richmond St North, London, ON, N6A3K7, Canada, aawaysheh@ivey.ca, Robert D. Klassen

Businesses engage in sustainable practices to help ensure their long-term profitability. Social practices make up one important dimension of sustainability. A firm's social practices can impact its employees, suppliers, customers, and external stakeholders. Preliminary survey results from Canadian plants are used to define a set of social practices across a firms' supply chain, and to examine the impact of social practices on firm performance.

5 - The Feedback Structure of Business Ethics
George Geistauts, Professor of Business Administration, University of Alaska Anchorage, College of Business & Public Policy, 3211 Providence Drive, Anchorage, AK, 99508, United States, afgag@uaa.alaska.edu, Ted Eschenbach, Elisha Baker

Feedback is a pervasive control mechanism in natural, social and engineered systems. Negative feedback limits the range of system behavior; positive feedback further amplifies behavior. We examine business ethics practice from the perspective of a complex feedback system, identifying and categorizing ethics feedback mechanisms, and evaluating their relative effectiveness.

■ TB58

S-Pike (Lev. 4)

Searching for Good Ideas

Cluster: New Product Development
Invited Session

Chair: Manuel Sosa, Assistant Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu

1 - The Effects of Problem Structure and Team Diversity on Brainstorming Effectiveness
Stylianos Kavadias, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, NW, Atlanta, GA, 30308-0520, United States, Stylianos.Kavadias@mgt.gatech.edu, Svenja Sommer

In this presentation we seek to reexamine a long debated question between the social psychology and the organizational theory literature, i.e. whether nominal groups are more or less effective than brainstorming groups. We show that the answer is not unidirectional but contingent on the basic parameters of the setting, namely the structure of the problem and the diversity of the team members. We also include more complex problem structures where multiple domains of expertise may be required.

2 - Status Effects in Technological Communities
Lee Fleming, Harvard Business School, lfleming@hbs.edu

Does author status matter for efforts to publish manuscripts describing new technology standards and innovations? This paper addresses this question by first exploiting a unique natural experiment that allows identification of status and quality effects.

3 - Where Do Creative Interactions Come from? The Role of Tie Content and Social Networks
Manuel Sosa, Assistant Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu

Why are some interactions more likely to generate novel and useful ideas than others? Integrating research on creativity, knowledge sharing, and social networks this work identifies how the creative interaction outcomes are influenced by the properties of the knowledge exchanged and the social networks surrounding the interaction. Hypotheses are tested in a sociometric study completed in a software development firm.

■ TB59

S-Seneca (Lev. 4)

Capacity and Pricing Decisions for New Products

Cluster: Capacity and Technology Management
Invited Session

Chair: Janice Carrillo, Associate Professor, Warrington College of Business, University of Florida, Gainesville, FL, United States, janice.carrillo@cba.ufl.edu

1 - Inventory Management Under Advance Selling: Optimal Order and Pricing Policies
Michelle MH Seref, University of Florida, Stuzin Hall, Gainesville, FL, 32606, United States, michelle.hanna@cba.ufl.edu, Aydin Alptekinoglu, Selcuk Erenguc

Under advance selling, in which an advance sales period precedes the spot period, customers are uncertain about their future product valuation. We consider an inventory management decision, in which we decide a one-time inventory order quantity at the beginning of the advance sales period as well as a portion of this inventory to reserve for advance sales. We use an expected profit maximization model to find the optimal order and pricing policies.

2 - Optimal Product Portfolio Decisions For Fusion Products with N Functions
Yuwen Chen, PhD Student, University of Florida, P.O. Box 117169, Gainesville, FL, 32601, United States, yuwen@ufl.edu, Peter Sin, Janice Carrillo, Asoo Vakharia

We investigate the manufacturer's optimal product portfolio decision under assumptions of linear price-demand relationship and demand substitution. The product portfolio decision is very complex, we create an algorithm which efficiently identifies the optimal solution based on the concavity property for the objective function. Numerical results show that the manufacturer should often select only a subset of fusion and single-function products to satisfy the market's multi-dimension needs.

3 - Impact of Process and Pricing Decisions on Successive Generations of New Products
Janice Carrillo, Associate Professor, Warrington College of Business, University of Florida, Gainesville, FL, United States, janice.carrillo@cba.ufl.edu, Michelle MH Seref

We develop an analytical model of coordinated product and process development when there are multiple generations of a product. Critical strategic decisions include not only the timing of successive product generations, but also introduction of advances in production technology. Trade-offs considered in the coordinated decision include demand and pricing implications for the next generation product.

4 - Advance vs. Late Selling: Information Advantage, Pooling Flexibility, or Wasteful Production?
Rachel Chen, University of California at Davis, Graduate School of Management, Davis, CA, United States, rachen@ucdavis.edu, Hemant Bhargava

When buyers are uncertain about product valuations for future consumption, the seller incur an information disadvantage by allowing consumers to delay purchase decisions with updated valuation information (which is unknown to the seller). Yet, late selling can benefit the seller when customers are heterogeneous, by increasing sellers' flexibility in pooling different consumer types.

■ TB60

S-University (Lev. 4)

Strategic Sourcing

Sponsor: Technology Management
Sponsored Session

Chair: WC Benton, Professor, Ohio State University, 2100 Neil Avenue, 610 Fisher Hall, Columbus, OH, 43210, United States, benton.1@osu.edu

1 - Evaluation, Implementation, and Management of Outsourcing Initiatives
Sean Handley, Doctoral Candidate, The Ohio State University, 2100 Neil Ave, 600 Fisher Hall, Columbus, OH, 43210, United States, handley_20@cob.osu.edu, WC Benton

Evidence from our preliminary research suggests that many organizations fail to realize the performance improvement expectations from their outsourcing efforts. In this research, we empirically analyze both manufacturing and business process outsourcing decisions to determine the management practices during the business case evaluation, implementation, and management stages that are related to successful outsourcing initiatives.

2 - The Impact of Supplier Development on Buyer-supplier Relationship
Ying Fan, PhD Candidate, Ivey School of Business, University of Western Ontario, Apt. 2005, 2 Forest Laneway, North York, ON, M2N5X7, Canada, yfan@ivey.uwo.ca, Prahinski Carol, WC Benton

Little is understood about how supplier development programs (SDPs), which include competitive pressures, evaluations, incentives and direct involvement, influence supplier performance. Using structural equation modeling (SEM) and data collected from 141 automotive suppliers, the results suggest that the relationship between SDP and performance is mediated by communication, cooperation, and commitment. Competitive pressures were found to have a negative influence in the communication model.

3 - Supplier Managed Inventories (SMI) and Supply Chain Power

WC Benton, Professor, Ohio State University, 2100 Neil Avenue, 610 Fisher Hall, Columbus, OH, 43210, United States, benton.1@osu.edu, Paul Rubin

Increasing competition and the rapid adoption of advanced information technology has prompted hospitals and their suppliers to reengineer their supply chains and examine collaborative supply chain efforts to reduce costs and improve efficiency, hospitals' sharing data using have become common practice. Supplier-managed inventory (SMI) has emerged in this context as an initiative that takes the collaborative efforts beyond information sharing.

4 - Governance for Growth: Real Options Perspectives on Supplier Transactions

Nile Hatch, Marriott School - BYU, Provo, UT, 84602, United States, nile@byu.edu

In buyer-supplier partnerships, firms focus on collaboration to create joint value rather than taking value from the other firm. Real options analysis of the growth potential of the relationship between a buyer and supplier indicates the appropriate governance structure for the relationship. Traditional outsourcing emphasizes the value of the option to switch suppliers; buyer-supplier partnerships emphasize the value of the option to grow capabilities.

Interactive Session

Tuesday, 12:30pm - 1:30pm

Exhibit Hall Entrance

Chair: Archis Ghate, Assistant Professor, University of Washington, Industrial Engineering, BOX 352650, Seattle WA 98195, United States, archis@u.washington.ed

1- User-centered Road Design in the Expression Synthesis Project

Jie Liu, University of Southern California, Daniel J. Epstein ISE Department, 3715 McClintock Avenue, GER 240, Los Angeles CA 90089, United States, jieliu@usc.edu, Elaine Chew, Alexandre Francois

The Expression Synthesis Project (ESP) uses a driving interface to enable users to create expressive musical performances. The road in ESP serves as a guide to encourage preferred expressive nuances in the performance. To better assist the user in creating a pleasing performance with tempo variations similar to a target performance, we model the user's driving behavior, then create a tailor-designed road, optimized using genetic algorithms. We present the results of this user-centered design.

2- Risk Level in Quantity and Time Flexible Contracts

Berrak Dag, University of Limerick, ER1-030 Enterprise Research Centre, University of Limerick, Limerick, Ireland, berrak.dag@ul.ie, Cathal Heavey, Paul Liston

Under uncertainty, companies prefer flexible contracts for outsourcing activities to reduce the risk for buyer and seller. Even though flexibility contracts are used, the risk cannot be eliminated completely. In this study, two types of flexible contracts; time and quantity flexibility contracts are modeled mathematically to determine the risk levels.

3- Operations Research in Breast Cancer Diagnosis

Jagpreet Chhatwal, University of Wisconsin-Madison, 4126 Mechanical Engineering, 1513 University Avenue, Madison WI 53706, United States, jchhatwal@wisc.edu, Elizabeth Burnside

Every two minutes a woman is diagnosed with breast cancer. In addition, 55-85% of the breast biopsies performed result in non-cancerous findings, showing unnecessary treatments and expenditure, and anxiety for the patients. We have developed two breast cancer risk prediction models based on Bayesian networks and logistic regression. We use Markov Decision Processes (MDP) to find the optimal timing of the biopsy for each patient that maximizes her total quality-adjusted expected life.

4- Organizing Virtually for Inter-organizational Technology Development: A Longitudinal Analysis of the Development of a Network Standard

Sanjeev Jha, Doctoral Student, University of Illinois at Chicago, 2402 UH (MC 294), 601 S Morgan Street, Chicago IL 60607, United States, sjha2@uic.edu, Mary Beth Watson-Manheim

In this longitudinal study, virtual organizing strategies are examined during the development of an inter-organizational technology. Technology development process has been conceptualized to be of two major stages: development and market stage. We will examine the development of a network standard, during the two stages, using a dataset of threaded discussions in archived mail list UBL initiative, which was developed virtually and has been successful in real world implementations.

5- Optimal Fences and Simultaneous Determination of Price and Inventory Decisions

Michael Zhang, Department of Finance, Information Systems & Management Science, Saint Mary's University, 903 Robie Street, Halifax NS B3H 3C3, Canada, mzhang@ivey.uwo.ca

In this study we look at business issues surrounding fences and discuss fencing in the context of the practice of RM. We show how to determine optimal pricing and inventory decisions when fences are not perfect. Next, we introduce a cost function representing efforts invested in fencing and characterize optimal fences.

6- Minimum Cost Testing Under Precedence Constraints

Tonguc Unluyurt, Assistant Prof., Sabanci University, Manufacturing Systems &Industrial Eng., Orhanli, Tuzla, Istanbul 34956, Turkey, tonguc@sabanciuniv.edu

In this talk, we will provide a review of the results on the minimum cost testing problem under precedence constraints. The minimum cost testing problem involves developing a testing strategy to find the correct state of the system with the minimum expected cost. In certain applications, precedence among tests appear naturally as a constraint. This makes the problem much more difficult. Mainly, these results are for certain k-out-of-n systems. We also present the initial results of our computational experiments. Essentially, we will compare the results of heuristic algorithms (including one which is based on ant colony optimization) with the solvable cases. For the cases when the optimal solutions cannot be obtained, we will compare the heuristic algorithms among themselves.

7- On the Quest of a Batch-time-series Forecasting Benchmark

Konstantinos Nikolopoulos, Supply Chain Management Research Group, Manchester Business School, M15 6PB, Manchester, United Kingdom, kostas.nikolopoulos@mbs.ac.uk, Vassilios Assimakopoulos, Nikolaos Bougioukos, Elli Pagourtzi, Fotios Petropoulos

This study discusses the performance of the Theta model and Damped Exponential Smoothing in batch time series forecasting; data of more than 10000 time series are gathered from various Forecasting Competitions (M1, M3, NN3, T) as well as publicly available time series (Monash, RAF). Data vary in time lags (hourly, daily, weekly, monthly, quarterly, and annually) as well as sector of origin (micro, macro, industry, transportation, etc). The aforementioned methods are tested against the Random walk model and specialized commercial forecasting software.

8- Response Time Reduction in Make-to-order and Assemble-to-order Supply Chain Design

Navneet Vidyarthi, PhD Candidate, Univesity of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo ON N2L 3G1, Canada, nkvidyar@engmail.uwaterloo.ca, Samir Elhedhli, Elizabeth Jewkes

Motivated by the strategic importance of response time reduction, this paper presents models for designing make-to-order and assemble-to-order supply chains. The problem is setup as a network of spatially distributed M/G/1 queues, modeled as a nonlinear MIP, and linearized using a simple transformation and a piecewise linear approximation. We present two solution approaches: an exact cutting plane algorithm and a Lagrangean relaxation heuristic. Then, we consider an assemble-to-order supply chain design model and propose a Lagrangean heuristic. Computational results and some managerial insights are provided.

9- Asymptotic Theory of Sequential Change Detection and Identification

Kazutoshi Yamazaki, PhD Student, Princeton University, ORFE Dept., Princeton University, Princeton NJ 08540, United States, kyamazak@princeton.edu, Savas Dayanik, Warren Powell

The distribution of a sequence of random variables suddenly changes at some unobservable time to one of finitely many distinct distributions, and one needs to detect and identify the change as soon as possible. We propose a sequential decision strategy that sets an alarm when the posterior probability of a certain type of change exceeds some threshold, and show its asymptotic optimality under various criteria.

10- A Theory of Activity Distribution Based on Spatial Interaction Through the Traffic Network

Takamori Ukai, Keio University, 3-14-1, Hiyoshi, Kouhoku-ku, Yokohama, Japan, ukai@ae.keio.ac.jp

In this study, we discuss the distribution of geographical significance, which is occurred by the accumulated interaction of the activity at points in cities among traffic network. The series of models provided in this study is a new, prescriptive model concentrating on the relations between activity distribution and spatial interaction.

11- Determining Multiple Distributions of Retail Facilities with Respect to Trip Chaining Behavior

Yudai Honma, Keio University, 3-14-1, Hiyoshi, Kohoku-ku, Yokohama-shi 223-8522, Japan, yudai@ae.keio.ac.jp, Osamu Kurita

The purpose of this study is to present the theoretical background for the formation of multiple distributions of retail facilities in cities. In particular, we focus on the role of multipurpose trip chaining behavior. Setting utility functions appropriately, we described the interdependence between urban retail facilities.

12- Optimization Efficiency Monitoring of Moving Objects in Sensor Networks

Boris Peltsverger, Dean/Professor, Georgia Southwestern State University, 800 GSW University Drive, Americus GA 31709, United States, plz@canes.gsw.edu, Svetlana Peltsverger, Jiangchuan Wang

Monitoring of moving objects in sensor networks create several problems related to energy efficiency and measurement redundancy. Each moving object can be discovered at the same time by dozens sensors. Such number of sensors very often is not necessary for purpose of tracking of the objects. The goal of this paper is to develop an algorithm which can turn on and off sensors depends on how many objects moving through the area and what of their (objects) distances from sensors in proximity.

13- Scheduling First Year Seminars

Dawn Rose, Assistant Professor of Mathematics, Emmanuel College, 400 The Fenway, Boston 02115, United States, rosed@emmanuel, Candace Selneck

We discuss a scheduling problem that arises at Emmanuel College: assign incoming students to freshmen seminars based on preferences and course constraints. Custom software was developed to solve the network flow problem with side constraints. The result is a practical application of OR that is appreciated by students and administrators.

14- Text Mining to Summarize Complicated Datasets Containing Structured, Nominal Data

Patricia Cerrito, Professor of Mathematics, Univ of Louisville, Department of Mathematics, Louisville KY 40292, United States, pcerrito@louisville.edu, Hamed Zahedi

The purpose of this study is to filter a large, healthcare database to patients undergoing treatment for Osteomyelitis to determine whether physicians are using antibiotics to preserve limbs. We use text mining to classify patients as to severity level, and survival data mining to examine elapsed time between amputations.

15- A Heuristic for Clark-Scarf Algorithm

Zumbul Bulut, Dept. of Industrial and System Engineering, Lehigh University, Bethlehem PA 18015, United States, zub205@lehigh, Lawrence Snyder

We study the problem of finding optimal basestock levels in a continuous-time serial supply chain. The Clark-Scarf Algorithm determines the optimal echelon base-stock levels recursively. We approximate the cost functions in this algorithm with piece-wise linear functions. This approach converts the echelon cost functions to Newsboy-type functions. Based on this, we derive closed form expressions for the echelon base-stock levels.

16- Recent Progress on the Probabilistic Set Covering Problem

Anureet Saxena, Tepper School of Business, CMU, 5624 Fifth Ave, Appt C13, Pittsburgh PA 15232, United States, anureets@andrew.cmu.edu

In this poster session we consider the probabilistic variant of the well-known set-covering problem with binary random right hand side. We give several MIP reformulations of this problem and study a class of strong cutting planes derived from polarity theory. Finally, we coroborrate our results by an extensive computational experiment conducted on a test-bed consisting of more than 10,000 probabilistic instances.

17- Data Envelopment Analysis of the Most Efficient National Healthcare Systems

Mehmet Ceyhan, Northeastern University, 334 Engineering Center, 360 Huntington ave, Boston MA 02115, United States, ceyhan.m@neu.edu, James Benneyan, Aysun Sunnecti

We report on the results of several models to identify countries with the most efficient healthcare systems, in terms of translating resources consumed into outputs produced. DEA models are developed based on several balancing dimensions of healthcare, including clinical outcomes, HALE, access, equity, safety, and resources. Results are reported for 180 countries, both overall and according to the four WHO categories of economic development when available.

18- Modeling and Optimization for Organization Design

Darby Grande, Aptima, Inc., 12 Gill St., Woburn MA 01801, United States, dgrande@aptima.com, Georgiy Levchuk

Motivated by force composition challenges in the US Army, we present a systems engineering approach to designing organizations in dynamic environments. We discuss a methodology for modeling missions and synthesizing concomitant optimal organizations using a three-phase iterative optimization process that derives an organizational design for given mission structures and organizational constraints.

19- Improvement, MD: A Checklist for Smart But Busy Change Leaders in Healthcare

Jose Valdez, University of Wisconsin Hospital and Clinics, 8501 Excelsior Drive, Suite 337, Madison WI 53711, United States, JValdez@UWHealth.org

The Improvement, MD Checklist is a synthetic, evolutionary framework for Quality/OR practitioners in complex systems such as healthcare. Presented as a list of didactic questions, the Checklist showcases a three-phase approach to leading change (Define, Design, Deployment) and the deliberate matching of task-roles (Modeling, Measurement, Management) in continuous systems improvement.

20 - An Intelligent Assembly Algorithm for Haptic Interface Applications of a Virtual Maintenance System

Jungwon Yoon, Department of Mechanical and Aerospace Engineering, Gyeongsang National University, Jinju, Korea, jwyoon@gnu.kr, Christiand Yoon

This paper presents the development of an intelligent assembly system with the utilization of a haptic device. In a virtual environment (VE), a maintenance process scheme can simulate the real world maintenance process. Moreover, during the simulation of a maintenance process, a path planning of the mechanical parts becomes important factor that will affect the overall efficiency of the maintenance system itself. Therefore, in addition to assembly sequence considerations such as the numbers of gripper exchanges and direction changes, a planner also should consider path planning factors under constraints such as obstacles and initial/final positions of the parts. This paper proposes a novel intelligent assembly algorithm by considering the assembly sequence of mechanical parts and path planning factors for a virtual maintenance simulation system. The algorithm involves a genetic algorithm (GA) to generate the optimal parts sequence and the shortest optional distance of each part during the assembly operation. By the suggested algorithm, the user will be haptically guided during the part assembly through the desired sequence and the shortest path of the assembly parts.

21 - Efficient Importance Sampling for the Serve the Longest Queueing System

Kevin Leder,Brown Universtiy, kleder@dam.brown.edu

An importance sampling algorithm for estimating the probability that at least one queue overflows in the serve the longest (weighted) queueing system. This change of measure is shown to be asymptotically efficient for an arbitrary number of queues and the only restrictions placed on the arrival and service rates are that the system be stable.

Tuesday, 1:30pm - 3:00pm

■ TC01

C-Room 602

Supply Chain I

Contributed Session

Chair: Seong Hyun Nam, Associate Professor, University of North Dakota, Management Department, P.O. Box 8377, Grand Forks, ND, 58202-8377, United States, seong_nam@und.edu

1 - Network Design of Two Stages Supply Chain Based on Partial Direct Delivery

Linhui Sun, Xi'an Jiaotong University, Xianning West Road,28, Xi'an, Sh, 710049, China, linhuisun@mail.xjtu.edu.cn, Linyan Sun

In order to decrease capital deposited in inventory and improve customer response, the optimal ratio or quantity of transfer and direct deliver are firstly determined for two stages supply chain. Then a mixed-integer nonlinear programming model was set up to solve the network design with multi-source, multi-distributed center, multi-consumer. Genetic algorithm based on priority weight coding is designed to find the optimization solution. Case study of Haier shows the method is effective.

2 - Strategic Decision of Service Level and Inventory Target in High-tech Industry

SugJe Sohn, Senior Supply Chain Modeling Engineer, Intel Corporation, 6505 W Chandler Blvd MS-CH11-111, Chandler, AZ, 85226, United States, sugje.sohn@intel.com

The decision of inventory targets is a composite of modeling factors such as product lifecycle, product segmentation, cost and price model, supply and demand variability and service level. It is a complicated decision particularly when the high product mix, shortened product lifecycle and increased uncertainty in supply chain are observed. This research suggests an integrated approach to determine the inventory targets with the illustrative test cases of single-echelon single-period base model.

3 - A Model Concerning the Optimal Permutations of Flow Shop Scheduling with a Learning Effect

Kai Cui, Xi'an Jiaotong University, xianning west road,28, xi'an, sh, 710049, China, luy33@stu.xjtu.edu.cn, Linyan Sun

A model using the optimal permutations algorithms to analyze flow shop scheduling with a learning effect is made and tested. In this model the processing times of jobs are defined as functions of their positions in a permutation. The objective is to minimize one of the three regular performance criteria: the total weighted completion time, the discounted total weighted completion time, and the sum of the quadratic job completion times. We also analyze the worst-case bound of the algorithms.

4 - Comparison of Three Forecasting Models for the Seasonal Type Demand

Raghu Sengupta, Assistant Professor, Indian Institute of Technology Kanpur, Indus. & Mgmt. Engg. Dept., Indian Institute of Technology Kanpur, Kanpur, UP, 208016, India, raghus@iitk.ac.in, Sunil Agrawal, Kripa Shanker

Bullwhip effect for non stationary seasonal end customer demand in a serial two tier supply chain is studied, which assumes end customer demand is non stationary SARIMA process, retailer's periodic review inventory replenishment policy is myopic, and retailer replenishment lead time is deterministic. The three seasonal forecasting demand models compared are Winter's, decomposition and ARIMA, and we calculate both order and on hand inventory expressions for the same.

5 - Determining the Optimal Number of Suppliers in Supply Base under Long Term Contract

Seong Hyun Nam, Associate Professor, University of North Dakota, Management Department, P.O. Box 8377, Grand Forks, ND, 58202-8377, United States, seong_nam@und.edu

This paper presents a policy control model that helps determine the optimal number of suppliers under long term contract considering two variables: the uncertain dynamics in demand and managerial costs to deal with uncertain problems in supply base.

■ TC02

C-Room 603

OR/MS and Sustainability

Cluster: Closed-Loop Supply Chains and Sustainable Operations
Invited Session

Chair: Leon McGinnis, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States, leon.mcginnis@isye.gatech.edu

1 - Energy Modeling at the Machine Level

Janet Twomey, Wichita State University, 1845 Fairmount, Wichita, KS, 67260-0035, United States, janet.twomey@wichita.edu, Haitao Liao, Lawrence Whitman, Bayram Yildirim

This talk reports on a framework for energy collection and operational models at the machine level. The framework gives detailed energy profiles of industrial equipment. That detailed profile not only provides an accurate assessment of energy consumed for a given material, machine, and part geometry, but also provides significant information for prescribing energy reduction strategies at the machine level. A description of the framework is provided, as well as scheduling intervention strategies for turning equipment ON/OFF during idle periods. An application to lower energy consumption at a Wichita, KS aircraft supplier is given for illustrative purposes. The limitations of the current results and ongoing research at the machine level are described, and the future research at the facility and enterprise level are discussed. This research has been supported by NSF DMI- 0537839 grant.

2 - Determining the Environmental Effects of a Remanufacturing Strategy for an Aluminum Automotive Powertrain Part

Sophie Govetto, Sustainable Design and Manufacturing Group, Georgia W. Woodruff School of Mechanical Engineering, Systems Realization Laboratory, Georgia Institute of Technology, Bert Bras

In the past few decades, globalization has led to a world economy with unbounded consumption. In addition to the consequential impoverishment of natural resources, this large consumption produces copious amounts of waste. This pollution and energy use can be reduced through proper reuse end-of-life strategies. Many have proposed remanufacturing as the best way to alleviate up some of these environmental burdens. In this study of an automotive powertrain part, we will compare three end-of-life strategies (disposal, remanufacturing and recycling). This study will demonstrate that from a life-cycle perspective, remanufacturing results in less emissions and energy consumption than recycling or disposal strategies, but also that these savings in emissions can be negated by long and inefficient reverse supply chains.

3 - A Triple Bottom Line Comparison of Carpet Reclamation Strategies for Urban Regions

Caroline Guidry, Georgia Institute of Technology, Systems Realization Laboratory, Atlanta, GA, 30332-0405, Bert Bras

The goal of this paper is to compare two end-of-life scenarios for carpet tiles reclaimed from an urban region. The specific focus is on PVC recycling vs. dumping post-consumer carpet tiles in the Atlanta metropolitan region. The comparison of the two strategies will be conducted via a Life-Cycle Assessment, which has been adapted to include economic and social indicators as well. Thus, the comparison of the two end-of-life scenarios will take place from an environmental, social and economic perspective.

4 - Organic Production Systems: An Emerging Operations Strategy?

Lieven Demeester, Assistant Professor of Operations Management, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, lieven.demeester@insead.edu, Mei Qi, Luk Van Wassenhove

We use a modified optimal market area model to show how supply chains are shaped by complementarities between material recycling, low-cost flexible process technologies, and plants taking advantage of local adaptation and customer proximity. We examine these complementarities in propositions and demonstrate that, in a realistic example for an engineering plastic in Western Europe, an understanding of these complementarities can make the difference between the continuation of a supply chain without recycling and the emergence of a closed-loop supply chain with recycling, localization, and market areas less than one third their original sizes. Our analysis shows that this combination of features, labeled organic production, qualifies as a supply-chain-level operations strategy, forms a model for emerging closed-loop supply chains, and, can have important implications for product, operations and supply chain strategies.

■ TC03

C-Room 604

Applied Research on Order Fulfillment

Cluster: Supply Chain
Invited Session

Chair: Jeremie Gallien, Associate Professor, MIT Sloan School of Management, 30 Wadsworth Street, E53-390, Cambridge, MA, 02142, United States, jgallien@mit.edu

1 - Dynamic Supply Routing for a Make-to-order Manufacturing Network

Jeremie Gallien, Associate Professor, MIT Sloan School of Management, 30 Wadsworth Street, E53-390, Cambridge, MA, 02142, United States, jgallien@mit.edu, Rohit Bhatnagar, Chee Chong Teo, Julie Alspaugh, John Foreman

Dell's supply chain for desktops involves Asian vendors shipping components by sea to several U.S. plants. While suppliers are responsible for shipping enough inventory, Dell can reroute and expedite their shipments while in transit to balance inventory across sites and dynamically track geographic demand patterns. We present optimization models developed with Dell to address this routing challenge and some insights gained from their implementation.

2 - Order Allocation Planning for Dell's US Manufacturing Network

Gareth Williams, MIT Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, gpw@mit.edu, Jeremie Gallien

Dell Computers recently expanded its US desktop manufacturing network to reduce supply chain costs and lead-times. While Dell's current planning process allocates demand to factories using a static map minimizing outbound costs, it recognizes the opportunity to rely instead on dynamic allocation maps minimizing inbound, outbound, and direct labor costs. We present an optimization model developed with Dell to exploit this opportunity and results showing significant savings potential.

3 - Stocking the Amazon: Inventory Planning in Large-scale Internet Retail

Chris Provan, PhD Student, Cornell University, 206 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States, cap73@cornell.edu, Paat Rusmevichientong, John Muckstadt, Russell Allgor, Ping Xu, Marcus Hum, David Murray

Our work explores the unique inventory problems that arise in the large-scale internet retail environment of Amazon.com. Areas of investigation include inventory allocation in multi-echelon supply chains with capacity constraints, ordering policies and stock-out decisions in a multiple demand class environment, and workload smoothing under seasonal dynamic demands. We present an innovative network design which takes advantage of economies of scale to address these questions.

4 - Fulfillment Policies for Bundled Orders
Ping Xu, Amazon.com, pingjosephine@gmail.com, Victor Martinez de Albeniz

We develop a stylized model to analyze the fulfillment policy when facing bundled customer orders. Initially, an online retailer stocks inventory for different SKUs in a warehouse. Customers then arrive stochastically and request a bundle: the retailer must decide whether to satisfy the entire bundle, only a subset, or not to satisfy the customer at all. We characterize the structural properties of the profit-to-go function and provide numerical examples to highlight managerial insights.

■ TC04

C-Room 606

Tutorial: Computational Global Optimization

Cluster: Tutorials
Invited Session

1 - Computational Global Optimization
Leon Lasdon, ROM department, McCombs Business School, University of Texas, Austin, TX, 78712, Lasdon@mail.utexas.edu, Janos D. Pinter

The objective of global optimization (GO) is to find the best possible solution in highly nonlinear models that possess multiple – local and global – optima. In this tutorial we state the general GO model and discuss some of its important special cases. Next, we review (theoretically and computationally) exact and heuristic solution approaches, and discuss software implementations. We also highlight illustrative applications and GO case studies, and point towards present and future challenges.

■ TC05

C-Room 607

Joint Session Optimization/ICS: New Developments in MINLP Solvers

Sponsor: Optimization/Global Optimization, INFORMS Computing Society
Sponsored Session

Chair: Kevin Furman, ExxonMobil, 1545 Route 22 East, Annandale, NJ, 08801, United States, kevin.c.furman@exxonmobil.com

1 - Using AMIGO, a Mixed Integer Global Optimizer: Methodology and Numerical Examples
Zsolt Ugray, Assistant Professor, Utah State University, 3515 Old Main Hill, Logan, UT, 84322-3515, United States, zsolt.ugray@usu.edu, Janos D. Pinter

We highlight recent developments of AMIGO, an Advanced Mixed Integer Global Optimizer. AMIGO combines solver strategies that work on general mixed integer problems with the LGO (Lipschitz Global Optimizer) solver suite for continuous global/local optimization. We discuss the algorithmic framework and show illustrative numerical examples.

2 - Experience in Solving Commercial Nonconvex MINLPs with KNITRO
Todd Plantenga, Sr Software Developer, Ziena Optimization, Inc, 1801 Maple Ave, Evanston, IL, 60201, United States, todd.plantenga@ziena.com, Richard Waltz

KNITRO, regarded as one of the best nonlinear optimization solvers for continuous problems, recently extended its scope to include problems with integer variables. We provide an overview of the new algorithm, and computational results on commercial MINLP applications. More information about KNITRO is available at www.ziena.com.

3 - New Developments for Solving MINLPs with AIMMS
Ximena Cerda, AIMMS Specialist, Paragon Decision Technology Inc., 5400 Carillon Point, Kirkland, WA, 98033, United States, Ximena.Cerda@aimms.com

AIMMS has been extended with KNITRO's brand new MINLP version. Up till now, MINLP could be solved using the (open and customizable) AIMMS Outer Approximation (AOA) algorithm or BARON. Adding KNITRO's MINLP version gives the AIMMS user more choice and flexibility in solving this difficult class of problems. We will demonstrate how to use KNITRO in AIMMS and do a comparison of AOA and KNITRO on real-life applications. For more information about AIMMS, AOA and KNITRO, see www.AIMMS.com.

■ TC06

C-Room 608

Innovations in Healthcare Operations

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Chris P. Lee, Assistant Professor, The Wharton School, Univ. of Pennsylvania, 3730 Walnut St., Suite 500, Philadelphia, PA, 19104, United States, cpclee@wharton.upenn.edu

1 - Retirement Planning: The Effects of Health Care Costs
Margret Bjarnadottir, MIT, 77 Mass Ave., MIT E40-149, Cambridge, MA, 02139, United States, margret@mit.edu, Dimitris Bertsimas

Health care costs can intimately affect one's financial well-being. A big portion of one's lifetime health care costs are incurred during retirement, and therefore taking these costs into account when planning for retirement is critical. We propose a way to model the uncertainty of health care costs, and investigate the effects of health care costs on different investment and insurance strategies for retirement.

2 - Health Savings Accounts: How Much to Contribute?
David Lowsky, PhD Candidate, Stanford University Graduate School of Business, 518 Memorial Way, S458, Stanford, CA, 94305-5015, United States, lowsky_dave@gsb.stanford.edu, Stefanos Zenios

Health savings accounts (HSAs) have been touted as a way to control rising healthcare costs. We develop a Markov healthcare cost prediction model based on a household's previous year cost percentile. The model is used to simulate a household's health savings account balance over time to determine the contribution levels necessary to reliably cover all future healthcare expenses. Cost prediction performance and HSA simulation results are presented.

3 - Two Results About the Size of Weighted Matchings, with Applications to Kidney Paired Donation
Sommer E. Gentry, Assistant Professor, United States Naval Academy, 572-C Holloway Road, Mailstop 9E, Mathematics Department, Annapolis, MD, 21402, United States, gentry@usna.edu, T. S. Michael, Dorry L. Segev

Kidney paired donation matches a patient and incompatible donor with another patient and donor for an organ exchange. The best donations are a weighted graph matching. A preemptive multiobjective matching problem is: first maximize transplants for a favored group, second maximize transplants for all, and lastly maximize geographic proximity of the donations. Two results about the size of weighted matchings allow solution of the multiobjective problem using standard weighted matching techniques.

■ TC07

C-Room 609

Stochastic Inventory Models

Cluster: Inventory
Invited Session

Chair: Xiuli Chao, University of Michigan/Chinese University of Hong Kong, 1205 Beal Ave, Ann Arbor, MI, United States, xchao@unity.ncsu.edu, zhoux@se.cuhk.edu.hk,

Co-Chair: Sean Zhou, Assistant Professor, Chinese University of Hong Kong, Department of Systems Engineering & Engi, Hong Kong, China, zhoux@se.cuhk.edu.hk

1 - Inventory of Cash-constrained Firms and the Option to Acquire Future Financing
Pierre-Yves Brunet, University of Michigan, 1205 Beal Ave., IOE 2811, Ann Arbor, MI, 48109, United States, brunetp@umich.edu, Volodymyr Babich

Trade credit financing allows cash-constrained firms to implement optimal operational decisions and signal their credit quality to banks and other lenders. Using a stochastic dynamic programming model we first study joint inventory and financing decisions of a firm and then compute the signaling value of trade credit financing. In this talk, we highlight the effects of financing constraints on inventory decisions and consequences of trade credit signals.

2 - Inventory and Process Flexibility in a Make-to-stock System with Product Substitution
Bora Kolfal, University of Alberta, 4-20K Business Building, Edmonton, AB, Canada, Bora.Kolfal@ualberta.ca, Mark Van Oyen, Seyed Iravani

We study the joint production-inventory control problem of a firm producing two substitutable products in a make-to-stock system. We prove the structure of the joint optimal production and substitution policy for the equal production rate case. We construct a multi-threshold policy as a substitute for the optimal policy for the general case. Our numerical study provides insights into the interaction and comparison of process flexibility and inventory flexibility.

3 - Analysis of Inventory Systems with Remanufacturing of Multi-Types Returns
Sean Zhou, Assistant Professor, Chinese University of Hong Kong, Department of Systems Engineering & Engi, Hong Kong, China, zhoux@se.cuhk.edu.hk, Zhijie Tao, Xiuli Chao

We study periodic-review inventory/production systems with multi-types of return products. We characterize the optimal inventory control policies that minimize the total costs for the systems with and without possible disposal of repairable products. We show that, under some circumstances, the optimal policy is simple and only given by some state-independent threshold levels. However, under some other scenarios, the optimal policy can also be quite complicated with state-dependent thresholds.

4 - A Few New Results About (s,S) and (s,S,p) Policies
Youyi Feng, Associate Professor, The Chinese University of Hong Kong, R609 M.M.W Engineering Building, Sys. Eng. & Eng. Mgmt., Hong Kong - ROC, yyfeng@se.cuhk.edu.hk

The author reports a few new developments in the (s,S) and (s,S,p) policies. These results focus on the characterization of suitable demand models and the structure of holding-shortage cost function. They provide new proofs for the discount and average optimality of these policies in the finite and infinite horizon settings.

■ TC08

C-Room 611

Humanitarian Relief Chain Management

Cluster: Humanitarian Relief Chain Management
Invited Session

Chair: Benita Beamon, Associate Professor, University of Washington, Box 352650, Seattle, WA, 98195-2650, United States, benita@u.washington.edu

1 - Pre-positioning Inventory for Emergency Response
Serhan Duran, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332, United States, sduran@isye.gatech.edu, Pinar Keskinocak, Marco A Gutierrez, Adaora Okwo

In humanitarian supply chains demand is complicated with many unknown factors such as location, size, and timing of disasters. We developed a pre-positioning strategy and compared it, in terms of its effectiveness and timeliness of response, with current practices of sending resources through local and global suppliers.

2 - Efficient Funding: Auditing in the Nonprofit Sector
Feryal Erhun, Assistant Professor, Stanford University, MS&E, Stanford, CA, 94305, United States, ferhun@stanford.edu, Natalie Privett

We take a contracting perspective to model the process of funders (foundations or the government) awarding grants and allocating funds between nonprofit organizations. We show that the effectiveness of the funding process and the nonprofit sector overall can be significantly improved through the use of efficient contracts and auditing. In fact, numerical analysis shows that the funder can potentially achieve nearly 35% improvement through auditing contracts.

3 - Last Mile Distribution in Humanitarian Relief
Burcu Balcik, PhD Candidate, University of Washington, Industrial Engineering Box 352650, Seattle, WA, 98195, United States, burcub@u.washington.edu, Benita Beamon, Karen Smilowitz

We consider the primary operational decisions related to local (or last mile) distribution in a humanitarian relief supply chain, namely: relief supply allocation, vehicle delivery scheduling, and vehicle routing. We present an MIP model, a Simulated Annealing algorithm, and practical heuristics for last mile distribution.

■ TC09

C-Room 612

Joint Session Homeland/DAS: OR in Homeland Security II

Cluster: Homeland Security, Decision Analysis
Invited Session

Chair: Vicki Bier, University of Wisconsin-Madison, Dept.. of Industrial and Systems Eng., 1513 University Avenue, Madison, WI, 53706, bier@engr.wisc.edu

1 - Domain Protection Methodologies
Donald Gaver, Distinguished Professor, Naval Postgraduate School, DGaver@nps.edu, K.C. Chng, Patricia Jacobs

An important domain (e.g. straits towards a Blue seaport) contains many benign(White)usually-friendly vessels; it is transited by fewer possibly dangerous (e.g. LNG) ships aimed to cause port damage. We analyze requirements and CONOPS for Blue defense forces: UAVs, USVs, Helos, and Patrol Craft, to minimize port damage.

2 - Optimization with Uncertainties for the Location and Allocation of Medical Supplies in an Emergency
Huseyin Onur Mete, PhD Student - Research Assistant, University of Washington, 6330 NE Radford Dr 3726, Seattle, WA, 98115, Turkey, mete@u.washington.edu, Zelda Zabinsky

We consider the location and allocation of medical supplies in an emergency. In the preparedness phase, we determine the warehouses to be active in the city and their inventory levels by a Stochastic Program to provide fast distribution to hazardous areas. In the response phase, we use the Stochastic Program to prepare a Mixed Integer Program to quickly dispatch the supplies and route vehicles with updated information. We include a case study of two earthquake scenarios in the Seattle area.

■ TC10

C-Room 613

Data-driven Inventory Control

Cluster: Inventory
Invited Session

Chair: Woonghee Tim Huh, Assistant Professor, Columbia University, 500 W 120th Street, MC 4704, New York, NY, 10027, United States, th2113@columbia.edu

1 - Non-parametric Inventory Control with Censored Demand
Woonghee Tim Huh, Assistant Professor, Columbia University, 500 W 120th Street, MC 4704, New York, NY, 10027, United States, th2113@columbia.edu, Paat Rusmevichientong, Retsef Levi

We develop a new non-parametric algorithm for a stochastic inventory model with lost sales and censored demand, where the demand distribution is not known a priori. In the repeated newsvendor problem, we prove the convergence of our algorithm to the fractile solution, and demonstrate it numerically to existing algorithms.

2 - An Adaptive Algorithm for Finding the Optimal Base-stock Policy in Lost Sales Inventory Systems
Paat Rusmevichientong, Assistant Professor, Cornell University, 221 Rhodes Hall, Ithaca, NY, 14853, United States, paatrus@cornell.edu, Ganesh Janakiraman, John Muckstadt, Woonghee Tim Huh

We study the problem of finding the best base stock policy in an inventory system with lost sales and positive replenishment lead times. In our model, the demand distribution is not known a priori and the manager must make the replenishment decision in each period based only on the past sales (censored demand) data. We develop a nonparametric adaptive algorithm that generates a sequence of order-up-to levels whose running average cost converges to the cost of the optimal base-stock policy.

3 - Pricing and Revenue Management with Operational Statistics
George Shantikumar, Professor, IEOR Department, University of California, Berkeley, CA, 94720, United States, jgshant@ieor.berkeley.edu, Leon Chu, Max Shen

Problem of deciding the price and order quantity in inventory control based on past data is considered. When the demand is an exponential stochastic function of price, we find operational statistics for the optimal price and order quantity. Numerical results show that the proposed solution results in an expected profit that is substantially better than those realized with classical approaches.

4 - Bounds and Heuristic for Optimal Bayesian Inventory Control with Unobserved Lost Sales

Li Chen, Lead Scientist, TrueDemand Inc., 485 Alberto Way, Suite 200, Los Gatos, CA, 95032, United States, li@tdemand.com

Consider a finite-horizon Bayesian inventory control problem with unknown demand distribution and unobserved lost sales. It is generally difficult to obtain the optimal solution to this problem because of Bayesian updating with censored demand data. However, bounds for the optimal solutions along the sample path can be obtained. We show that these bounds can be easily computed and that they offer intuitive insights about the value of information and the value of learning.

■ TC11

C-Room 614

Operational Issues in the Management of Outsourced Supply Chains

Cluster: Supply Chain
Invited Session

Chair: Andy Tsay, Associate Professor, Santa Clara University, Leavey School of Business, OMIS Dept., 500 El Camino Real, Santa Clara, CA, 95053, United States, ATSAY@STANFORDALUMNI.ORG

1 - Managing Outsourced Product Design: The Effectiveness of Alternative Integration Mechanisms

Geoffrey Parker, Tulane University, A. B. Freeman School of Business, 7 McAlister Dr., New Orleans, LA, 70118, United States, gparker@tulane.edu, Alison Davis-Blake, Edward Anderson

We report preliminary results from a four-year study of interorganizational integration mechanisms and coordination tools used during product and process development projects. Results suggest that nearly all firms employ personnel dedicated to managing outsourcing relationships. Surprisingly, firms make little use of sophisticated information technology or modular product designs. We find that the effects of a single mechanism or tool can vary dramatically across different outcomes.

2 - Should Purchasing Activities be Outsourced Along with Production?

Rachel Zhang, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, United States, rzhang@ust.hk, Kaijie Zhu, Xi Yang

When outsourcing its production to a contract manufacturer, a brand name company may also let the manufacturer take on the procurement of materials to save overhead costs and to focus on its core competency. But outsourcing the purchasing function may induce the manufacturer to seek inexpensive but low-quality suppliers, which may in turn damage the market share of the brand name company. We use a game-theoretic approach to evaluate the option of outsourcing purchasing activities.

■ TC12

C-Room 615

Economic Models for Managing and Scheduling Capacity

Cluster: Scheduling
Invited Session

Chair: John Goodale, University of Oregon, Lundquist College of Business, Eugene, OR, United States, jgoodale@LCBmail.uoregon.edu

1 - Scheduling and Control of Individuals in Service Environments

John Goodale, University of Oregon, Lundquist College of Business, Eugene, OR, United States, jgoodale@LCBmail.uoregon.edu

In this paper we consider the employee scheduling problem in service environments in which agents are unique. We introduce a new scheduling model that accounts for individual characteristics and control. We show that solutions to the new formulation are effective in allocating service capacity based on economic performance, and we provide insights into the scheduling issues in this environment.

2 - Cross-training Policies for Parallel Service Operations with Supply Uncertainty

Fred Easton, Professor, Syracuse University, Whitman School of Management, Syracuse University, Syracuse, NY, 13244, United States, ffeaston@syr.edu

Although cross-training investments enhance the ability of service delivery systems to respond to demand uncertainty, employee absences may compromise those gains. We study the effects of absenteeism on the performance of chained cross-training policies in multi-task service delivery systems staffed with heterogeneous employees working overlapping shifts.

3 - Dynamic Model of Quality Improvement in Manufacturer-supplier Contract

Sidong Zhang, PhD Candidate, Syracuse University, 721 University Ave., Syracuase, NY, 13244, United States, szhang01@syr.edu

Usually quality is a static requirement in a contract rather than an evolving process, though quality improvement is a continuous process. This paper studies a dynamic contractual mechanism to motivate the supplier to improve quality continuously and spontaneously given price is exogenous and consumer's quality expectation is increasing. This paper studies the supplier's quality improvement decision making behavior given the dynamic contractual mechanism.

■ TC13

C-Room 616

Mixed Integer Nonlinear Programming: Theory and Computation

Sponsor: Optimization/ Integer Programming
Sponsored Session

Chair: Andrew Miller, University of Wisconsin-Madison, 3156 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, United States, amiller@engr.wisc.edu

1 - Strong Valid Inequalities for Bilinear Integer Knapsack Sets

Kwanghun Chung, School of Industrial Engineering, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States, khchung@purdue.edu, Jean-Philippe Richard, Mohit Tawarlamani

In this talk, we present strong valid inequalities for bilinear integer knapsack sets that arise as a substructure in applications such as cutting stock and trim loss. In particular, using convex extensions, we show that the convex hull for the unbounded case can be expressed as the disjunctive hull of single-term unbounded bilinear integer knapsack sets. We incorporate the derived inequalities within a branch-and-cut framework and conduct computational experiments to investigate their strength.

2 - Spatial Branch-and-bound Algorithms for MINLP

Pietro Belotti, Tepper S. of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, United States, belotti@andrew.cmu.edu, Françeois Margot, Ignacio Grossm ann, Lorenz Biegler, Jon Lee, Pierre Bonami, Andreas Waechter, Laszlo Ladanyi

We present a spatial branch-and-bound approach for solving non-convex MINLPs. A reformulation-linearization technique and an NLP solver are used to obtain a lower- and an upper bound, respectively. We describe specific branching rules and bound tightening techniques that help solving several classes of MINLP problems. We then report on our experience on a large set of both MINLP and continuous NLP instances.

3 - A Lifted Linear Programming Branch-and-bound Algorithm for Mixed Integer Conic Quadratic Programs

Juan Pablo Vielma, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, jvielma@isye.gatech.edu, Shabbir Ahmed, George Nemhauser

We develop a linear programming based branch-and-bound algorithm for mixed integer conic quadratic programs, which is based on a higher dimensional or lifted polyhedral relaxation of conic quadratic constraints introduced by Ben-Tal and Nemirovski. We present results of computational experiments on a series of portfolio optimization problems and show that the algorithm significantly outperforms commercial and open source solvers based on both linear and nonlinear relaxations.

4 - New Formulations for Optimization with Stochastic Dominance Constraints

Jim Luedtke, Georgia Institute of Technology, jluedtke@isye.gatech.edu

We present new integer and linear programming formulations for first and second order stochastic dominance constraints respectively. These formulations are more compact than existing formulations, and relaxing integrality in the first order constraints formulation yields a formulation for second order constraints, demonstrating the strength of this formulation. Computational tests illustrate the benefits of the new formulations.

■ TC14

C-Room 617

Nonlinear Programming

Cluster: Nonlinear Programming
Invited Session

1 - Interior-point Methods for Nonlinear Dynamic Optimization

Alexandre Caboussat, Assistant Professor, University of Houston, 4800 Calhoun Rd, Houston, TX, 77204-3008, United States, caboussat@math.uh.edu

Dynamic optimization problems arise when coupling a constrained optimization problem with ordinary differential equations. We present a numerical method for the simulation of the dynamics of an atmospheric aerosol particle. An implicit discretization scheme for the ordinary differential equations is coupled with a primal-dual interior-point method for the optimization problem. Extension is presented when considering a sequence of optimization problems coupled with differential equations.

2 - Euclidean Distance Matrix Completion Problems

Haw-ren Fang, Postdoctoral Associate, Univ. of Minnesota, Dept.. of Computer Science & Engineering, Minneapolis, MN, 55108, United States, hrfang@cs.umn.edu, Dianne O'Leary

A Euclidean distance matrix (EDM) is one in which the (i,j) entry is specified by the distance between particles i and j. The Euclidean distance matrix completion problem (EDMCP) is to complete a given partial matrix to make it an EDM. We survey 3 different approaches to tackling EDMCP, and advocate solving it by nonconvex optimization. To avoid local minima, we develop an initialization and a dimensionality relaxation scheme, involving a weighted version of principal component analysis.

3 - Iterative Methods for Large-scale Unconstrained Optimization

Jennifer Erway, Assistant Professor, Wake Forest University, Department of Mathematics, Post Office Box 7388, Winston-Salem, NC, 27109, United States, jerway@math.ucsd.edu, Philip Gill, Joshua Griffin

Recent advances in large-scale constrained optimization have revived interest in methods based on sequential unconstrained optimization. We consider an unconstrained optimization method that finds an approximate solution of a constrained subproblem at each iteration. The iterative trust-region solver is based on the method of sequential subspace minimization. Two alternative methods are proposed, and numerical results will be presented.

■ TC15

C-Room 618

Interior Point Method, Finite Element Method, and Inverse Optimization in Stochastic Programming

Sponsor: Optimization/ Stochastic Programming
Sponsored Session

Chair: Michael Chen, PhD Candidate, Northwestern University, 2145 Sheridan Road IEMS, Evanston, IL, 60201, United States, michael-chen@northwestern.edu

1 - Self-concordant Tree and Decomposition Based Interior Point Methods for Stochastic Convex

Michael Chen, PhD Candidate, Northwestern University, 2145 Sheridan Road IEMS, Evanston, IL, 60201, United States, michael-chen@northwestern.edu, Sanjay Mehrotra

We consider barrier problems associated with two-stage and multistage stochastic programs. We show that in their barrier forms, each objective function and barrier recourse function of any stages are self-concordant families with respect to the barrier parameter. In particular, we show that the first stage complexity value of the problem increases additively with the number of stages and scenarios.

2 - Modeling and Numerical Solution of Portfolio Optimization Problems with Transaction Costs

Zhen Liu, Assistant Professor, University of Missouri - Rolla, 1870 Miner Circle, Rolla, MO, 65409, United States, zliu@northwestern.edu, John Birge

In analogy to American option pricing, we study portfolio optimization problems through the Local Discontinuous Garlerkin Finite Element Method combined with an optimization method: We set up a buy-and-hold problem and then we find an optimal set of trades to move to an optimal portfolio whenever the current portfolio is far from the ideal. We give error bounds for the numerical method, with which we establish overall bounds for the problem and prove the convergence of this method.

3 - Inverse Stochastic Linear Programming

Gorkem Saka, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, gos2@pitt.edu, Andrew Schaefer, Lewis Ntaimo

Inverse optimization perturbs objective function to make an initial feasible solution optimal with respect to perturbed objective function while minimizing cost of perturbation. We extend inverse optimization to two-stage stochastic linear programs with a finite number of scenarios. Since the resulting model grows with number of scenarios, we present decomposition approaches for solving these problems. We anticipate that as the size of the problem increases, decomposition will become essential.

■ TC16

C-Room 619

Supply Chain Optimization

Cluster: Optimization (Invited)
Invited Session

Chair: Thomas Sharkey, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, Fl, 32611, United States, sharkeyt@ufl.edu

1 - The Static Stochastic Knapsack Problem with Normally Distributed Item Sizes

Yasemin Merzifonluoglu, Assistant Professor, Virginia Tech, Industrial and Systems Engineering Dept., Blacksburg, VA, United States, yasemin@vt.edu

Static stochastic knapsack problem requires assigning items with random sizes to a knapsack with known and fixed capacity.When the realization of the sum of selected item sizes exceeds the capacity, a penalty cost is assessed.We seek to maximize the expected net value resulting from the assignment of items.We provide an exact solution method for a linear relaxation of the problem when item sizes are independent and normally distributed, which is used in a branch-and-bound algorithm.

2 - The Economic Lot-sizing Problem with Market Selection

Wilco van den Heuvel, Assistant Professor, Erasmus University Rotterdam, Burg. Oudlaan 50, Rotterdam, ZH, Netherlands, wvandenheuvel@few.eur.nl, Joseph Geunes, Edwin Romeijn, Thomas Sharkey, Erhun Kundakcioglu, Albert P.M. Wagelmans

In the economic lot-sizing problem with market selection we are given a number of markets, where each markets has a revenue and a sequence of demands. The objective is to find the subset of markets that maximizes profit. The profit of a subset of markets consists of the revenues minus the minimum lot-sizing cost to satisfy the demands of the selected markets. We discuss the NP-completeness of the problem, and we develop polynomial time algorithms for some special cases of the problem.

3 - Optimal Pricing for Multiple Products and Customers with Different Risk Tolerence

Max Shen, Associate Professor, University of California, Department of IEOR, Berkeley, CA, 94720-1777, United States, shen@ieor.berkeley.edu, Tingting Cui

We consider a Stackleberg game between a manufacturer and a retailer. The manufacturer, as the leader, decides the wholesale prices for a set of products it offers in order to maximize total profits. The retailer decides order quantities with respect to the wholesale prices and random demands. Based on different properties of the utility function, we develop various techniques to compute the equilibrium solution.

4 - A Class of Nonlinear Generalized Assignment Problems

Thomas Sharkey, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, Fl, 32611, United States, sharkeyt@ufl.edu, Edwin Romeijn

The Generalized Assignment Problem seeks an assignment of jobs to machines that minimizes the sum of the assignment costs while respecting the capacity of each machine. We consider an extension of this problem where, along with the assignment costs, there is a nonlinear cost function associated with each machine whose argument is a linear function of the jobs assigned to that machine. We discuss heuristic approaches to solve this class of problems and analyze their performance asymptotically.

■ TC17

C-Room 620

The Design of IT Outsourcing Contracts

Sponsor: Information Systems Society
Sponsored Session

Chair: Anjana Susarla, University of Washington, asusarla@u.washington.edu

1 - Contractual Provisions to Mitigate Holdup: Evidence from Information Technology Outsourcing

Anjana Susarla, University of Washington, asusarla@u.washington.edu, Ramanath Subramanyam, Prasanna Karhade

Contractual incompleteness combined with the need for relationship-specific investments gives rise to the holdup problem in IT outsourcing. We suggest that extensibility terms in contracts reduce the holdup problem. We also find that extensibility terms are important even when contracts are well designed with respect to the extent of initial contingencies. We also test for ex post efficiency of contract design by examining contract renewals between firms and vendors.

2 - An Empirical Analysis of Contract Structures in IT Outsourcing

YuanYuan Chen, Emory University, 1300 Clifton Road, Atlanta, GA, United States, yuanyuan_chen@bus.emory.edu, Anandhi Bharadwaj

Outsourcing of IT services has received much attention in the information systems literature.However, there has been considerably less attention paid to actual contract structures used in IT outsourcing. Drawing on transaction cost, agency and relational exchange theories we hypothesize the effects of transaction and relational characteristics on the specific contractual provisions as well as on overall contract extensiveness.

3 - On Vendor Preferences for Contract Types in Offshore Software Projects: FP versus T&M Contracts

Anandasivam Gopal, Assistant Professor, University of Maryland, Smith School of Business, College Park, MD, 20910, United States, agopal@rhsmith.umd.edu, Konduru Sivaramakrishnan

Prior research has indicated that on average, offshore vendors have higher profits associated with Time and Materials (T&M) contracts than Fixed Price (FP) contracts. This research raises two questions. First, is the relative importance of various profit drivers different across two contractual regimes? Second, does it follow that vendors unconditionally prefer T&M contracts for all projects? We address these questions by using data on 93 offshore projects completed by a leading Indian vendor. We employ an endogenous switching regression framework and the program evaluation methodology to show that profit equations are distinctly different for the two contractual regimes. Using these two profit equations, we are also able to identify contingencies under which the vendor prefers a FP contract to a T&M contract. We hypothesize that the vendor's ability leverage information asymmetry about capabilities and experiences translates into the vendor preferring FP contract to secure larger information rents. Our results support this hypothesis and suggest that the vendor would prefer the FP contract for larger and longer projects with larger teams. However, vendors would prefer a T&M contract when the risk of employee attrition from the project team is high. In addition, we discuss managerial implications of these results in the paper.

■ TC18

C-Room 201

Parallel Computing and Integer Programming

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Jeff Linderoth, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706-1572, United States, jtl3@lehigh.edu

1 - Deterministic MIP: An End to Chaos in Parallel MIP

Roland Wunderling, ILOG, Ober-Eschbacher Str. 109, Bad Homburg, HE, 61352, Germany, roland@ilog.com

Traditional parallel MIP solvers have been available for a long time, yet two issues prevented them from being used by default: The requirement of expensive special hardware, and the non-reproducibility of results and run-times. Today issue 1 has been eliminated by the advent of multi-core CPUs as a standard and issue 2 by the new CPLEX deterministic parallel MIP solver. We will discuss its design and compare its performance to both sequential and traditional parallel MIP.

2 - Effectiveness of Parallel Computing for Mixed Integer Programming Using Xpress-MP

Gabriel Tavares, Consultant, Dash Optimization Inc, 560 Sylvan Avenue, Englewood Cliffs, NJ, 07632, United States, gabriel.tavares@dashoptimization.com, Alkis Vazacopoulos, Richard Laundy

Xpress-MP features sophisticated, robust algorithms to quickly and accurately solve industry's most demanding Mixed Integer Programming Problems (MIPs) with millions of variables and constraints. Xpress Parallel-MIP harnesses the power of multi-core machines to give impressive performance improvements over a large set of models. In this work we investigate the impact of using parallel computing to reduce the solution times across different types of MIPs derived from real world applications.

3 - Experiments with Solving Difficult Integer Programs on Distributed Computing Platforms

Jeff Linderoth, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706-1572, United States, jtl3@lehigh.edu, James Ostrowski, François Margot, Greg Thain

We recount our experiences in solving very difficult mixed integer programs with the help of powerful computing platforms. Our recent progress on solving the football pool problem and on computing the incidence width of Steiner Triple Systems will be discussed.

■ TC19

C-Room 203

INFORMS Computing Society Student Paper Award Winner

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: John Chinneck, Professor, Carleton University, Systems and Computer Engineering, 1125 Colonel By Drive, Ottawa, ON, K1S5B6, Canada, chinneck@sce.carleton.ca

1 - 2006 Winner: Variable-number Sample-path Optimization

Michael Ferris, Professor, University of Wisconsin-Madison, Department of Computer Sciences, 1210 West Dayton Street, Madison, WI, 53706, United States, ferris@cs.wisc.edu, Geng Deng

The sample-path method approximates the expected simulation output by the average of sample observations with a common random number sequence. We describe a new variant of the UOBYQA algorithm (Unconstrained Optimization BY Quadratic Approximation), which integrates a Bayesian Variable-Number Sample-Path scheme to choose appropriate number of samples. The statistically accurate scheme determines the number of simulation runs, and guarantees the global convergence of the algorithm.

2 - 2007 Winner

The 2007 ICS Student Paper Award winner will be publicly announced at the ICS Business meeting on Monday November 5. Come and see the details of the prizewinning work!

■ TC20

C-Room 204

Intertemporal Preferences and Decisions I

Sponsor: Decision Analysis
Sponsored Session

Chair: Enrico Diecidue, INSEAD, Bd. de Constance, 77305 Fontainebleau cedex, Fontainebleau, 77305, France, enrico.diecidue@insead.edu

1 - Discount Functions for Fitting Individual Data

Han Bleichrodt, Erasmus Universiteit, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, bleichrodt@few.eur.nl, Peter P. Wakker, Kirsten Rohde

The commonly used hyperbolic discount functions imply decreasing impatience. At the individual level there will always be some individuals who exhibit increasing impatience. Hence, to fit data at the individual level, new discount functions are needed. This paper introduces such functions, which can accommodate any degree of decreasing or increasing impatience.

2 - The Effects of Temporal Distance on Attitudes Toward Ambiguity

Ayse Onculer, INSEAD, INSEAD, Bd. de Constance, 77305 Fontainebleau cedex, Fontainebleau, 77305, France, ayse.onculer@insead.edu, Selcuk Onay, Dolchai La-Ornual

Building on a recent paradigm which emphasizes the importance of the source of ambiguity, we distinguish between outcome vagueness and probability vagueness. Then, using Construal Level Theory, we predict that temporal distance would affect attitudes towards these two types of ambiguity in different ways. In a series of experiments we found that while temporal distance does not have any effect on attitudes toward probability vagueness, it affects attitudes toward outcome vagueness considerably.

3 - Was William Burroughs a Hyperbolic Discounter? Two Tests of Dynamic Inconsistency

Daniel Read, Professor of Behavioural Economics, Durham Business School, Mill Hill Lane, Durham, DH1 3LB, United Kingdom, daniel.read2@durham.ac.uk, Shane Frederick

We describe two new and careful tests for hyperbolic discounting. Respondents chose between smaller-sooner (SS) and larger-later (LL) monetary amounts, both weeks before receiving SS, and immediately before. Hyperbolic discounting predicts more impatient shifts (from LL to SS) than impatient ones (SS to LL). In fact, however, both were equally likely. We argue that previous evidence of inconsistent planning reflected non-discounting processes not eliminated by the experimental design.

4 - Delayed Resolution of Uncertainty: Further Evidence

Enrico Diecidue, INSEAD, Bd. de Constance, 77305 Fontainebleau cedex, Fontainebleau, 77305, France, enrico.diecidue@insead.edu, Mohammed Abdellaoui, Ayse Onculer

In most real decisions a considerable time between the choice and the resolution of uncertainty may occur. We capture the impact of delayed resolution of uncertainty through the probability weighting function. We propose an elicitation of individual probability weighting functions with and without delayed resolution of uncertainty. The case of unknown time of resolution is presented. Applications and modeling implications are discussed.

■ TC21

C-Room 205

Joint Session DAS/Technology Evaluation and Assessment: Medical Technology Evaluation and Assessment I

Sponsor: Decision Analysis, Technology Evaluation and Assessment
Sponsored Session

Chair: Jeffrey Stonebraker, GlaxoSmithKline, Five Moore Drive, Research Triangle Park, NC, 27709, United States, jeffrey.s.stonebraker@gsk.com

1 - Incorporating Extrinsic Goals Into Cost-effectiveness Analyses for Technology Assessment

Gordon Hazen, Professor, Northwestern University, IEMS Department, Evanston, IL, 60208, United States, hazen@iems.northwestern.edu, Min Huang

Technology assessments that incorporate cost-effectiveness analysis typically rely on quality-adjusted life expectancy as a measure of benefit. However, personal goal-achievement milestones extrinsic to the QALY model may be important for technologies involving interventions with immediate mortality risk. In this case delayed intervention may have higher personal benefit. We explore these issues and illustrate their impacts on cost-effectiveness analyses.

2 - Eradication: Evaluating Permanent Disease Elimination as an Outcome

Kimberly Thompson, Harvard School of Public Health, 677 Huntington Ave., 3rd Floor, Boston, MA, 02115, United States, kimt@hsph.harvard.edu

This paper provides a historical and dynamic look at medical technologies for managing polio, explores the issues associated with applying static cost-effectiveness modeling approaches in the context of dynamic diseases, suggests the need for living economic models for interventions that appropriately change with time, and demonstrates important dynamics in the decisions related to eradication.

3 - Exploring the Role of Novel Biomarkers to Improve Breast Cancer Screening Strategies

Elissa Ozanne, Harvard Medical School, 101 Merrimac St., 10th Fl., Boston, MA, 02114, United States, elissa@mgh-ita.org, Yiwey Shieh, Laura Esserman

Breast cancer screening practices have made modest reductions in mortality while incurring enormous societal costs. Biomarkers associated with genetic predisposition and short-term risk promise to advance the field. To guide implementation of such markers into clinical decision-making, we employ cost-effectiveness analysis to explore possible combinations of these tests with standard screening modalities and chemoprevention.

■ TC22

C-Room 206

Decision Analysis Fundamentals

Contributed Session

Chair: Cynthia Knott Eck, Assistant Professor, Marymount University, 1000 North Glebe Road, Arlington, 22207, United States, cynthia.knott@marymount.edu

1 - How to Measure Decision Quality?

Jae-Hyeon Ahn, Professor, KAIST, Dongdaemun-Gu Chongrangri 2 Dong 207-43, KAIST, Seoul, South Korea, jahn@kgsm.kaist.ac.kr, Youngsok Bang

Despite the importance of measuring decision quality, it is not clear how to measure it in an objective way. To address the problem, we attempt to develop measurement items for decision quality using statistical factor analysis approach. For the statistical analysis, one-year executive level meeting logs in a company are used. Then we discuss how to apply this approach to measure decision quality in different business environments.

2 - Are Inconsistent Decisions Better? An Experiment with Pairwise Comparisons

Pedro Linares, Universidad Pontificia Comillas, Alberto Aguilera 23, Madrid, 28015, Spain, pedro.linares@upcomillas.es

This paper tries to contribute to the discussion on whether intransitive decisions may better represent decision makers preferences. We will focus on the multiple-criteria decision making problem, since it is one of the most usual stances where this intransitivity appears. Results from our experiment show that, when intransitivities are removed, preferences are not better represented, and therefore that the effort to do so may not be justified.

3 - Assessing Cross Cultural Risk Perception and Attitude Within Real World Decision Contexts

Gang Wang, Research Assistant, Wayne State University, Industrial and Manufacturing, 4815 Fourth St., Detroit, MI, 48201, United States, wanggang@wayne.edu, Kenneth Chelst

We describe a methodology for determining cross-cultural differences in risk perception and risk attitude. We use real-world decision scenarios to explore risk perception and attitudes for both financial and time measures. To assess the impact of culture, we administer questions from the well-established Globe study. We discuss the statistical tools used to analyze the data, the value of follow-up interviews, and present some findings from a survey of automotive engineers in the US and China.

4 - Integrating Location and Scheduling Decisions for International Industrial Plant EngineeringProjects

Dirk C. Mattfeld, Prof. Dr., Technical University of Braunschweig, Abt-Jerusalem-Str. 4, Braunschweig, DE, 38106, Germany, d.mattfeld@tu-bs.de, Jiayi Yang

International industrial plant engineering projects have to satisfy a given local content requirement. Under this restriction decisions on production locations on the components of the plant must be made. The location decisions taken directly influence project scheduling. We propose a mathematical model minimizing the total project costs. The model is evaluated by computational experiments on real-world as well as benchmark data using CPLEX.

5 - Using AHP to Rate Celebrity Endorsers Across Industries to Consider Differences in Criteria Weights

Cynthia Knott Eck, Assistant Professor, Marymount University, 1000 North Glebe Road, Arlington, 22207, United States, cynthia.knott@marymount.edu, James Ryerson

Six AHP models were developed to compare criteria weights and celebrity ratings with respect to three different industries; based on the amount of money they spend on marketing their products. We aim to determine if there is a difference amongst celebrity ratings based on which industry a company is in and which products they are marketing. We will hypothesize as to why there may or may not be differences in celebrity ratings across industry and product type.

■ TC23

C-Room 208

Risk Analysis I

Contributed Session

Chair: Aditya Saharia, Associate Professor, Fordham University, School of Business, 113 W. 60th Street, New York, NY, 10023, United States, saharia@fordham.edu

1 - Uncertainty Analysis of Dynamical Event Network for Workplace Safety

Ming Yu, Xi'an Jiaotong University, the Management School, Xianning West Road 28, Xi'an, 710049, China, hhhhym@yahoo.com.cn, Linyan Sun

This paper relates to theoretical studies on event network, socio-technical system, and uncertainties. Dynamical event network is based on probability wave and event tree analysis. Socio-technical system is applied to dynamical event network. The paper focuses on construction of dynamical event network, which is basic for workplace safety analysis. The optimization of structure and output of safety event network is crucial, which includes event relation and probability wave coherence analysis.

2 - Integrated Security Management in Service Enterprise Networks

Xiangyang Li, Assistant Professor, University of Michigan-Dearborn, 2260 EC, 4901 Evergreen Road, Dearborn, MI, 48128, United States, xylum@umich.edu, Yung-Wen Liu

This proposition focuses on a new security centric management theme for service enterprises. Firstly, we refine the preliminary security taxonomy to investigate the entirety of security concerns and their interaction with the underlying enterprise structure. Then we utilize dependency modeling to bridge referential representation and hybrid probabilistic modeling. Lastly, quality assurance is achieved by adaptive knowledge integration guided by updated entropy, complexity and utility scores.

3 - Employment Loss Analysis Model (ELAM)

Jeesang Jung, Graduate Student, University of Virginia, Dept.. of Systems and Information Engnr, 151 Engineer's Way, Charlottesville, VA, 22904, United States, bok_snoopy@yahoo.com, Joost Santos, Yacov Haimes

The ELAM scrutinizes employment losses using the IIM's output on economic inoperability as input. This model uses the simple linear relationship between the industry value-added and employment; the relationship is derived from the Constant Elasticity of Substitution (CES) production function. The employment loss data provided by ELAM is expected to be higher than actual losses because the model assumes that the labor market is completely flexible, which is not true in the real economy.

4 - Operations Analysis Credentialing

Michael S. McCoy, Boeing Technical Fellow, Boeing Company, Operations Analysis, P.O. Box 516, M/C S270-3760, St. Louis, MO, 63166, United States, michael.s.mccoy@boeing.com, Robert L. Simons

Boeing is developing a credentialing program to link Operations Analysis (OA) company-wide, by defining education, training, and experience. Standardizing criteria for Operations Analysts across the enterprise benefits both the company's internal and external customers. Formalizing credentialing promotes cross-location trust in the uniform quality of OA professionals, regardless of geographic location in the Company, thus encouraging project portability, rather than personnel relocation to respond to the fluctuating workload among US and international Boeing sites. An Operations Analysis credentialing program provides the mechanism for linking Operations Analysis, across the enterprise, through an education, training, and professional development approach. Defining the knowledge, skills, and abilities necessary for Operations Analysis credentialing at multiple levels, can promote the future development, application, and growth of Operations Analysis across the larger community. The Boeing Company is currently developing such a corporate credentialing process. Developing a common criterion for Operations Analysts across an enterprise provides enormous benefits for the enterprise, and the larger Operations Analysis stakeholder community. By establishing the foundation for Operations Analysis credentialing, the enterprise can formalize the framework and underpinnings necessary to encourage and evolve cross-location recognition and acceptance of Operations Analysis knowledge, skills, and expertise. This approach links with technical professional development activities and will evolve towards a truly enterprise-wide Operations Analysis profession that contributes to all aspects of the enterprise's product and service offerings. In summary, only through credentialing and professional development activities can the enterprise appreciate the full value of an Operations Analysis Profession applying Operations Analysis expertise, enterprise-wide.

5 - The Impact of ERP Systems on the Internal Audit Function

Aditya Saharia, Associate Professor, Fordham University, School of Business, 113 W. 60th Street, New York, NY, 10023, United States, saharia@fordham.edu, Bruce Koch

From an internal audit perspective, enterprise systems have created new opportunities and challenges in managing internal as well as external risks. In this work, we report result of a survey of internal auditors' perception of changes in their ability to identify and manage operational, financial, technological, compliance and other risks.

■ TC24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations

Invited Session

1 - Frontline Systems, Inc. - Robust Optimization, Stochastic Programming, and Simulation Optimization Made Easy

Daniel Fylstra, President, Frontline Systems Inc., P.O. Box 4288, Incline Village, NV, 89450, United States, dfylstra@frontsys.com

What's the best way to optimize models with uncertainty? Simulation optimization is flexible, but not scalable to large models. Stochastic programming is less flexible but more scalable, and supports recourse decisions. Robust optimization is very scalable to large models, but has been hard to implement. See how Premium Solver Platform makes all of these methods easily usable in Microsoft Excel, in one unified framework.

2 - SAS Higher Education Consulting - Turning Data into Information with SAS Enterprise Miner

Susan Walsh, SAS Higher Education Consulting, SAS Campus Dr., Cary, NC, 27513, susan.walsh@sas.com

It has been estimated that the amount of data in the world has been doubling every 18 to 24 months. Multi-gigabyte databases are now commonplace. In order to turn this data into information, data mining is used in industry in a number of areas, including but not limited to credit scoring, customer churn, fraud detection and donations analysis. This presentation will introduce SAS Enterprise Miner with an emphasis on its use for predictive modeling.

■ TC25

C-Room 210

Advanced SPC for Profile Monitoring (I)

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Judy Jin, University of Michigna, Industrial & Operations Engineering Dept., Ann Arbor, MI, 48109, United States, jhjin@umich.edu

Co-Chair: Yong Lei, Industrial and Operations Engineering, University of Michigan, Ann Arbor, MI, 48109, United States, ylei@umich.edu

1 - SPC for Monitoring Nonlinear Profiles Using Wavelets and B-splines

Shing Chang, Associate Professor, Kansas State University, Industrial and Manufacturing Systems Eng, changs@ksu.edu

A statistical process control framework is proposed to monitor nonlinear profiles. The proposed methodology aims at identifying mean shifts or the shape changes in a profile. Discrete wavelet transformation (DWT) is applied to separate variation or noise from profile contours. A B-spline model is then used to further reduce problem dimension.

2 - Decomposition and Compression of Multivariate Data Using Diffusion Wavelets

Poornima Balakrishna, Doctoral Student, Systems Engineering and Operations Research, George Mason University, Fairfax, VA, 22030, United States, pbalakri@gmu.edu, Rajesh Ganesan

This talk will present the steps to perform wavelet decomposition of multivariate data. We also present a strategy where the methodology can be applied to mitigate the curse of dimensionality in reinforcement learning approaches via function approximation.

3 - Bayesian Hierarchical Model for Integrating Multi-resolution Data
Haifeng Xia, PhD Candidate, Texas A&M, 238 Zachry, 3131 TAMU, College Station, TX, 77840, United States, haifeng_xia@neo.tamu.edu, Yu Ding, Bani Mallick

We present a Bayesian hierarchical model for integrating multi-resolution data. It includes a Gaussian process to model low-resolution data and a neighborhood linkage model to bridge the multi-resolution datasets. The Bayesian hierarchical framework utilizes information at all the resolution levels and predicts better at locations where only low-resolution measurements are available or no measurements are available. Improvements are demonstrated using metrology datasets of two resolutions.

4 - Phase I Analysis for Monitoring Nonlinear Profiles in Manufacturing Processes
Li Zeng, Department of Industrial and Systems Engineering, University of Wisconsin-Madison, Madison, WI, 53706, United States, lzeng1@wisc.edu, Yu Ding, Shiyu Zhou

The high dimensionality and data contamination present a challenge to the Phase I analysis of nonlinear profiles. This paper presents a strategy which constitutes a data reduction component that projects the original data into a lower dimension subspace and a data separation technique that detects single and multiple shifts as well as outliers in the data.

■ TC26

C-Room 211

Joint Session DM/ICS/Computational Methods for Data Mining: Math Programming in Data Mining

Sponsor: Data Mining (Sponsored), INFORMS Computing Society, Computational Methods for Data Mining
Sponsored Session

Chair: Paul Brooks, VCU, Dept.. of Stat. Sci. and O.R., P.O. Box 843083, Richmond, VA, 23284, United States, JPBrooks@vcu.edu

1 - Robust Support Vector Machine Training via Convex Outlier Ablation
Linli Xu, University of Alberta, AICML lab, Dept.. of Computing Science, University of Alberta, Edmonton, AB, Canada, linli@cs.ualberta.ca

One of the well known risks of support vector machines (SVMs) is their sensitivity to outliers. These risks are normally mitigated by using a soft margin criterion. In this paper, we present a more direct approach that explicitly incorporates outlier suppression in the training process. In particular, by expressing a convex relaxation of the joint training problem as a semidefinite program, one can robustly train an SVM while suppressing outliers.

2 - Optimization Algorithms for Large Scale Web Classification
S. Sathiya Keerthi, Yahoo! Research, 2821 Mission College Blvd., Santa Clara, CA, 95054, United States, selvarak@yahoo-inc.com

Large scale classification problems routinely arise in many web applications; these are usually approached using support vector machine and maximum entropy models. The training of any one of these models involves the solution of an optimization problem involving a large number of variables and a large number of loss terms. This talk will focus on issues associated with these problems and discuss effective schemes for solving them.

3 - A Subgradient Approximation to LP-based Rank Optimization for Problems with Binary Output
Kaan Ataman, Assistant Professor, Chapman University, One University Drive, Orange, CA, 92866, United States, ataman@chapman.edu, Nick Street

Many real-world problems with binary outputs require predictive models that successfully order cases relative to each other. A general family of rank optimization algorithms that maximizes the area under the ROC curve require quadratic number of constraints with respect to the number of cases, limiting its application to moderate and large problems. We propose a subgradient approximation for formulations in the form of an LP, that significantly reduce the solving times for large datasets.

4 - Robust Support Vector Machines via Integer Programming
Paul Brooks, VCU, Dept.. of Stat. Sci. and O.R., P.O. Box 843083, Richmond, VA, 23284, United States, JPBrooks@vcu.edu, Romy Shioda

Support Vector Machines (SVMs) are a popular mathematical programming-based method for classification. This talk explores robust formulations of SVMs that are less sensitive to outliers than traditional formulations. The robust formulations involve the use of discrete optimization. Solution strategies and implemetations are described, and computational results are presented.

■ TC27

C-Room 212

Service Industry I

Contributed Session

Chair: Suman Mallik, University of Illinois, 1206 South Sixth Street, Champaign, IL, 61820, United States, mallik@uiuc.edu

1 - Including Coordination Effects in a Queueing Network Model of a Business Process
Lixiang Jiang, Research Assistant, Florida International University, 10555 West Flagler St, Miami, FL, 33174, United States, lixiang.jiang@gmail.com, Ronald Giachetti

parallelization usually requires greater coordination of activities. Analytical models such as queueing networks generally ignore any changes in work due to human factors. In this paper we build a model to incorporate an estimation of the coordination work as a function of the process structure into an open queueing network model. We demonstrate the model by analyzing a health care scenario and discuss implications for the trade-off between greater parallelization and coordination.

2 - Performance Evaluation of Metro Stations in Shanghai
Wenjun Gu, PhD Student, University of Illinois Urbana-Champaign, Department of Business Administration, 350 Wohler Hall, 1206 S. 6th St., Champaign, IL, 61820, United States, wenjun.gu2@gmail.com, Sanjeev Bordoloi

Metro stations in Shanghai differ in size, structure and general operations. We studied the metro system in Shanghai from service contacts perspective and conducted a performance evaluation of selected stations using Data Envelopment Analysis. In this paper, we present our results and some managerial insights of our analysis.

3 - In Quest for Excellence in Flight by PCPA (Passenger Cabin Patrol Audit)
Youn Sung Kim, Professor, Inha University, 253 Yonghyun-Dong Nam-Gu, Incheon, 402-751, Korea, Republic of, younsung.kim@marshall.usc.edu, Chi Min Lee

The focus of this study is on developing a service quality audit system through analyzing service processes of airlines' cabin service. We developed PCPA(Passensger Cabin Patrol Audit), a cabin service process oriented customer survey derived from cabin service blueprint. PCPA consisted of questions on 11 stages of walk-through audits. We can suggest the cabin service quality improvement strategy to the airline company by use of this PCPA method.

4 - Platform Identification for Service Family Design Using a Coalitional Game
Seung Ki Moon, Graduate Research Assistant, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States, moonsky@psu.edu, Soundar Kumara, Jun Shu, Timothy Simpson

In this paper, we extend principles from product family design into new service development and introduce a new methodology to identify a module-based platform for service family design using service-based process analysis and a game theoretic approach. We employ a coalitional game to determine strategic equilibrium solutions for platform design in a given service family. To demonstrate implementation of the proposed methodology, we use a case study involving a family of banking services.

5 - Managing On-air Ad Inventory in Broadcast Television
Suman Mallik, University of Illinois, 1206 South Sixth Street, Champaign, IL, 61820, United States, mallik@uiuc.edu, vSrinivas Bollapragada

Motivated by the experiences of NBC, we present a model for managing the on-air ad inventory in broadcast television. The ad inventory in this industry is priced based on rating points or the number of viewers that watch a commercial. A television network often sells a substantial amount rating points before the broadcast season when neither the performance of its shows nor the spot market price is known. Our model describes an optimal way of achieving this.

■ TC28

C-Room 213

Data Structures in Constraint Programming

Sponsor: INFORMS Computing Society / Constraint Programming and Optimization
Sponsored Session

Chair: Irit Katriel, Post Doc, Brown University, 115 Waterman st., Providence, RI, United States, irit@cs.brown.edu

1 - A Constraint Store Based on Multivalued Decision Diagrams
John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu, Henrik Reif Andersen, Tarik Hadzic, Peter Tiedemann

A typical domain store propagates a limited amount of information. We propose a richer constraint store in the form of a limited-width multivalued decision diagram (MDD). It reduces to a traditional domain store for width 1 but allows greater pruning of the search tree for larger widths. We define MDD consistency as an extension of generalized arc consistency. We propose specialized propagation algorithms for alldiff and inequality constraints and report computational experiments.

2 - Propagating Knapsack Constraints in Sublinear Time
Meinolf Sellmann, Assistant Professor, Brown University, sello@cs.brown.edu, Pascal Van Hentenryck, Eli Upfal, Irit Katriel

We develop an efficient incremental version of an existing cost-based filtering algorithm for the knapsack constraint. On a universe of n elements, m invocations of the algorithm require a total of O(n log n+mk log(n/k)) time. We show that the expected value of k is significantly smaller than n on several interesting input distributions. After a theoretical study, we introduce heuristic enhancements and demonstrate the new algorithm's performance experimentally.

3 - Filtering Algorithms for the Sequence Constraint
Willem-Jan van Hoeve, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, United States, vanhoeve@andrew.cmu.edu, Louis-Martin Rousseau, Ashish Sabharwal, Gilles Pesant

We consider the sequence constraint, that appears in many applications such as car manufacturing and nurse scheduling. We present several filtering algorithms in the context of constraint programming: One is based on a regular-language representation, while another applies a specific accumulating data structure. The latter algorithm is the first to achieve complete filtering in polynomial time. We also provide experimental results showing their effectiveness.

4 - Compiling Constraint Networks into and/or Multi-valued Decision Diagrams (AOMDDs)
Rina Dechter, University of California, Irvine, dechter@ics.uci.edu, Robert Mateescu

We augment Ordered Decision Diagrams with AND nodes, to capture function decomposition structure yielding AND/OR multivalued decision diagram (AOMDD). AOMDDs compile a constraint network into a canonical form supporting polynomial time solution counting, enumeration and equivalence queries. The AOMDD size, generation time and space are exponentially bounded by the model's treewidth. AOMDDs can also be extended to compile optimal solutions in a combinatorial optimization problem.

■ TC29

C-Room 214

Joint Session OS/ICS: Innovation in Network Flows and Very Large-Scale Neighborhood Search

Cluster: Optimization /Computational Optimization and Software, INFORMS Computing Society
Invited Session

Chair: Doug Altner, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States, daltner@isye.gatech.edu

1 - Efficient Algorithms for the Constrained Maximum Flow Problem
Cenk Caliskan, Assistant Professor, University of Delaware, Department of Business Administration, 236 Alfred Lerner Hall, Newark, DE, 19711, United States, caliskanc@lerner.udel.edu

The constrained maximum flow problem is to send the maximum flow from a source to a sink in a directed network subject to a constraint that the total cost of the flow can be at most D. We present a specialized network simplex algorithm and a polynomial time double scaling algorithm. We then present the results of the computational tests that involve both algorithms and the existing ones. Computational tests prove that the proposed algorithms are faster than the existing algorithms.

2 - VLSN Search Approach for Load Planning Problem at Intermodal Rail Terminal
Ashish Nemani, Research Assistant, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32608, United States, aknemani@ufl.edu, Krishna Jha, Ravindra Ahuja

The load planning problem at a rail terminal is to assign containers and trailers to the scheduled trains to maximize the train utilization. We formulate the problem as a multicommodity flow problem on an underlying network. We solve the problem using two variants of very large scale neighborhood search heuristics. We present the computational results comparing heuristics and exact approaches.

3 - Modular Abstract Self-learning Tabu Search
Michael Ciarleglio, University of Texas at Austin, Austin, TX, United States, michael.ciarleglio@gmail.com, J. Wesley Barnes

A general-purpose optimization engine, MASTS (Modular Abstract Self-Learning Tabu Search), employs advanced tabu search techniques including dynamic neighborhood selection and rule based objectives. The MASTS framework includes tools for solution archiving and parallel computations, and can be adapted to a variety of multi-criteria problems. In conservation planning for endangered species, MASTS incorporates novel methods for optimizing the geometric layout of conservation areas.

4 - The Maximum Flow Reoptimization Problem
Doug Altner, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States, daltner@isye.gatech.edu, Ozlem Ergun

Given a master network and an extraordinarily long sequence of subnetworks that will be revealed in an online fashion, how should one heuristically compute the value of the maximum flow in each sub-network as quickly as possible? In this talk we will identify a plethora of non-trivial applications from a diverse range of problems, discuss our heuristics and present computational results.

■ TC30

C-Room 2A

Techometrics Paper Session on Variable Selection

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Randy Sitter, Professor, Simon Fraser University, Dept. of Statistics & Act. Sci., Burnaby, BC, V5A1S6, Canada, sitter@stat.sfu.ca

1 - An Efficient Variable Selection Approach for Analyzing Designed Experiments
Ming Yuan, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, GA, United States, myuan@isye.gatech.edu

The analysis of experiments where a large number of potential variables are examined is driven by the principles of effect sparsity, effect hierarchy, and effect heredity. We propose an efficient variable selection strategy to specifically address the unique challenges faced by such analysis. The proposed methods are very fast to compute and can find sparse models that better satisfy the goals of experiments.

2 - Variable Selection for Gaussian Process Models in Computer Experiments
Derek Bingham, Simon Fraser University, Dept.. Statistics and Actuarial Science, 8888 University Dr., Burnaby, BC, Canada, dbingham@stat.sfu.ca, Crystal Linkletter, Dave Higdon, Nick Hengartner, Kenny Ye

Simulation of complex phenomena often requires a large number of inputs and is computationally expensive. Identifying the inputs that most impact the system can be a critical step. Here, we introduce a new, simple method for identifying active factors in Gaussian process models for computer screening experiments. The posterior distribution of an inert factor is used as a reference distribution against which the importance of true experimental factors can be assessed.

3 - Darwinian Evolution in Parallel Universes: A Parallel Genetic Algorithm for Variable Selection
Mu Zhu, Associate Professor, University of Waterloo, 200 University Ave W, Waterloo, ON, Canada, m3zhu@uwaterloo.ca, Hugh Chipman

In many applications, it is desirable to identify a few important variables that affect a certain outcome of interest. The genetic algorithm (GA) seems a natural tool for solving such a problem. In this talk, I will first demonstrate that the GA is actually not terribly effective for such a purpose. I will then propose a simple twist. The idea is to run a number of GAs in parallel without allowing each GA to fully converge, and to consolidate the information from the individual GAs in the end.

■ TC31

C-Room 2B

Robust Design

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Dan Frey, Associate Professor, MIT, 77 Mass. Ave., Room 3-449D, Cambridge, MA, 02139, United States, danfrey@MIT.EDU

1 - Taguchi's Approach to Robust Parameter Design: A New Perspective

Roshan Vengazhiyil, Assistant Professor, Georgia Tech, Groseclose 0205, Room 337, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, roshan@mailhost.isye.gatech.edu

Adjustment factors play a crucial role in Taguchi's approach to robust parameter design. However, the notion of adjustment factors is not well defined and ambiguities exist in the selection of those factors. In this article, we propose a criterion for selecting adjustment factors. This new criterion can be used to explain and extend Taguchi's approach. The concept is illustrated using two examples.

2 - Robust Fixture Layout Design with Consideration of Datum Features Uncertainty

Jianjun (Jan) Shi, Professor, U. of Michigan, 1205 Beal Avenue, IOE 1784, Ann Arbor, MI, 48109, United States, shihang@umich.edu, Judy Jin, Jian Liu

Dimensional variations of datum features will lead to improper location of parts and subassemblies. This research develops a methodology to achieve robust fixture layout design for multistage manufacturing processes, which considers the datum features uncertainty to consistently provide the best performance. A robust design methodology and case study are presented.

3 - Perspectives on Robust Design

Kailash Kapur, Professor, University of Washington, Industrial Engineering, Seattle, WA, 98195, United States, kkapur@u.washington.edu

If we define robustness as excellent performance or continuous survival under changing and uncontrollable factors or under factors that are not controlled or managed using rational decisions, then achieving robustness is a natural process for any physical or biological system. Some perspectives on the philosophy of robustness using examples related to reliability, product design and organizational design will be presented.

4 - Single Array Designs for Robustness Studies

Lulu Kang, PhD Student, H. Milton Stewart School of Industrial and Systems Engineering, 350440 Gatech Station, Atlanta, GA, 30332, United States, lulu@gatech.edu, Roshan Vengazhiyil

In robust parameter design, single array designs usually have much smaller run size than the cross array designs and thus are more economical. But designing efficient single arrays is hard, because it is very important to estimate interactions between control and noise factors for parameter design. In this work we show that the importance of effects and hierarchy of effects are two different concepts and propose a Bayesian approach to integrate the two concepts in the design of single arrays.

■ TC32

C-Room 302

Business Applications I

Contributed Session

Chair: Chunyang Tong, Assistant Professor, Shanghai University of Finance and Economics, Guoding 777, SIBA, Shanghai City, 200433, China, tongchunyang@gmail.com

1 - The Role of Load Planning in a Warehouse Management System

Robert Haessler, Emeritus, University of Michigan, P.O. Box 2836, Ann Arbor, MI, 48106, United States, robertwh@umich.edu, Brian Talbot

This paper describes the development of a load planning system for trailer shipments of low density products and the role it plays in improving labor productivity when used in conjunction with a warehouse management system. The source of the improvement in productivity is the uncoupling of a shipment and an individual loader who is responsible for completely loading that shipment.

2 - Modeling Postponement in a Multi-commodity Production-distribution Model Using Inventory Ranks

Brijesh Rao, Research Associate, Industrial Distribution, Texas A&M, 3367 TAMU, College Station, United States, brijesh@entc.tamu.edu, Senthil Gunasekaran, Praveen Kuttuva, Barry Lawrence, Sivakumar Sellamuthu

A billion-dollar industrial distributor has about 50 locations in the United States and stocks about 25,000 different SKUs. The company uses postponement strategies - not all SKUs are stocked at all locations, and transshipment occurs as needed on an internal trucking network. We present a methodology that uses inventory ranks to determine sourcing locations for each SKU–location combination. We use the resulting information in a multi-commodity production-distribution network design model.

3 - Shift Consolidation on the Ski Mountain

Nan Zhou, Centre for Operations Excellence, Sauder School of Business, University of British Columbia, 209, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, nan.zhou@coe.ubc.ca, Anjali Awasthi, Derek Atkins, Maurice Queyranne

Operations at ski hill resorts are highly dependent on short shifts, ranging only a few hours. With the increasing maturity of these industries the cost of contractual employee hiring is significant. We were approached by a ski resort owner to investigate the opportunity of creating more permanent positions by combining short term positions, often in very different departments (e.g. food and ski rentals), into full working positions. This talk presents the results of this case study.

4 - Do Quit Your Day Job: Optimal Timing of Conversion from Corporate to Entrepreneurial Employment

David Croson, Associate Professor, SMU Cox School of Business, 333 Fincher, 6212 Bishop Blvd, Dallas, TX, 75275, United States, dcroson@cox.smu.edu

This paper derives an optimal-control method of analyzing entrepreneurial decisions -- a research area dominated by qualitative methods. Given that the entrepreneur works at her day job to build capital for her startup, when should she quit to launch it? I show entrepreneurs quit sooner than optimal, with predictably poor results. Comparative statics show, surprisingly, that paying higher wages will not help retain employees; faster capital accumulation trumps the incentive to stay in the job.

5 - On Dynamic Control of Renewable Assets

Chunyang Tong, Assistant Professor, Shanghai University of Finance and Economics, Guoding 777, SIBA, Shanghai City, 200433, China, tongchunyang@gmail.com

In this paper, we will discuss the dynamic control on arrival rates of a multi-server system. We study the value of dynamic control and compare it with performance with a static control. In particular, we identify a condition such that a dynamic control policy is justified. We further characterize the property of dynamic policy and discuss some approximation method to solve large sized problem. We will discuss some extention at the end of the presentation.

■ TC33

C-Room 303

Maritime and Port Operations

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Diego Klabjan, University of Illinois at Urbana-Champaign, 205 North Mathews Avenue, Urbana, IL, 61801, United States, klabjan@uiuc.edu

1 - Multi-ship Crane Sequencing with Yard Congestion Constraints

Diego Klabjan, University of Illinois at Urbana-Champaign, 205 North Mathews Avenue, Urbana, IL, 61801, United States, klabjan@uiuc.edu, David Simchi-Levi, Shawn Choo

Crane sequencing in container terminals determines the order of ship discharging and loading jobs that quay cranes perform. The yard congestion constraints are relaxed in the spirit of the Lagrangian relaxation so that the problem decomposes by vessel into smaller sub-problems solved by branch-and-price. An efficient primal heuristic is designed. Computational experiments reveal that we are able to solve very large problems in a reasonable computational time.

2 - Liner Shipping Alliances and the Theory of the Core

Richa Agarwal, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, United States, ragarwal@isye.gatech.edu, Ozlem Ergun

Alliance formation among liner shipping carriers is common. Carriers form strategic alliances by pooling their ships and operating them together to gain economies of scale, extend customer base and increase asset utilization. We design a mechanism to allocate benefits, costs and capacity on the ships among the carriers in an alliance . Further we utilize notions from game theory, specifically the notion of the core of a game, to study the fairness of the allocation provided by our mechanism.

■ TC34

C-Room 304

Network Behavior Modeling with Uncertainty

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: S. Travis Waller, Assistant Professor, Department of Civil Engineering, University of Texas, Earnest Cockrell Jr. Hall, 6.204, Austin, TX, 78712, United States, stw@mail.utexas.edu

1 - Exploiting Network Characteristics and Driver Knowledge for Effective Traffic Routing

Srinivas Peeta, Professor, Purdue University, Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, peeta@purdue.edu, Alexander Paz

Network and behavioral characteristics are exploited looking for opportunities to enhance the effectiveness of a behavior-consistent traffic routing framework while testing the sensitivity of the model to the use of different control paradigms. Different information-based control paradigms are formulated and experiments are conducted to compare the effectiveness and stability of the behavior-consistent framework.

2 - Network Flow Under Information Provision

Avinash Unnikrishnan, Graduate Research Assistant, The University of Texas at Austin, 1 University Sta. C1761, ECJ Hall 6.2, Austin, TX, 78731, United States, avinash@mail.utexas.edu

A formulation for the user equilibrium problem where users learn the state of the outgoing arcs when they reach the upstream node is provided. A solution algorithm and numerical results will be presented. Formulation of the system optimal variant of the above problem will also be presented.

3 - An Algorithmic Framework for Mixed Logit Assignment

Patrice Marcotte, University of Montreal, Department of Computer Science and OR, C.P. 6128, Succursale Centre-Ville, Montreal, QC, H3C 3J7, Canada, marcotte@iro.umontreal.ca, Cinzia Cirillo, Fabian Bastin

The assignment procedure associated with mixed logit models involves the evaluation of a complex integral that is usually performed by simulation. In this presentation, we introduce alternative algorithms that exploit the decomposition of the problem into its deterministic and stochastic components, within the general framework of quasi Monte-Carlo methods. Applications to urban transportation and revenue management will be discussed.

4 - User Equilibrium Under Operational Demand-side Uncertainty

Avinash Unnikrishnan, GRA, The University of Texas, 1 University Station c1761, ECJ Hall suite 6.2, Austin, TX, 78712, United States, avinashu@gmail.com, S. Travis Waller, Steven Boyles

A novel traffic equilibrium problem is introduced to model the effect of day-to-day demand uncertainty, in which travelers are unaware of the true travel demand before making their path choices. Basic solution properties (such as existence and uniqueness) are explored, as are basic algorithms for finding such an equilibrium.

■ TC35

C-Room 305

Air Transport and OR: New Approaches

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Eric Delmelle, Assistant Professor, University of Idaho, Department of Geography, McClure Hall 203, Moscow, ID, 83844, United States, delmelle@uidaho.edu

1 - The Maximum Visibility/Shortest Path Problem Applied to Routing of UAVs

Eric Delmelle, Assistant Professor, University of Idaho, Department of Geography, McClure Hall 203, Moscow, ID, 83844, United States, delmelle@uidaho.edu, Irene Casas

A bi-objective problem known as the maximum visibility/shortest path, applied to routing of Unmanned Aerial Vehicles (UAVs) is presented. The inputs are a network and an elevation model of the underlying terrain. The network is constructed to reflect the terrain topography i.e., greater density where there is a strong variation in altitude. With the built network, heuristic techniques are applied to solve the bi-objective problem.

2 - Scheduled Maintenance Planning for a Per-seat On-demand Air Transportation Service

Gizem Keysan, Georgia Tech, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, gizem@gatech.edu, George Nemhauser, Martin Savelsbergh

Our study focuses on two aspects of maintenance planning without fixed flight schedules: the long-term capacity decisions for the maintenance facility and the short-term decisions regarding the jets to be maintained. The aim is to use the maintenance cycle of the jets efficiently while providing a smooth workflow into the maintenance facility and ensuring the capacity of the facility is not exceeded. We use a look ahead strategy over a rolling time horizon to determine the jets to be maintained.

3 - The Dial-a-flight Problem: Computing Bounds for an Expanded Multi-commodity Flow Formulation

Faramroze Engineer, Georgia Institute of Technology, United States, fenginee@isye.gatech.edu, George Nemhauser, Martin Savelsbergh

We investigate a column generation re-formulation of the dial-a-flight problem in which the main challenge is solving the pricing problem. Due to the size of the networks representing possible jet itineraries and the side constraints that need to be satisfied, solving the pricing problem, a constrained shortest path problem, is intractable with standard labeling schemes. We use a multi-layered, dynamic labeling algorithm that exploits problem specific structure to solve the pricing problem.

4 - On-demand Jets: An Approach for Solving the Acceptance/Rejection Problem

Satish Ukkusuri, Assistant Professor, Rensselaer Polytechnic Institute, 4032 JEC, Troy, NY, 12180, United States, ukkuss@rpi.edu, Wilfredo Yushimito

This talk will discuss a new formulation for solving the scheduling problem of On-Demand jets considering the acceptance/rejection of requests. An important problem that has not been addressed so far is whether or not to accept a request which is consequent with initial scheduling. This paper proposes a simple heuristic that benefits from the savings that can be obtained by using hard time windows. Numerical results on test networks are presented.

■ TC36

C-Room 306

Urban Transportation Planning Models VIII: Freight and Logistics

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Qisheng Pan, Associate Professor, Texas Southern University, Dept. of Urban Plnng & Env Policy, Houston, TX, United States, pan_qs@tsu.edu

1 - Planning Models for City Logistics

Teodor Gabriel Crainic, University of Quebec in Montreal, Ecole des Sciences de la Gestion, C.P. 8888, succ. Centre-Ville, Montreal, QC, H3C3P8, Canada, theo@crt.umontreal.ca

We address planning issues in two-tier City Logistics systems. We focuss on models for the short-term planning of operations, which may also be part of system-evaluation procedures. We'll devote most of the talk to routing issues, models, and solution procedures.

2 - Modeling Biofuel Supply Chains with Real-world Geographies and Supply Uncertainty

Yueyue Fan, Assistant Professor, University of California, Department of CEE, Davis, CA, 95616, United States, yyfan@ucdavis.edu

Design of biofuel infrastructure is dependent on the geography of uncertain supply and demand. A stochastic MINLP model is developed to design biofuel production and delivery infrastructures with real-world geographies and uncertainties.

3 - A Unified Approach to State Freight Flow Model Development

Peerapol Sittivijan, Oklahoma State University, Stillwater, OK, United States, peerapol.sittivijan@okstate.edu, Sandeep Srivathsan, Charu Ojha, Jiahui Wang

We present an approach that considers regional and with-in state freight flows in a unified manner. We develop a code-mapping scheme to relate commodity categories to industrial sectors. Using the code-mapping scheme and the population and employment data in each county, we split the attraction and production freight flows from state to county level. The flow assignment of combined regional-state freight movement will be used to identify paths with high freight flow at the county level.

4 - Freight Assignment Mechanisms: Methodology and Case Study
Qisheng Pan, Associate Professor, Texas Southern University, Dept. of Urban Plnng & Env Policy, Houston, TX, United States, pan_qs@tsu.edu

This paper compares methodology and performance of four different kinds of freight assignment mechanisms, including the simple all-or-nothing assignment, user-equilibrium assignment (SUE), feedback loop between distribution and assignment (LDA), and the advanced combined distribution and assignment (CDA). It uses the freight movement in Southern California as empirical case to examine these mechanisms.

■ TC37

C-Room 307

Analysis for Nation Building

Sponsor: Military Applications
Sponsored Session

Chair: Greg Parlier, Dr., SAIC, 255 Avian Lane, Madison, AL, 35758, United States, GREG.H.PARLIER@saic.com

1 - VV&A of Large PMESII Simulations
Dean Hartley, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States, DSHartley3@comcast.net

Simulations used to model nation building and other operations where political, military, economic, social, information, and infrastructure (PMESII) factors are relevant stretch the boundaries of scientific knowledge. Consequently verifying, validating and accrediting (VV&A) are difficult tasks. This presentation covers the results of a recent project for DARPA on VV&A of a large PMESII simulation.

2 - Snapshot of USG Civilian Capabilities to Support Reconstruction and Stabilization
Martin Lidy, Research Staff Member, Institute for Defense Analyses, 4850 Mark Center Drive, Alexandria, VA, 22311, United States, mlidy@ida.org

A number of recent directives and transformation initiatives are intended to improve the U.S. Government (USG) capabilities to carry out the President's transformational diplomacy and reconstruction and stabilization policies outlined in the current National Security Strategy. This snapshot describes the USG civilian capabilities that are emerging from this process and some of the challenges to successful implementation.

3 - Community-Level Peacebuilding
Vicki Johnston, SAIC, 6725 Odyssey Drive, Odyssey II - Room 2039, Huntsville, AL, 35806, United States, vicki.v.johnston@saic.com

Processes and Technology Insertion Strategies for Renewing Civic Security: Emphasizing a bottoms-up approach to Peace-Building at the local levels, this discussion will explore the high-level processes of facilitated, fully-represented community emergency planning and training activities.

4 - What About the People? Accounting for Indigenous Populations in SASO and Recovery Plans
Paul Deason, Analysis Fellow, SAIC, 4815 Agave Dr., Las Cruces, NM, 88001-7592, United States, deasonp@zianet.com

The intent is to address the characteristics and qualifications in military sustainment and support planning representation to account for the needs of the encountered civilian population, including disaster recovery and humanitarian assistance and relief, and how to facilitate sustainable economic and cultural recovery.

5 - Defense Reform in the Republic of the Philippines
Greg Parlier, Dr., SAIC, 255 Avian Lane, Madison, AL, 35758, United States, GREG.H.PARLIER@saic.com

This presentation is a summary of defense reform efforts supported by the Institute for Defense Analyses since the end of the Cold War. Emphasis will be placed upon current efforts, including ongoing support to the Philippine Defense Reform Project, a joint effort undertaken by the United States and the Government of the Philippines during the past four years.

■ TC38

C-Room 308

Marketing I

Contributed Session

Chair: Robert Harmon, Professor, Portland State University, P.O. Box 751, Portland, OR, 97207, United States, HarmonR@pdx.edu

1 - Bidding for Consumer Dollars: Modeling a Retailer's Price and Variety Decisions
Adam Fleischhacker, PhD Candidate, Rutgers Unviersity, 73 Castle Rock Road, Lake Hopatcong, NJ, 07849, United States, adam_fleischhacker@yahoo.com, Mahesh Kumar

We model retail competition that is based on the joint marketing-operations decisions of price, variety, convenience, and inventory management using a novel application of auction theory. We treat a retailers' decision on what products to sell and at what price to sell them as the process of creating a bid in an auction for customer dollars. Leveraging the structure provided by a competitive bidding metaphor, we present conditions for simultaneously optimizing price and variety decisions.

2 - Consumer Adoption Process: A Study with Special Reference to Users of Wireless Phone Features and Services
Avinash Kapoor, Prof. (Dr.), MDI, Meharauli Road, Gurgaon, 122001, India, avinashkapoor@mdi.ac.in, Chinmaya Kulshrestha

The Study focuses on identifying the extent of adoption of wireless phones by selecting a random sample of Young users in Jaipur,Rajasthan India. Empirical model based on Rogers theory of adoption was tested using Anova. Results have implications for wireless phone manufacturers for profiling and segmenting the market to increase sales.

3 - Product Design for the Bottom of the Pyramid Market
Bin Shao, binshao01@gmail.com

In the research, we address the product design and pricing strategies for the bottom of the pyramid (BOP) market. We explore whether it is always profitable for a firm to go to the BOP market? Should A firm serve all customers at the BOP or only part of them? Will the new market be contiguous with the current market? If the firm enters the BOP market, what is the best price and the best size for the new product?

4 - Channel Coordination in Dual-channel Supply Chains
Gangshu Cai, Assitant Professor, Kansas State University, 101 Calvin Hall, Manhattan, KS, 66505, United States, gangshu@gmail.com

This paper studies coordination mechanisms in a dual-channel supply chain involving an online direct channel and a traditional retail channel. In a game-theoretic framework, we show the evidence of Prisoner's Dilemma and Pareto Zone in the dual-channel supply chain. We utilize a centralized wholesale price (CWP) contract which can coordinate the supply chain. We also explore the impacts of inconsistent pricing and consistent pricing schemes on the supplier and the retailer.

5 - Intangible Value: A Review and Directions for Research
Robert Harmon, Professor, Portland State University, P.O. Box 751, Portland, OR, 97207, United States, HarmonR@pdx.edu

This paper further augments the total product/service concept to include intangible values such as emotion and experience. Intangible value attributes are thought to have a stronger linkage with buyer behavior than that associated with physical product and service attributes. A review of the dimensions of intangible value and implications for future research are presented.

■ TC39

C-Room 309

Operations in Emergency Medicine

Sponsor: Health Applications Section
Sponsored Session

Chair: Gregory Dobson, Associate Professor, University of Rochester, Simon School, Rochester, NY, United States, greg.dobson@simon.rochester.edu

1 - Improving Emergency Room Capacity Efficiency
Vesa Kämäräinen, Helsinki University of Technology, Otanimentie 17, Espoo, 02, Finland, vesa.kamarainen@tkk.fi, Karita Ilvonen, Hanna Lehtonen, Ari Palomäki, Petri Parvinen

Many emergency rooms have either insufficient resources or inefficient ways to use them, or both. In this paper, emergency room capacity efficiency is approached from two perspectives: resource efficiency and resource availability. These aspects are analyzed through demand-supply analysis. This study resulted in concrete capacity efficiency improvements with respect to ER premises and staffing.

2 - Patient Flow Through an ICU
Hsiao-Hui Lee, PhD Candidate, University of Rochester, Simon School, Rochester, NY, United States, hsiao-hui.lee@simon.rochester.edu, Gregory Dobson, Edieal Pinker

This paper investigated how the OR surgery schedule, patient profile, and the utilization, affect the incidence of bumping a patient from the ICU to another ICU or the floor earlier than medically advisable. We present an aggregation-disaggregation algorithm to solve the ICU bumping problem as a large scale Markov chain.

3 - Providing Decision Support for the Management of Pediatric Asthma Exacerbation in the ED

Szymon Wilk, Post-doctoral Fellow, University of Ottawa, Telfer School of Management, 136 Jean-Jacques Lussier St, Ottawa, ON, K1N 6N5, Canada, wilk@management.uottawa.ca, Ken Farion, William Elazmeh, Wojtek Michalowski, Stan Matwin, Dympna O'Sullivan

Asthma exacerbation is prevalent medical reason for children to be brought to the ED. Its clinical management follows complex care pathway that is difficult to evaluate without a comprehensive clinical DSS. We are developing the MET-A3Support-Asthma clinical DSS using a multi-agent framework. This talk describes two agents: a triage agent for early assessment of asthma severity and an evidence-based agent for retrieval of patient-specific evidence from an on-line repository.

4 - Impact of Physician Styles on Patient Flow in the ED

Vera Tilson, Assistant Professor, University of Rochester, Simon School, Rochester, NY, United States, Vera.Tilson@simon.rochester.edu

Physicians have different preferences for sequencing their work in the ED. We develop a mathematical model to examine how these preferences affect patient flows in the ED: door-to-doctor time and door-to-door time as well as the utilization of physicians.

■ TC40

C-Room 310

Public Health and Public Health Preparedness

Sponsor: Health Applications Section
Sponsored Session

Chair: Anke Richter, Associate Professor, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Rd, Bldg 234, Monterey, CA, 93943, United States, arichter@nps.edu

1 - Do HMO and Its For-Profit Expansion Jeopardize the Survival of Hospital Safety Net Services?

Yu-Chu Shen, Assistant Professor of Economics, Naval Postgraduate School, Monterey, CA, 93943, United States, yshen@nps.edu

This study examines the effect of health maintenance organizations (HMO) and for-profit HMO share on the survival of safety net services in hospitals between 1990 and 2003. I find that the risks of shutting down hospital safety net services do not vary by different levels of overall HMO penetration in the current environment. However, conditional on overall HMO penetration level, increasing for-profit presence of HMO does increase the risk of shutting down several safety net services.

2 - The Cost and Effectiveness Analysis of a Behavioral Intervention for HIV-infected Persons

Sada Soorapanth, Assistant Professor, San Francisco State University, College of Business, San Francisco, CA, 94132, United States, sada@sfsu.edu

The study goal was to assess the costs and effectiveness of a HIV behavioral intervention to reduce the transmission risk from the HIV-infected persons to their uninfected sexual partners. We considered various behavioral interventions from published studies. The Monte Carlo simulation model was used to convert the intermediate outcomes of theses studies to the number of infections averted, quality-adjusted life years saved, and monetary benefits/costs.

3 - Emergency Personnel Resource Allocation In Mass Casualty Disasters

Susan Heath, Assistant Professor, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States, skheath@nps.edu

This research addresses the allocation of emergency personnel in mass casualty disaster situations. This research uses queueing theory and simulation to develop rules of thumb that an Incident Commander could use in a variety disaster situations to quickly determine how many of their emergency response personnel resources to assign to the 3 primary tasks of triage, patient movement, and initial patient treatment and preparation for transport. The focus is on the initial disaster response.

4 - Input for Modeling Hospital Emergency Response: Medical Personnel Availability

Anke Richter, Associate Professor, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Rd, Bldg 234, Monterey, CA, 93943, United States, arichter@nps.edu, Joan McInerney, MD, FACEP

medical personnel available to perform life-saving interventions. A common misconception is that all medical personnel can and will respond. Surveying two New York Metropolitan Area hospitals, we assess the ability and willingness of physicians to evaluate and resuscitate victims of WMD terrorist events upon arrival to the hospital. Significant factors influencing results are discussed and should form a more realistic basis for modeling efforts.

■ TC41

C-Room 3A

Joint Session B&SB/HAS: OR and Systems Biology

Sponsor: INFORMS Computing Society/ Bioinformations & Systems Biology, Health Applications Section
Sponsored Session

Chair: Joel Sokol, Associate Professor, School of ISyE, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu

1 - Clique Generalizations and Clusters in Biological Networks

Balabhaskar Balasundaram, Assistant Professor, Industrial Engineering & Management, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, baski.balasundaram@okstate.edu, Sergiy Butenko

Networks such as protein interaction networks and gene co-expression networks play important roles in systems biology. Cliques and quasi-cliques have been most popular as cluster models in this area. In this talk, we will discuss why graph theoretic clique generalizations from social network analysis provide interesting alternatives to the existing approaches. We present our mathematical programming approaches to finding such clique generalizations and preliminary numerical results.

2 - Novel Mathematical Model and Algorithm for Sibling Relationship Reconstruction

W. Art Chaovalitwongse, Assistant Professor, Rutgers University, 96 Frelinghuysen Rd, Piscataway, NJ, 08854, United States, wchaoval@rci.rutgers.edu, Mary Ashley, Saad Sheikh, Tanya Berger-Wolf, Bhaskar DasGupta, Chun-An Chou, Isabel Caballero

There has been a growing application of molecular markers (microsatellites) to study wild populations of plant and animals. This has created the need for new computational methods of establishing pedigree relationships (sibsets) among individuals in these populations. In this talk, we present a new mathematical model for parsimoniously reconstructing the sibsets. This model is a generalization of set covering problem and we present a new algorithm to solve this problem.

3 - Estimating the Robustness of Regulatory Networks Using McMC and Trust Regions

Leo Lopes, University of Arizona, University of Arizona - SIE, Tucson, AZ, United States, leo@sie.arizona.edu, Jay Konieczka, Parker Antin, Matej Boguszak

We estimate the robustness of a cell regulatory network: the network's ability to produce a given phenotype when the parameters governing the relationships between the molecules vary. We exploit the fact that re-optimization is significantly cheaper than optimization by combining a Metropolis-Hastings algorithm with Trust Region concepts. We present our algorithm and the conditions under which the algorithm is better than the current state of the art.

4 - Insights From Network Models of a Needle Exchange

Joel Sokol, Associate Professor, School of ISyE, Georgia Institute of Technology, Atlanta, GA, 30332-0205, United States, jsokol@isye.gatech.edu, Yao-Hsuan Chen

We model disease transmission in a network of needle exchange participants, and obtain insights into preventing disease spread within and outside of the test population.

■ TC42

C-Room 3B

OR Models in Healthcare I

Contributed Session

Chair: Richard Hughes, Associate Professor, University of Michigan, 2019 BSRB, 109 Zina Pitcher Pl, Ann Arbor, MI, 48109, United States, rehughes@umich.edu

1 - Marketing of Pharmaceuticals Under a Price-Volume Agreement

Hui Zhang, Faculty of Business Administration, Lakehead University, hzhang2@lakeheadu.ca, Greg Zaric

Marketing is one major component of pharmaceutical expenditures. The amount of marketing investment and the impact on demand are unobservable to third-party payers such as insurers. This creates risk for payers. However, payers can use some contracts such as price –volume agreements to control this risk. This paper investigates how one type of price-volume agreement is designed with the presence of moral hazard. We develop a principal-agent model to identify how moral hazard changes both the drug maker and the payer's decisions and their performance, and how different constraints influence the optimal results.

2 - A Study of Efficiency in a Routine Medical Physical Examination
Wheyming Song, Professor, Taing Hua University, Chinchu, Taiwan, Taiwan, Taiwan - ROC, wheyming_song@yahoo.com, Aaron Bair, Mingchang Chih

We studied the impact of three factors on efficiency in terms of the incidence of prolonged patient wait time (ippwt) and doctor utilization in a medical visit. Simulation results show that patient dispatching rules, given the set constraints, have negligible influence on ippwt; the physician starting shift time is highly correlated with the ippwt; a policy of two-time arrival scheduling resulted in a reduction of ippwt from 25% to 50%, but did not affect physician utilization.

3 - Application of Genetic Algorithms to Gene Interactive Rules for Preventing the Formation of Cancerous Cells
Farhad Azadivar, Professor, University of Massachusetts Dartmouth, 285 Old Westport Road, North Dartmouth, MA, 02747, United States, fazadivar@umassd.edu, Danh Cong Nguyen

Genes regulate the expression of other genes and impact the dynamic interacting entities that build stable phenotype structures. The objective of this research is to find some gene interactive rules from observed micro-array data to redirect the transition of state of the cancerous development of cells into a benign process. The Genetic Algorithm is used to determine actions that will assist in the transition of a steady state tumor producing network to that of a non-tumor producing.

4 - The Role of Medical Professionals in Top Management Teams of Healthcare Organizations: An Economic Model
Stefan Scholtes, Professor, Judge Business School, Cambridge University, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, s.scholtes@jbs.cam.ac.uk, Ludwig Kuntz

The appropriate role of a medical director in a hospital's top management team is a controversial issue. Clearly, the medical director plays an important role in balancing medical and financial performance. It is perceived wisdom amongst the medics that the medical director should have a strong role, on an equal footing with the commercial director, because a sub-ordinate role is likely to give financial considerations the upper hand in decision making, leading to cost-cutting with detrimental effects on medical performance. We will argue that this is not necessarily the case. We will analyse a decision model, based on Nash and Stackelberg solutions, and provide empirical evidence to support our view.

5 - An Integer Programming Model for Distal Humerus Fracture Fixation Planning
Richard Hughes, Associate Professor, University of Michigan, 2019 BSRB, 109 Zina Pitcher Pl, Ann Arbor, MI, 48109, United States, rehughes@umich.edu, Madhav Karunakar, Joseph Maratt, Ya-Sin Peaks, Lisa Doro

Surgical treatment of distal humerus fractures involves securing bone fragments using screws placed through two metal plates that have pre-drilled holes. Not all holes can be used because the screws would intersect other screws, penetrate the joint surface, or pass through the olecranon fossa. We propose an integer programming model for solving this surgical planning problem. An example of a comminuted distal humerus fracture is used to illustrate the method.

■ TC43

S-Grand Ball. A (Lev. 2)

New Research in Airport and Terminal Airspace Operations

Sponsor: Aviation Applications
Sponsored Session

Chair: Jasenka Rakas, PhD, University of California at Berkeley, Nextor, 107B McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu

1 - Modeling the Operational and Delay Impact of Air Traffic Control Automation Tools
Magan Smirti, University of California at Berkeley, NEXTOR, Berkeley, CA, 94720, United States, msmirti@berkeley.edu, Xing Chen, Mark Hansen

This study examines the use and impact of Traffic Management Advisor (TMA) during its early stages of deployment at Chicago Center. The focus on early stage deployment creates a methodological challenge due to sporadic usage, possibly leading to spurious results if simple with/without comparisons are made. In an effort to isolate the impact of TMA, an alternate method is employed. We find evidence that TMA did not increase capacity but did reduce capacity variability.

2 - Simulation and Validation of Airport Capacity Models
Amy Kim, University of California at Berkeley, NEXTOR, Berkeley, CA, 94720, United States, amy_kim@berkeley.edu, Mark Hansen

To improve the state-of-the-art, the development of a new airport capacity model is under consideration by the FAA; however, this requires a better understanding of existing models. To this end, runway operations at several airports were modeled using at least two computer capacity models. The goal is to compare simulated capacity results with one another, with estimated rates produced with empirical data, as well as with documented capacity values.

3 - Data Transformations for Terminal Airspace Queuing Models
David Lovell, Associate Professor, University of Maryland, 1173 Martin Hall, College Park, MD, 20742, United States, lovell@eng.umd.edu, Andrew Churchill, Michael Ball, Avijit Mukherjee, Amedeo Odoni

It is common to model terminal airspace as a queuing system in order to determine performance metrics such as delay. The input data for such models, when taken from the most common databases, are confounded with a large variety of other influences, and model performance typically suffers as a result. We show some techniques for filtering and remediating these influences, and the subsequent performance gains that can be expected.

4 - Airport Service Availability Meets Capacity to Yield Airport Effectiveness
Jasenka Rakas, PhD, University of California at Berkeley, Nextor, 107B McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu, Borhan Oskoorouchi

This study examines the limitations posed by Communication, Navigation and Surveillance (CNS) system outages on airport effectiveness. We show how effectiveness, as a new measure of performance, can be used for terminal airspace and airport capacity estimates by considering CNS outages and airport service availabilities. The proposed model also takes into consideration various runway configurations, traffic mix compositions and weather conditions.

■ TC44

S-Grand Ball. B (Lev. 2)

Pedagogical Research: Working on a Course Design Project

Sponsor: INFORM-ED
Sponsored Session

Chair: Donna Llewellyn, Director, Georgia Tech, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@cetl.gatech.edu

1 - Pedagogical Research – Working on a Course Design Project
Donna Llewellyn, Director, Georgia Tech, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@cetl.gatech.edu

In this session, we will go through the steps of working on the most common type of pedagogical research – that related to the design or redesign of a course. We will work from course objectives through assessment of student learning to the actual teaching activities. This is the third in a series of four sessions at this conference on pedagogical research. Feel free to come even if you missed the first two!

■ TC45

S-Capitol Hill (Lev. 3)

Models and Analysis in Financial Engineering

Cluster: Financial Engineering
Invited Session

Chair: Xin Guo, UC Berkeley, Berkeley, CA, United States, xinguo@newton.berkeley.edu

1 - A Hyper-exponential Jump-diffusion Model
Steven Kou, Columbia University, 312 Mudd Building, Dept.. of IEOR, 500 West 120th Street, New York, NY, 10027, United States, sk75@columbia.edu, Ning Cai

We provide analytical solutions to path-dependent options, including lookback, quantile, and American options, under a hyper-exponential jump-diffusion model, which includes the double exponential jump-diffusion model as a special case. The analytical solutions are made possible by using matrix algebra and integro-differential equations.

2 - American Option Pricing Under Stochastic Volatility: A Model Comparison
Manisha Goswami, PhD Candidate, Department of Industrial and Systems Engineering, University of Florida, 2911 SW 13th Street #42, Gainesville, FL, 32608, mansonu@ufl.edu, Farid AitSahlia

Over the past few years model complexity in quantitative finance has increased substantially in response to earlier models that did not capture critical events for risk management. However, it is still not clear that the increased complexity is matched by additional accuracy in the ultimate result. In the specific context of option pricing addressed in this talk, I compare the pricing accuracy of two models: one that consists of the standard geometric Brownian motion with

constant coefficients, and another where the volatility coefficient is itself a stochastic process. The data for the study are based on S&P 100 index options; the estimation methodology on indirect inference, and the pricing approach is an extension of the regression-based simulation method of Longstaff and Schwartz (2001).

3 - Robust Portfolio Selection and Learning

Andrew Lim, Associate Professor, IEOR Department, 4141 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States, lim@ieor.berkeley.edu, George Shantikumar, Lian Yu

We formulate a robust dynamic portfolio selection problem, using the notion of relative regret, in a model where learning is possible. Though the formulation is not Bayesian, a Bayesian-type solution is obtained endogenously. It involves a weighted posterior where the posterior is tilted towards models that performed well historically. The tilting addresses in part the problem of slow convergence often associated with Bayesian learning of the mean.

4 - Multiple Stopping Problems and Application to Employee Stock Options

Tim Leung, siutang@Princeton.EDU, Ronnie Sircar

Many problems in Financial Engineering involve the interaction between stochastic control and multiple stopping; e.g. portfolio optimization with many American options. We study problems of this type in incomplete market settings, and characterize the optimal strategies. As an application, we provide a valuation tool for employee stock options that captures many of their characteristics.

■ TC46

S-Ballard (Lev. 3)

Electricity Markets Simulation

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Julian Barquin, Prof., Comillas University, C/ Alberto Aguilera, 23, Madrid, 28015, Spain, julian.barquin@iit.upcomillas.es

1 - Simulating the Western Electricity System's Response to a Carbon Market

Andrew Ford, Professor, Washington State University, Troy Hall 311, Pullman, WA, 99164-4430, United States, forda@wsu.edu

This paper describes a computer simulation analysis of a cap and trade market to reduce carbon emissions in the electricity system in the western USA and Canada. The simulations show a dramatic reductions in carbon emissions over the next two decades. This analysis is made possible by a novel, interdisciplinary combination of system dynamics and power systems engineering methods.

2 - Fighting Market Power by Auctioning Generation: How Much, How Often? A System Dynamics Approach

Juan Jose Sanchez, IIT, Comillas University, Santa Cruz de Marcenado, 26, Madrid, Ma, 28015, Spain, JuanJose.Sanchez@iit.upcomillas.es, Julian Barquin, Efraim Centeno

The effectiveness of auctions of long-term contracts in mitigating market power is related both to the amount and to the tenor of the contracts, but there is not a consensus on the optimal figures and on the long-term effects. This paper proposes to address these issues by means of a dynamic model. In particular, a detailed realistic model of the power system, conjectured price responses computation, and forward trading with price formation based on expected spot plus risk premium are considered

3 - Game Theory Models for Electricity Market Simulation

Ettore F. Bompard, Associate Professor, Politecnico di Torino - Dipartimento di Ingegneria Elettrica, C.so Duca degli Abruzzi, 24, Torino, TO, Italy, ettore.bompard@polito.it, Yuchao Ma, Graziano Abrate

In oligopoly electricity markets, the network structure poses strict physical and operational constraints which provide very specific occasions of market power. Based on the individual producer's surplus maximization problem nested with the pool typed market clearing, this paper provides a comparative analysis of the application of game theory models to network constrained electricity markets. The network impacts on market performances are addressed with reference to the IEEE30 bus test system.

■ TC47

S-Admiral (Lev. 3)

Valuation and Control of Commodity Storage

Cluster: Operations Management in Commodity Markets and Agribusiness
Invited Session

Chair: Owen Wu, University of Michigan, Ann Arbor, MI, owenwu@bus.umich.edu

1 - Valuation of Downstream Liquefied-natural-gas Storage

Mulan X. Wang, Carnegie Mellon University, 5000 Forbes Ave Posner Hall A27, Tepper School of Business, Pittsburgh, PA, 15213, United States, mulan@cmu.edu, Nicola Secomandi, Sunder Kekre, Alan Scheller-Wolf

Motivated by current developments in the liquefied-natural-gas (LNG) industry, we study the operations of LNG supply chains facing both supply and price risk. We model the upstream LNG production, ocean shipping logistics and dynamic spot price, and characterize the structure of the optimal inventory management policy.

2 - Optimal Inventory-trading Policy for Commodity Storage Assets

Nicola Secomandi, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, ns7@andrew.cmu.edu

This talk presents the structure of the optimal inventory trading policy for a storage asset when the commodity price state-variable evolves according to a Markov process and the storage technology features inventory dependent capacity functions, and provides managerial insights on the meaning of high and low price state-variable values.

3 - Inventory Control and Risk Management of Natural Gas Storage Assets

Owen Wu, University of Michigan, Ann Arbor, MI, owenwu@bus.umich.edu

Managing a natural gas storage asset involves optimizing injection and withdrawal of natural gas and managing the risk using futures. The delivery of matured futures is typically evenly spread over the entire delivery month, which affects the injection and withdrawal rates. We study the structure of the optimal inventory control and trading strategy.

4 - Capacity Planning for Process Industries Under Competition and Resource Scarcity

Kumar Rajaram, Associate Professor, UCLA Anderson School, 110 Westwood Blvd, Los Angeles, CA, 91403, United States, kumar.rajaram@anderson.ucla.edu, Uday Karmarkar

We consider a competitive version of the traditional capacity planning model of production with capacity constraints. We first consider a single-tier version of this problem without interactions with the raw material supply tier and utilize a Cournot framework. We next extend our model using a successive Bertrand-Cournot framework to include interactions with the raw material supplying sector. Such situations have recently occurred in several process industry settings,including petro-refining.

■ TC48

S-Fremont (Lev. 3)

Stochastic Processes/Optimization II

Contributed Session

Chair: Spyros Reveliotis, Associate Professor, ISyE, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, spyros@isye.gatech.edu

1 - Asymptotic Study of the MLE of a Change-Point Under Smooth Changes in Multivariate Gaussian Families

Li Tan, Washington State University, Department of Management and Operations, Pullman, WA, 99164, United States, tanli@wsu.edu, Stergios Fotopoulos, Krishna Jandhyala

The problem of estimating an unknown change-point in a sequence of independent random elements defined on a general space is considered. We develop a framework for deriving the asymptotic distribution of the maximum likelihood estimator of the change-point under the smooth change formulation. The general methodology is then applied for smooth changes in the mean vector or the covariance matrix for a multivariate Gaussian process. Finally, we apply the methodology to the financial data from NYSE.

2 - The Limited Processor Sharing Queue
Wemke van der Weij, PhD Student, CWI, Kruislaan 413, Amsterdam, 1098 SJ, Netherlands, W.van.der.Weij@cwi.nl, Misja Nuyens

We study a so-called limited processor sharing model with c servers and an infinite buffer. The active servers share an underlying resource. For this model we prove that for service times with a decreasing failure rate, the queue length is stochastically increasing in c, and that for service times with an increasing failure rate, the queue length is stochastically decreasing in c. This result is extended to the queue with multi-class customers, and to the limited foreground-background queue.

3 - Natural Gas Operations with Pipelines and LNG
Lars Hellemo, PhD Candidate, NTNU, Alfred Getz veg 3, Trondheim, 7491, Norway, lars.hellemo@iot.ntnu.no, Asgeir Tomasgard, Emre Armagan, Paul Barton

Natural gas resources are developed in places with harsher environment and in greater distances from markets than before. The value chain must be able to respond to both seasonal variations and market uncertainty to operate efficiently. We propose an integrated model of the natural gas value chain, including wells, pipelines, processing plants and LNG tankers. LNG tankers are used to exploit price differences in separate markets. The model is formulated as a stochastic mixed integer program.

4 - Moment Closure Approximation Procedure for Stochastic Fatigue Crack Propagation Problem
Binod Maharjan, Graduate Student, Texas Tech University, Department of Industrial Engineering, Box 43061, Lubbock, TX, 79409, United States, b.maharjan@ttu.edu

Several models, such as DTMCs, CTMCs, and Yang's Power Model, have served as useful representations in approximating stochastic fatigue crack propagation. Crack growth rates due to fatigue loading are typically nonlinear functions of length, and closed form solutions are often difficult to obtain. We propose using moment closure to approximate the moments of crack length through the nth order over time. Systematic procedure for constructing moment closure functions of an arbitrary order will be considered utilizing the Paris-Ergodan crack growth equation, and the boundary value problem is formulated for the statistical moments to reach a given crack size. An experimental study is designed to verify the results that are obtained from the moment closure approximation procedure for the particular problem.

5 - The Optimal Node Visitation Problem
Spyros Reveliotis, Associate Professor, ISyE, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, spyros@isye.gatech.edu, Theologos Bountourelis

Given a stochastic, acyclic, connected digraph with a single source node, we want to visit each of its terminal nodes a certain number of times while minimizing the expected number of the graph traversals. In this talk we provide a fromal characterization of the problem, establish its PSPACE-hardness, and develop a family of effficient policies with polynomial complexity.

■ TC49

S-Greenwood (Lev. 3)

Revenue Management Models

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kfridgeirsdottir@london.edu

1 - Product Quality Selection: Contractual Agreements in a One Manufacturer Multiple Supplier Environment
Mehmet Sekip Altug, PhD Candidate, Columbia University, 3022 Broadway, Uris Hall 4J, New York, NY, 10027, United States, msa2104@columbia.edu, Garrett van Ryzin

We consider a model with one manufacturer who makes an end product using multiple components, each provided by a different supplier. Suppliers sell components at a wholesale price that depends on component quality. The quality of the end product is determined by the quality of the individual components. The manufacurer seeks to maximize profits by trading off quality and component cost. This creates competition among the suppliers. We analyze possible contractual agreements in the channel.

2 - Strategic Management of Distressed Inventories
Ozge Sahin, Assistant Professor of OMS, Ross School of Business, University of Michigan, Ann Arbor, MI, 48109, United States, ozge@bus.umich.edu, Guillermo Gallego, Robert Phillips

We investigate models in which the decision to sell inventory at a discount will change the future expectations of customers and hence their buying behavior. We show that a single-price policy is optimal if all buyers are strategic and demand is known to the seller. Relaxing any of these conditions can lead to a situation in which a markdown policy is optimal. If customers update their expectations of availability over time, then optimal sales limit policies can evolve in a complex fashion.

3 - Revenue Management with Limited Information: Managing Cancellations
Itir Karaesmen, University of Maryland, College Park, MD, United States, ikaraes@rhsmith.umd.edu, Michael Ball, Yingjie Lan

We formulate the multi-fare, single-leg seat inventory control problem using limited information on demand and cancellation rates. We analyze the problem using competitive analysis of online algorithms. We determine the optimal overbooking pad as well as the optimal booking limits (i) to maximize the competitive ratio, and (ii) to minimize the maximum absolute regret. We present computationally efficient solution methods and discuss results of numerical experiments.

4 - Revenue Management for Online Advertising with Impatient Advertisers
Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kfridgeirsdottir@london.edu, Sami Najafi-Asadolahi

The Internet is a fast growing advertising medium. We consider a web host selling advertising space on its website. The advertisers that approach the web host are impatient and not willing to wait for their ad to be posted. We develop queueing models for the operation of the web host and derive a closed-form solution of the probability distribution for the number of advertisers in the system. We study the revenue maximisation problem of the web host and determine the optimal advertising price.

■ TC50

S-Issaquah A & B (Lev. 3)

Revenue Management for Congestion-sensitive Services

Sponsor: Revenue Management & Pricing - Invited/Sponsored
Sponsored Session

Chair: Costis Maglaras, Columbia Business School, 409 Uris Hall, New York, NY, United States, c.maglaras@gsb.columbia.edu

1 - Dynamic Leadtime Quotation Under General Customer Utilities
Baris Ata, Associate Professor, Northwestern University, Evanston, IL, b-ata@kellogg.northwestern.edu, Tava Olsen

We consider a make-to-order system where customers are dynamically quoted leadtimes (and prices) who have general (non-linear) disutility for delay. We use approximations in the large-capacity asymptotic regime and recommend asymptotically optimal policies for convex, concave, and convex-concave leadtime cost functions. The policies are intuitive and readily implementable and provide delay guarantees for all served customers. They are also tested numerically; resulting in significant benefits.

2 - Product Design in a Market with Satisficing Customers
Matulya Bansal, Student, Columbia Business School, Uri Hall, 3022 Broadway, New York, NY, 10027, United States, mb2431@columbia.edu, Costis Maglaras

We study the product design problems of monopolist that serves a market of heterogeneous customers that behave as follows: each customer selects the cheapest product among those whose price is less than his valuation and their product quality exceed a customer-specific quality threshold. We characterize the optimal product menu for such a market, contrast it to results based on more traditional models of choice behavior, and specialize our findings to several application settings.

3 - Video Distribution on the Internet: Peer-to-peer vs. Client-server
Ramesh Johari, Stanford University, Terman Engineering Center, Room 319, Stanford, CA, United States, ramesh.johari@stanford.edu, Srinivas Shakkottai

We use a fluid model to compare the peer-to-peer model for video distribution with a more traditional client-server approach. We analyze the relative performance of the two schemes, both from the point of view of consumers, as well as the content provider; under a word-of-mouth demand model, we show that peer-to-peer file transmission generally performs better. We also study the implications for pricing and capacity management.

■ TC51

S-Kirkland (Lev. 3)

Stochastic Networks

Cluster: Queueing Models
Invited Session

Chair: David Gamarnik, Assistant Professor, MIT, E53-353 Sloan School of Management, MIT, Cambridge, MA, 02445, United States, gamarnik@mit.edu

Co-Chair: Ana Radovanovic, IBM, Route 134, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States, aradovan@us.ibm.com

1 - On Series Jackson Networks and Determinantal Transition Kernels

Ton Dieker, Postdoc, IBM Research, P.O. Box 218, Yorktown Heights, NY, 10598, United States, t.dieker@proba.ucc.ie, Jon Warren

Product forms for Jackson networks constitutes a cornerstone in the theory of queueing networks, but much less is known about the so-called time-dependent behavior, i.e. the underlying Markov transition kernels. This talk discusses some recent developments in the context of series Jackson networks. It turns out that determinants appear in the transition kernels, and that these facilitate the analysis of relaxation times. Key ingredients include techniques from random-matrix theory.

2 - Blocking Probabilities in Capacitated Loss Systems with Variable Demands

Yingdong Lu, Dr., IBM Research, IBM Research, Yorktown Heights NY 10598, United States, yingdong@us.ibm.com, Ana Radovanovic

Loss network models have become popular in the analysis of service systems. However, computing customer blocking probabilities explicitely becomes intractable even for small capacities. Using compund point processes to capture stochastic variability in the request process, we derive simple asymptotic expressions for blocking probabilities even for loss networks with very complicated topologies. We discuss interesting extensions and demonstrate accuracy of the derived formulas.

3 - Corrected Diffusion Approximations in the Halfin-Whitt Regime

Bert Zwart, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, 30332, United States, bertzwart@gatech.edu

We give corrected diffusion approximations and bounds for the no-wait probability in the M/M/s and M/D/s queue. These results can be used to evaluate the quality of the square root staffing formula. We show analytically why this staffing formula works so well - even for small systems. In addition, we show how the Halfin-Whitt approximation can be adapted in such a way that it becomes accurate for systems which are not in heavy traffic or systems with a small number of servers.

4 - Fluid and Diffusion Approximation of Limited Processor Sharing Queue

Jiheng Zhang, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, 30332, United States, jrz@gatech.edu, Bert Zwart, Jim Dai

Motivated by application in computer systems, we study a modification of a processor sharing queue where only up to a limited number of jobs can equally share the server's full capacity at a time, excess jobs have to wait in a FIFO buffer. We first study the existence, uniqueness and invariant manifolds of fluid model solution. Then based on these, we establish fluid and diffusion approximations of the system.

■ TC52

S-Leschi (Lev. 3)

Artificial Intelligence Applications II

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Anurag Agarwal, Assistant Professor, University of Florida, P.O. Box 117169, Gainesville, FL, 32611, United States, aagarwal@ufl.edu

1 - Induction of a Marketing Strategy for a New Pet Insurance Company, Using Decision Tree Approaches

Adrian Becker, PhD Candidate, MIT Operations Research Center, 77 Mass Ave, Bldg E40-130, Cambridge, MA, 02139-4307, United States, adrian.becker@alumni.upenn.edu, Alan Abrahams, Daniel Sabido, Rosskyn D'souza, George Makriyiannis, Michal Krasnodebski

In this data mining application case study, we help PetPlan to model the demographics of their most desirable customers. We obtain and integrate relevant publicly accessible data, including US census data, and veterinary location data. We use a traditional entropy-based decision tree algorithm, and a novel profit-based algorithm. We evaluate the results in terms of statistical significance, accuracy, profitability, and robustness, and make recommendations for PetPlan's marketing strategy.

2 - Analyzing Performance of Hedge Funds through a Learning-based Piecewise Method

Fei Pan, Purdue University, Krannert School of Management, West Lafayette, 47906, United States, panfei@gmail.com, Bo Zeng, Kwei Tang

Hedge funds as a unique asset class may use flexible strategies, leverage, and derivative securities that make performance measurement complex. In this paper, we apply a learn-based piecewise method to explain returns. Support vector machine clustering accomplishes the learning ability of this approach. Experimental results show this algorithm has more explanation power. Further, we apply this approach to investigate the relationship between fund size and returns and discover some novel results.

3 - Bayesian Networks for Automatic Optimization Algorithm Selection

Patricia Hough, Sandia National Laboratories, P.O. Box 969, MS 9159, Livermore, CA, 94551, United States, pdhough@sandia.gov, Victoria Howle

We present a two-phase approach to automatically selecting an optimization algorithm to solve a given simulation-based problem. We first use a Bayesian network to classify an optimization problem based on its canonical description. We then use probabilistic models of human expert recommendation combined with experimental performance data to choose a suitable algorithm. Finally, we discuss initial studies on test problems and challenges associated with simulation-based problems.

■ TC53

S-Medina (Lev. 3)

Facility Location

Contributed Session

Chair: Francisco Barahona, IBM Research, P O Box 218, Yorktown Heights, NY, 10598, United States, barahon@us.ibm.com

1 - The Supplier Location Problem

Nathan Palmer, PhD Student, University of Alabama, 3550 Watermelon Road, #11E, Northport, AL, 35473, United States, npalmer@cba.ua.edu, John Mittenthal, Charles Sox

There is a set of S suppliers that must produce and transport components to a single assembly plant whose location is fixed. The problem is to determine the locations of the S suppliers while considering a tradeoff between transportation costs and demographic-related costs.

2 - A Study of Location Problem and Vehicle Routing Problem for Two Obnoxious Facilities

Chikong Huang, Professor, National Yunlin University of Science & Technology, 123 University Road, Section 3, Touliu, 640, Taiwan - ROC, huangck@yuntech.edu.tw, Chih-Wang Chang

This study focuses on the location problem and vehicle routing problem for two obnoxious facilities, existing and new facility. A mathematic model is developed to minimize the social cost and the rearranged vehicle routing costs for both facilities. This research proposes an integrated heuristic algorithm which combines a genetic algorithm and a simulated annealing algorithm. The GA is to improve vehicle routing and the SA is designed for improvement of facility location.

3 - An Efficient Algorithm for Capacitated Multi-facility Location Problem

Chansiri Singhtaun, PhD Student, Kasetsart University, 10/50 Soi Ruamjaipattana 3, Chokchai 4 Rd.,Ladprao, Bangkok, 10230, Thailand, s_chansiri@yahoo.com, Peerayuth Charnsethikul

This paper proposes an extreme point ranking based method for a squared-Euclidean distance multi-facility location problem with inseparable demands under balanced transportation constraints. The numerical experiments are randomly generated to test the efficiency of the proposed algorithm by comparing with linearization algorithm. The results show that the proposed algorithm provides the better solutions with less processing time for all various sizes of problems.

4 - The Capacitated Hierarchical Path Problem

Macarena Donoso, PhD Student, Pontificia Universidad Catòlica de Chile, Vicuña Mackenna 4860, Macul, Santiago, 6904411, Chile, macarena.donoso@udp.cl, Vladimir Marianov

We formulate and solve a two-level distribution network design problem. A costlier path is constructed through some nodes of the network. Remaining customers are reached through cheaper, capacitated delivery routes. We minimize the cost, considering both the path and delivery routes. Applications are newspaper and courier distribution systems. An integer programming formulation, a solution procedure based on iterative incorporation of valid inequalities and computational experience are offered.

5 - On the P-median Polytope of Y-free Graphs

Francisco Barahona, IBM Research, P O Box 218, Yorktown Heights, NY, 10598, United States, barahon@us.ibm.com, Mourad Baiou

We consider a well known class of valid inequalities for the p-median and the uncapacitated facility location polytopes, the odd cycle inequalities. It is known that their separation problem is polynomially solvable. We define a nontrivial class of graphs, where the odd cycle inequalities together with the linear relaxations of both the p-median and uncapacitated facility location problems, suffice to describe the associated polytope.

■ TC54

S-Queen Anne (Lev. 3)

Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Mohan Chaudhry, Professor, Royal Military College of Canada, Dept. of Math and Compt Scicence, POBox 17000, Station Forces, Kingston, On, K7K 7B4, Canada, chaudhry-ml@rmc.ca

1 - Complete Solution for the Stationary Queue-length Distribution of a Bulk Arrival/Bulk Service Queue

Leo Cordeau, Department of Math and Computer Science, Royal Military College of Canada, Kingston, On, K7K 7B4, Canada, Leo.Cordeau@rmc.ca, Mohan Chaudhry

Using level crossing arguments, relationships between pre-arrival, random, and post-departure epoch queue-length probabilities, for a bulk arrival / bulk service queue, are developed. Next, the roots method is used to invert the probability generating function for the stationary pre-arrival queue-length distribution. Then, given arbitrary inter-arrival times, arrival group size and service group size, a complete solution for the stationary queue-length probabilities is determined.

2 - To Find the Distribution of the Number of Renewals of a Renewal Process Using Laplace Transforms

Boon Ong, Dr, Royal Military College, P.O. Box 1700 Stn Forces, Kingston, ON, K7K 7B4, Canada, ong-b@rmc.ca, Mohan Chaudhry

The distribution of the number of renewals of a renewal process over a time period 0 to t is found by inverting a Laplace transform using the roots method. Where a distribution has no Laplace transform, continued fractions are used to approximate the Laplace transform.

3 - Numerical Solution of the Versatile Batch-service Geo(X)/G(a,Y)/1 Queue

Jing Gai, Ms., Royal Military College of Canada, P.O. Box 17000, Station Forces, Kingston, ON, K7K7B4, Canada, Jing.Gai@rmc.ca, Mohan Chaudhry

We present numerical results for the bulk-arrival bulk-service single-server Geo(X)/G(a,Y)/1 queue by inverting of the probability generation function (p.g. f) of the number in the queue.

4 - Stability of Join-the-Shortest-Queue Networks

Jim Dai, Professor, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, 30332, United States, dai@gatech.edu, John Hasenbein, Bara Kim

This talk is on stability behavior in a variant of a generalized Jackson queueing network. In our network, some customers use a join-the-shortest-queue policy when entering the network or moving to the next station. We provide examples showing that distributional information other than mean values and tie-breaking probabilities is needed in order to characterize the stability of such systems. A byproduct of our analysis is a new method for using the fluid model of a queueing network to show non-positive recurrence of a process.

5 - Busy-Periods of Discrete-Queues and the Lagrange Implicit Function Theorem

Geoffrey Brown, Royal Military College, Geoffrey.Brown@rmc.ca

We solve the Busy-Period distribution explicitly for several discrete-time queueing models. The results are obtained using the coefficient operator version of the Lagrange Theorem. The coefficient operator notation also leads to an efficient algorithm for obtaining probabilities from the Lagrangian distributions.

■ TC55

S-Ravenna (Lev. 3)

Future Air Traffic Management Concepts

Sponsor: Aviation Applications
Sponsored Session

Chair: Avijit Mukherjee, Associate Project Scientist, U.C. Santa Cruz, MS 210-8, NASA Ames Research Center, Moffett Field, CA, 94035, United States, itsavijit@gmail.com

1 - Impact of Deterministic Constraints on New York Flights

Shon Grabbe, Doctor, NASA Ames Research Center, Mail Stop: 210-10, Moffett Field, CA, 94035, United States, shon.r.grabbe@nasa.gov, Dr. Banavar Sridhar, Dr. Avijit Mukherjee

To reduce the effect of delays on New York flights, strategic, traffic flow management control strategies were calculated from an aircraft-level model using both heuristic and optimization solution methodologies. The results are presented in terms of aggregate- and aircraft-level flight delay, equity, and routing metrics.

2 - Network Characteristics of Current and Future Air Traffic Demand in the United States

Dr. Banavar Sridhar, NASA Ames Research Center, Banavar.Sridhar@nasa.gov

Air traffic is modeled as a network with several thousand nodes. Several networks exhibit the scale-free property that as the network grows in size, a small number of components have a disproportionate influence on the successful operation of the network. This paper describes the network properties of the current air traffic system and uses future scenarios of air traffic growth to understand the performance of future air traffic networks.

3 - Uncertain Aggregate Arriving Aircraft Operations in Atlanta Airspace

Dr. Kenneth Kuhn, University Affiliated Research Center, kkuhn@arc.nasa.gov

This research translates radar echo top heights and vertically integrated liquid measures into measures of the aggregated behavior of aircrafts around Atlanta, Georgia. A new methodology for this translation problem is introduced, notable for its ability to overcome the limitations on sizes of data sets considered and the restrictive model forms that hampered previous analyses. Several interesting results are presented.

4 - Dynamic Airspace Configuration Concepts and Algorithms

Dr. Parimal Kopardekar, Associate Principal Investigator, Dynamic Airspace Configuration, NASA Ames Research Center, Mail Stop 210-10, Moffett Field, CA, United States, Parimal.H.Kopardekar@nasa.gov

The paper describes concepts and algorithms for Dynamic Airspace Configuration (DAC). The purpose of the DAC is to increase airspace capacity through strategic airspace organization and dynamic allocation of airspace and controller resources to reduce the imbalance between traffic demand and airspace capacity. Preliminary findings demonstrating the benefits of these concepts will be discussed.

■ TC56

S-Wallingford (Lev. 3)

Energy Gas and Thermal

Contributed Session

Chair: Sujin Kim, Visiting Assistant Professor, Purdue University, Grissom Hall, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, sujin@purdue.edu

1 - Analysing Capacity Booking for Natural Gas Transportation in a Stochastic Complementarity Problem

Asgeir Tomasgard, Dr, NTNU, Gloeshaugen, Trondheim, NA, 7491, Norway, asgeir.tomasgard@iot.ntnu.no, Kjetil Midthun, Yves Smeers, Mette Björndal

We present an equilibrium model for a booking system in a gas transportation network. The market is organized as a primary market where capacity may be booked before the required capacity need is known and a short-term secondary market where capacity may be traded after demand uncertainty is resolved. This is modelled as a Generalized Nash Equilibrium game where each player's decision problem is a two-stage stochastic program with recourse.

2 - The LNG Value Chain on a Tactical Horizon

Kristin Tolstad Uggen, Researcher, SINTEF Applied Economics and Operations Research, S.P. Andersens veg 5, Trondheim, 7465, Norway, ktu@sintef.no, Marte Fodstad, Frode Römo

We will present a rich MIP model for the LNG value chain. The value chain spans from production trains to consumers including spot markets for natural gas. The focus will be on modeling as much of the real-world constraints as possible and still obtain reasonable computation times. The model includes

production, transportation by vessels, consumption and different contract types. Results from real-life cases will be presented.

3 - A Stochastic Model for the Natural Gas Value Chain

Marte Fodstad, Researcher, SINTEF Applied Economics and Operations Research, S.P. Andersens veg 5, Trondheim, NO, 7465, Norway, marte.fodstad@sintef.no, Frode Römo, Asgeir Tomasgard

We will present a model supporting tactical decision making in a natural gas value chain. The model coordinates production, transportation, transportation booking, deliveries in take-or-pay contracts and spot trading under stochastic prices and nominated contract volumes. Estimating the value of flexibility in the take-or-pay contracts is an important area of use. In that setting we will in particular focus on how to model the customers' nominations in the take-or-pay contracts.

4 - An Operational Portfolio Optimization Model for a Natural Gas Producer

Kjetil Trovik Midthun, SINTEF, S P Andersens vei 5, Trondheim, Norway, Kjetil.Midthun@sintef.no, Asgeir Tomasgard, Matthias Nowak

We present a portfolio optimization model focusing on daily production, transportation and contract planning for a large natural gas producer. The time horizon under consideration is one week. The paper discusses the value of actively using the storage capacity based on the line-pack in the pipelines to maximize profit for the producer. We also look at the value of using a stochastic model as compared to a deterministic model.

5 - Computing Optimal Schedules for a Thermal Plant in a Deregulated Electricity Market

Sujin Kim, Visiting Assistant Professor, Purdue University, Grissom Hall, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States, sujin@purdue.edu, Jose Prina

We consider the short-term scheduling problem for a single thermal plant in a deregulated electricity market. The thermal producer sells all its production in the spot market. His objective is to compute a schedule that maximizes its profit and use this schedule to construct bids. Bids from producers are subsequently used to compute market clearing prices. The thermal producer is subject to spot price uncertainty. Solution methodologies are based on dynamic programming and simulation.

■ TC57

S-Columbia (Lev. 4)

O.R. in Sports

Sponsor: O.R. in Sports
Sponsored Session

Chair: Eric Huggins, Assistant Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States, huggins_e@fortlewis.edu

1 - Scheduling the First Stage of an International Soccer Tournament with Fairness

Murat Kurt, PhD Candidate, Department of Industrial Engineering, University of Pittsburgh, Pittsburgh, PA, 15261, United States, endmuratkurt@yahoo.com

International tournaments are one of the ways that are increasing the attractiveness of soccer, which is one of the most popular sports in the world. In this talk, fair allocation of the first-stage games of such tournaments to a predetermined set of cities is discussed, and to identify the fairest feasible allocation, that meet some other requirements imposed on the schedule, a method requiring the solution of a sequence of 0-1 integer optimization problems is proposed.

2 - Updating Play Calling using Game Theory and Exploring Risk Behavior through Response Surface Methodology

Jeremy Jordan, The Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States, jeremy.jordan@wpafb.af.mil, Sharif Melouk, Marcus Perry

We utilize game theory within a framework for updating optimal decisions based on new, available information from the perspective of an offensive unit of a football team. A decision maker, such as a coach or quarterback, may change perceived optimal policy based on available knowledge of the opponent's strategy. We apply utility theory to account for different risk preferences and response surface methodology to explore good risk strategies with which to approach each situation.

3 - And the Seattle Seahawks Are Now On the Clock...

Jeffrey Ohlmann, Assistant Professor, University of Iowa, Tippie College of Business, 3749 Donegal Ct., Iowa City, IA, 52246, United States, jeffrey-ohlmann@uiowa.edu, Matthew Gibson

Sports leagues conduct new player entry drafts in which franchises select players to complement their existing rosters. We model a team's player selection decisions as an optimization problem subject to uncertainty induced by imperfect knowledge of opposing teams' player valuations and draft strategies. We solve this discrete stochastic optimization problem using heuristic search. We present computational results for simulated NFL drafts and fantasy football drafts.

4 - Punter Efficiency Rating

Eric Huggins, Assistant Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States, huggins_e@fortlewis.edu

We develop an efficiency rating system for punters similar to the passing efficiency rating for quarterbacks. Typically, punter efficiency is simply measured by average yards per punt. However, the length depends on where the punter starts from: a 40 yard punt from the 50-yard line would be very good, whereas a 40 yard punt from the punter's own 20-yard line would qualify as poor. We also consider fair catches, touchbacks, average return yards, and other statistics in the efficiency rating.

■ TC58

S-Pike (Lev. 4)

Issues in Technology and NPD

Cluster: New Product Development
Invited Session

Chair: Janice Carrillo, Associate Professor, Warrington College of Business, University of Florida, Gainesville, FL, United States, janice.carrillo@cba.ufl.edu

1 - Managing New Product Development with Uncertain R&D Input from a Third Party a Sequential Game

Shantanu Bhattacharya, shantanu.bhattacharya@insead.edu

In this paper, we consider two OEMs who are competing in a common market, and are developing a product jointly with a technology to be sourced from a third party. The third party has an uncertain R&D process, and the probability of successful development of the technology is increasing in the volume commitment and joint investments made by the competing OEMs.

2 - Role of Project Organization Choice on Architectural Misalignment in Distributed Technology Projects

Anant Mishra, University of Minnesota, 321 19th Ave S, Minneapolis, United States, amishra@csom.umn.edu, Kingshuk Sinha

Architecture misalignment occurs during the integration phase of a project when task modules that share design interfaces and functional dependencies are not aligned, and do not function well together. Based on data collected from 665 projects between January to March 2007, we investigate (i) the direct effect of project organization choice on architectural misalignment and (ii) how project organization choice moderates the relationship between architecture misalignment and project performance.

3 - Capturing the Degree of Mass Customization in Product Architecture Modularization Strategies

Juliana H. Mikkola, Associate Professor, Copenhagen Business School, Dept.. of Operations Management, Solbjerg Plads 3, Frederiksberg, DK, 2000, Denmark, jh.om@cbs.dk

Increasing number of firms are benefiting from mass customization (MC). MC is realized through a combination of product architecture modularity strategies (i.e. product design for manufacturability) and postponement strategies (i.e. product design for distribution). This paper proposes a model to measure the degree of mass customization embedded in product architectures.

4 - Revisit to Architectural Innovation

Jin-Kyu Park, Assitant Professor, Florida International University, Industrial & Systems Engineering, 10555 West Flagler St. / EC 3100, Miami, FL, 33174, United States, kyupark@fiu.edu, Chanchai Tangpong, Young K. Ro

The widely accepted notion that incumbent firms falter in the market when dealing with architectural innovation begs the question of whether they can successfully introduce architectural innovations in a mature industry. We investigate the U.S bicycle drive train component industries via in-depth case analyses. This study highlights the importance of an incumbent's prior innovation experience, new product architecture knowledge, and hierarchy mode for successful architectural innovation.

■ TC59

S-Seneca (Lev. 4)

Economic Modeling of New Product Innovation: A Deep Dive

Cluster: Capacity and Technology Management
Invited Session

Chair: Vish Krishnan, Professor, University of California, San Diego, CA, vkrishnan@ucsd.edu

1 - Product Quality Choice, Competition and Supply Chain Design
Stylianos Kavadias, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, NW, Atlanta, GA, 30308-0520, United States, Stylianos.Kavadias@mgt.gatech.edu, Mark Ferguson

We explore the interplay between product design choices and their effect on the supply chain transactions. A large number of examples indicates that product design choices, and the overall product performance (quality), is relying on off the shelf standardized components, and it affects component pricing. We develop a normative model that highlights the profitability drivers for the different industrial settings.

2 - Sequential Innovation with Strategic Consumers and Suppliers
Karthik Ramachandran, Assistant Professor, Southern Methodist University, Cox School of Business, P.O. Box 750333, Dallas, TX, 75275, United States, karthik@cox.smu.edu, Vish Krishnan

Modular upgradability has been shown to be valuable for both manufacturers and consumers of improving products. However, a time-inconsistency problem arises if (i) Strategic consumers if the future versions of the product design would continue to be modular, or (ii) Strategic suppliers of stable subsystems seek to appropriate gains from product improvement. We formalize this two-pronged design inconsistency problem and offer an integrated product-design and module-pricing based solution.

■ TC60

S-University (Lev. 4)

Knowledge, Learning, Intellectual Capital-III: Knowledge-Based Views

Sponsor: Technology Management
Sponsored Session

Chair: Nile Hatch, Marriott School - BYU, Provo, UT, 84602, United States, nile@byu.edu

1 - The Role of Key Architects in Influencing Technology Trajectories
Erica Fuchs, Post-Doctoral Fellow, M.I.T., 73 Magazine Street, Apartment 401, Cambridge, MA, 02139, United States, erhf@mit.edu

The results of a study of the social processes that influence innovation trajectories in microprocessors suggest that small elite cliques (informal networks) of key architects act to coordinate innovation across the various stages of the technology pipeline. The paper also discusses how the five leading microprocessor firms have to bring fringe technological communities into the established social framework to achieve radical architectural and technological change.

2 - Technological Development at the Boundaries of the Firm
Jeffrey Macher, Assistant Professor, Georgetown University, G-04 Old North, Washington, DC, 20057, United States, jtm4@georgetown.edu

This paper examines how the knowledge-based view can be applied to firm boundary decisions and the performance implications of those decisions. A theoretical and empirical examination of how firms efficiently organize for technological development is conducted. Particular organization approaches are superior, depending on the structure of problems and the depth of technological area experience. Semiconductor manufacturing and pharmaceutical drug development serve as the empirical settings.

3 - Quality of Group-Tacit Knowledge
Zeynep Erden, ETH Zurich, SMI, KPL G13, Kreuzplatz 5, Zurich, Switzerland, zerden@ethz.ch, Georg von Krogh, Ikujiro Nonaka

Abstract: In this article we review some of the central elements in organizational knowledge creation theory, define Ñquality of group-tacit knowledge and develop a model explaining different levels in the quality of group tacit knowledge. As the basis for our model development, we use the SECI model from organizational knowledge creation theory (Nonaka, 1994).

4 - Venturing with Novel Ideas: Using the Transformation Heuristic to Learn Not to Fail
Tony Briggs, Boston University School of Management, 595 Commonwealth Ave., Boston, MA, 02215, United States, tbriggs@bu.edu, Paul Carlile

How do entrepreneurs make investment decisions within minutes of hearing of a novel idea? We find that high performing entrepreneurs: (1) share a high volume of ideas, (2) fail ideas from very limited criteria, and (3) quickly fail most ideas without significant investments in information gathering. They select ideas which, independent of their evaluative criteria, share a particular aesthetic for transformation. We describe the use of this aesthetic as the transformation heuristic.

Tuesday, 4:30pm - 6:00pm

■ TD01

C-Room 602

Supply Chain II

Contributed Session

Chair: Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 205 N Mathews Ave, Urbana, IL, 61801, United States, yfouyang@uiuc.edu

1 - The Effects of Sharing Upstream Information on Product Rollover
Zhaolin Li, Assistant Professor of Management Sciences, City University of Hong Kong, P-7620 Academic Building, P-7620, 83 Tat Chee Avenue, Kowloon Tong, Hong Kong, - ROC, zherli@cityu.edu.hk, Long Gao

We consider a one-manufacturer-one-retailer inventory system, where the manufacturer introduces new and improved products over an infinite planning horizon using the solo-roll strategy. We devise a supply chain contract that coordinates the inventory system and maximizes the chain profit. When the system is coordinated, information sharing improves the performance of both supply chain entities. But this may not be true if the system is not coordinated.

2 - A Model for Mid-season Pricing and Inventory Distribution
Satyaveer Singh Chauhan, Concordia University, 1455 de Maisonneuve Blvd. West, Montreal, Canada, sschauha@jmsb.concordia.ca, Anjali Awasthi, Tatiana Bouzdine-Chameeva

We consider a single seasonal product displayed at multiple locations for a possible sale. During mid-season sales manager like to adjust the inventory at stores based on the recent sales and discount. We propose a model and a solution approach for defining the new discount price and the quantity to be shifted among the retailers while taking transportation cost into account.

3 - Fixed Delay versus Negative Base-stock Policy in Multi-echelon Inventory Systems
Ching-Yu Chen, Rutgers University, 101 Bleeker St #75, Newark, NJ, 07102, United States, chingche@andromeda.rutgers.edu, Yao Zhao

This research addresses the optimization of inventory placement in multi-stage supply chains. In particular, we compare and contrast two policies: the fixed delay policy and the negative base-stock policy. A stochastic service time model is utilized, in which demand is random, transportation and processing times are stochastically determined. We shall evaluate these two policies under diverse network topologies and conduct both analytical and numerical studies to provide structural insights.

4 - Inventory Models for Semiconductor Production Systems with Downgrading of Components
Haiqing Song, National University of Singapore, Erg Lab, ISE Dept.. 1 Engineering Drive 2, Singapore, sg, 117576, Singapore, isesh@nus.edu.sg, Huei-Chuen Huang

We consider an inventory management problem arising from a semiconductor production in which two semi-finished items B1 and B2 are made with fixed proportion at the first stage. Then B2 is transformed into product C2 while B1 can be transformed into product C1 or downgraded into product C2. The demand of the final product C2 is not allowed to be substituted by C1 in order to protect the profit margin and market price. Two inventory polices are analyzed and evaluated via numerical simulation.

5 - Order Stability of Supply Chain Networks
Yanfeng Ouyang, Assistant Professor, University of Illinois at Urbana-Champaign, 205 N Mathews Ave, Urbana, IL, 61801, United States, yfouyang@uiuc.edu, Xiaopeng Li

This paper presents exact formulas to characterize the stream of orders placed by any supplier in general supply chain networks, for any stationary customer demand(s). The paper also derives robust analytical conditions to quantify the amplification of order fluctuations when customer demand information is not available.

■ TD02

C-Room 603

PhD Student Research

Cluster: Closed-Loop Supply Chains and Sustainable Operations
Invited Session

Chair: Aejaz Khan, University of Houston, Decision and Information Sciences, Bauer College of Business, Houston, TX, United States, amkhan4@mail.uh.edu

1 - An Inter-Temporal Model for Lease Returns

V. Daniel R. Guide, Jr., Dept.. of SC & IS, Pennsylvania State University, University Park, PA, United States, dguide@psu.edu, Susan Xu, Zheng Jia

We explore the problem of a firm with leased product returns during the lease period. The firm seeks to maximize the total profits over the lifecycle of the product.The faces the choice of remanufacturing or salvaging the product. We explore scenarios that considers cases of remanufacturing with various lead times, and various time between decisions.

2 - Reverse Supply Chain Design for Multiple Channel Product Returns

Aejaz Khan, University of Houston, Decision and Information Sciences, Bauer College of Business, Houston, TX, United States, amkhan4@mail.uh.edu, V. Daniel R. Guide, Jr.

Consider a manufacturer receiving returns of a product that may be sold both at a retail location and over the internet. Internet product returns could be returned either at the retail location or shipped to the retailer's distribution center. In this paper, we study three reverse supply chain designs and determine the major drivers that influence the choice of each design.

■ TD03

C-Room 604

Competition in Supply Chains

Cluster: Supply Chain
Invited Session

Chair: Xuan Zhao, Assistant Professor, Wilfrid Laurier University, 75 University Ave. West, Waterloo, ON, N2J 6C1, Canada, xzhao@wlu.ca

1 - Competitive Price Matching Guarantees: Role of In-store Availability and its Verification

Arcan Nalca, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, arcan.nalca@mcgill.ca, Tamer Boyaci, Saibal Ray

Under the simplest form of price matching guarantees (PMG), a firm matches the lower price offered by a competitor store. We study a competition model with two retailers and a manufacturer and derive/compare the equilibrum prices and profits to analyze the effect of in-store availability and its verification on PMGs. The precise effect of in-store availability and its verification is linked to two factors: the relative sizes, and reservation prices, of different customer segments in the market.

2 - Price Competition Under Yield Uncertainty

Awi Federgruen, Professor, Columbia University, 419 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, af7@columbia.edu, Nan Yang

We analyze the equilibrium behavior in an industry with N suppliers with random yield processes, competing for the business of one or several buyers who face uncertain demands. The suppliers have different yield distributions and procurement costs, and are engaged in price competition. The buyers react to the selected prices and the suppliers' yield characteristics by determining a total order size and its allocation among the suppliers, minimizing purchasing costs under a service constraint.

3 - A Dynamic Pricing Model Under Duopoly Competition

Benny Mantin, UBC, 2053 Main Mall, Sauder School of Business, Vancouver, BC, V6T1Z2, Canada, benny.mantin@sauder.ubc.ca, Daniel Granot, Frieda Granot

In a multi-period finite-horizon fixed-inventory setting, consumers zigzag between two competing retailers, selling identical goods, upon observing prices which exceed their willingness to pay (aka zigzag competition). We are interested in the effect of competition on pricing policies and corresponding retailers' profits. We find that prices decline exponentially, and we further investigate the robustness of the results by, e.g., changing consumers' characteristics.

4 - Inventory Competition for Newsvendors Under the Profit and Revenue Satisficing Objective

Xuan Zhao, Assistant Professor, Wilfrid Laurier University, 75 University Ave. West, Waterloo, ON, N2J 6C1, Canada, xzhao@wlu.ca, Victor Shi

The classical Newsvendor (NV) model has been widely used to understand the single-period inventory-management problem. Recent years have witnessed an extensive study of NVs under competition. Most of the literature, if not all, has assumed NVs' objectives are to maximize profits. In reality, however, many inventory managers' objectives are to achieve the pre-determined profit and (or) revenue targets. This paper aims to understand competitive NVs with profit or profit and revenue satisficing objectives.

■ TD04

C-Room 606

Tutorial: Supply Chain Management in the Context of Humanitarian Disasters

Cluster: Tutorials
Invited Session

1 - Supply Chain Management in the Context of Humanitarian Disasters

Luk Van Wassenhove, Professor, INSEAD, Boulevard de Constance, Fontainebleau, IF, 77300, France, luk.van-wassenhove@insead.edu

This presentation will introduce supply chain management in the humanitarian context, and outline the need for better preparedness and response to disasters. We also discuss opportunities for more effective collaboration among humanitarian organizations, as well as between humanitarians and private organizations. The presentation uses a number of real cases to highlight opportunities to do interesting research with a high potential impact.

■ TD05

C-Room 607

OR Applications in the Automotive Industry

Cluster: O.R. Practice
Invited Session

Chair: Erica Klampfl, Operations Research Group, Ford Research & Advanced Engineering, Room 3011, RIC Building, MD 2122, 2101 Village Rd, Dearborn, MI, 48124, eklampfl@ford.com

1 - Making Strategic Sourcing Decisions to Support Restructuring Efforts

Erica Klampfl, Operations Research Group, Ford Research & Advanced Engineering, Room 3011, RIC Building, MD 2122, 2101 Village Rd, Dearborn, MI, 48124, eklampfl@ford.com, Mike Wolcott, Chip McDaniel, Yakov Fradkin

We present a method for enabling strategic decisions to support restructuring of a portfolio of automotive components, where part cost varies with plant utilization, freight and re-sourcing costs are minimized, and parts may be constrained to particular families. We provide a case study for successful application of this method.

2 - Manpower Reduction Heuristic for Automotive Assembly Planning

Kacie Theisen, Ford Research & Advanced Engineering, 2101 Village Rd, Room 3011, RIC Building, MD 2122, Dearborn, MI, 48124, ktheise1@ford.com, Erica Klampfl, Oleg Gusikhin

We present a heuristic to minimize manpower on a mixed-model assembly line by reassigning work within a neighborhood of the current assignment. This heuristic is based on current operation assignments and does not require explicit representation of precedence constraints. We present an example where good starting manpower assignments are provided.

3 - Integrated Process Planning and Supply Chain Configuration Using Petri Nets

Oleg Gusikhin, Ford Research & Advanced Engineering, RIC Building, Room 3011, MD 2122, 2101 Village Rd, Dearborn, MI, 48124, ogusikhi@ford.com, Erica Klampfl

We present a Petri Net-based approach automating the MIP formulation of the Supply Chain configuration problem with alternative assembly sequences. We start with a Petri Net model of the assembly processes, which unfolds into the Supply Chain model. The MIP formulation is based on the matrix representation of this model.

4 - Labor Allocation in Automotive Planning: Leveraging a Flexible Workforce

Ada Barlatt, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, abarlatt@umich.edu, Amy Cohn

In an automotive stamping facility, a single workforce is shared across presslines within the facility. We consider the problem of simultaneously deciding the workforce size and allocation of laborers across presslines. We present a divide-and-conquer approach to ensure tractability and discuss how this approach extends to other hierarchical planning problems.

■ TD06

C-Room 608

Marketing-Operations Interface Research

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Wenqiang Xiao, Assistant Professor, New York University, 3 Washington Square Village, #4B, New York, NY, 10012, United States, wxiao@stern.nyu.edu

1 - Supplier Competition in Retail Supply Chains

Gurhan Kok, Associate Professor, Duke University, One Towerview Drive, Durham, NC, United States, gurhan.kok@duke.edu, Gerard Cachon

We analyze the competition between two manufacturers selling a product each through a common retailer. As a best response, a manufacturer can always increase its profit by offering a quantity discount contract. The equilibrium solution with quantity discount contracts, however, may lead to lower profits for the manufacturers and higher retailer profit, relative to the equilibrium with wholesale price contracts.

2 - Implications of Product Returns on Channel Relations

Canan Savaskan, Northwestern University, r-savaskan@kellogg.northwestern.edu, Jeff Shulman, Anne Coughlan

This paper examines the implications of commercial product returns on channel relations between a manufacturer and a retailer. We develop a game theoretic bilateral supply chain model to identify conditions under which manufacturer (or retailer) would be in a better positon to assume product returns responsibility. We solve for the restocking fee decisions under different channel formats and discuss the role of restocking fees on channel incentives.

3 - Dynamic Scheduling and Planning of In-game Advertisements

Sridhar Tayur, SmartOps, 12 Federal Street, Suite 400, Pittsburgh, PA, 15212, United States, stayur@smartops.com, John Turner, Alan Scheller-Wolf

With the acquisition of Massive Incorporated by Microsoft, and of Adspace by Google, the competition for acquiring market leadership in this nacsent but fast growing space is well on its way. As the number of multi-player, internet based games, players and the number and types of advertisments grow, there is a need for optimization methods that are quick as well as effective.

4 - Information Acquisition and Production Planning

Wenqiang Xiao, Assistant Professor, New York University, 3 Washington Square Village, #4B, New York, NY, 10012, United States, wxiao@stern.nyu.edu, Fangruo Chen

We consider a salesforce compensation problem where the salesperson is engaged in two types of activities, gathering information about the market condition and promoting sales. The information gathered by the salesperson can be used by the firm to improve its production planning. We study several types of contracts, and find that a contract that requires the salesperson to submit a sales forecast maximizes the firm's expected profit.

5 - Innovation Contests and Multi-agent Problem Solving

Yi Xu, Assistant Professor, University of Miami, 412B Jenkins Bldg., 5250 University Dr., Coral Gables, FL, 33146, United States, yxu@exchange.sba.miami.edu, Christian Terwiesch

In an innovation contest, a firm (the seeker) facing an innovation related problem posts this problem to a population of independent agents (the solvers) and then provides an award to the agent that has generated the best solution. In this paper, we find that the seeker can benefit from a larger solver population as he obtains a more diverse set of solutions.

■ TD07

C-Room 609

Stochastic Inventory Models

Cluster: Inventory
Invited Session

Chair: Qing Li, Hong Kong Univ of Science and Technology, Clear Water Bay, Kowloon, Hong Kong - ROC, imqli@ust.hk

1 - Stochastic Fluid Models for Production-Inventory Systems

Vidyadhar Kulkarni, Professor, Dept. of Stat and OR, University of North Carolina, Chapel Hill, NC, 27599-3260, United States, vkulkarn@email.unc.edu, Keqi Yan

We consider a production-inventory system where the production and demand rates are modulated by an external environment that evolves as a continuous time Markov chain. Orders can also be placed at an external supplier. We present methods of computing the optimal ordering policies in the presence of leadtimes and backorders.

2 - Price-only Contract with Backup Supply

Yao Zhao, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States, yaozhao@andromeda.rutgers.edu, Xiaowei Xu

We explore a new potential way to mitigate the "double marginalization effect by a backup supply. Specifically, we consider a supply chain with one manufacturer and one retailer in newsvendor settings. In addition to regular supply, the manufacturer may offer a backup supply to satisfy demand not met by the retailer. We study when to offer backup supply, how it affects regular supply and overall supply chain profit.

3 - Integrating a One-time Probabilistic Special Purchasing Opportunity with On-going Decisions

Hussein Naseraldin, University of Calgary, 2500 University Drive NW, Calgary, Alberta, Calgary, AB, T2N1N4, Canada, hnaseral@ucalgary.ca, Edward Silver

An inventory controller, who replenishes the inventory of an item on a regular basis, may encounter special opportunities to purchase the item at a reduced price. Of particular interest is the case where there is a one-time opportunity that may, with known information, occur in the short-term. In this paper we integrate a one-time, probabilistic opportunity with the on-going decisions. We show that order-up-to-level is the optimal policy and we obtain the exact form of the optimal solution.

4 - Optimal Policies for Inventory Systems with Ordering Postponement

Qing Li, Hong Kong Univ of Science and Technology, Clear Water Bay, Kowloon, Hong Kong - ROC, imqli@ust.hk, Xiaoli Wu, Ki Ling Cheung

A retailer replenishes its inventory by first making a delivery request at a fixed cost without specifying a quantity and then placing an order when a delivery vehicle arrives after one period. We show that the optimal policy on delivery requests follows a simple threshold structure. However, the optimal policy for ordering decisions is complex and hence a simple heuristic is proposed and tested.

■ TD08

C-Room 611

Inventory Management

Contributed Session

Chair: Seok Ho Chang, Assistant Professor, Nanyang Technological University, Nanyang Avenue 50, Singapore, seokhochang@ntu.edu.sg

1 - How to Differentiate Service Level to Maximize the Economic Benefits

Peter Berling, Lund University, PO-Box 118, Lund, 22100, Sweden, peter.berling@iml.lth.se

By differentiating service-levels savings can be obtained while still maintaining an average target service level. However, this is not common in practice partly due to little knowledge of the potential savings and partly due to a lack of suitable methods to group the products. Our purpose is to; estimate the potential savings; find suitable basis for an ABC-classification; derive a simple to use method to determine the appropriate service level for each class.

2 - Consignment Stock of Inventories with Buyer's Warehouse Capacity Constraint

Sheng-Pen Wang, Associate Professor, Dept. of Business Administration, Chang Gung University, Taoyuan, 333, Taiwan - ROC, wangsp@mail.cgu.edu.tw

We consider a supply chain problem in which a manufacturer produces a single item and periodically delivers it to a buyer on the consignment policy. An integrated inventory model, making joint economic lot size decisions of the

manufacturer's production and the replenishment subject to consignee's warehouse capacity constraint, is constructed to minimize the manufacturer's total cost. An algorithm that optimially solves the proposed model is presented along with a numerical illustration.

3 - Inventory Management with Direct Shipments
Haldun Sural, Assoc. Prof., METU, Industrial Eng Dept., METU, Ankara, 06531, Turkey, sural@ie.metu.edu.tr, Meltem Denizel, Oguz Solyali

We consider two periodic inventory management problems with direct shipment strategy. The first problem generalizes the dynamic lot sizing model in a one supplier-multiple retailer environment and the second one assumes an order up to level inventory policy for the retailers. We present extended mixed integer linear formulations and report our computational results.

4 - A Mathematical Modelling Approach for Floating Stock Policy
Morteza Pourakbar, PhD Student, Erasmus University Rotterdam, Room H07-09, Burg. Oudlaan 50, P.O. Box 1738 3000 DR Rotterdam, Rotterdam, Netherlands, pourakbar@few.eur.nl, Rommert Dekker, Andrei Sleptchenko

In this paper a mathematical approach for analysing the concept of Floating Stock is presented. The floating stock concept exploits inter-modal to deploy inventories in a supply chain in advance of demand. In the proposed model we try to optimize the advanced shipping time of containers by inter-modal transport. A comparison is made regarding the simulation results of previously developed policies showing this concept has advantages in inventories over pure road and pure inter-modal.

5 - Modeling, Analysis and Comparison of Tandem Lines with Two Unreliable Machines and a Finite Buffer
Seok Ho Chang, Assistant Professor, Nanyang Technological University, Nanyang Avenue 50, Singapore, seokhochang@ntu.edu.sg, Stanley B. Gershwin

This paper considers tandem lines with two unreliable machines and a finite buffer. The first machine is an unreliable single-item machine and the second machine is an unreliable batch machine. The purpose of this paper is to present a model, its exact analysis and comparison of these systems. We present conservation of flow, flow rate-idle time relationships and equivalence property. We also present performance measures of interest such as production rate and expected in-process inventory.

■ TD09

C-Room 612

All Hazards: OR and Homeland Security

Cluster: Homeland Security
Invited Session

Chair: Karima Nigmatulina, MIT, Cambridge, MA, United States, knigmatu@MIT.EDU

1 - Planning the Bioterror Response Supply Chain: Learn and Live
Margaret Brandeau, Professor, Stanford University, 407 Terman Engineering Center, Stanford, CA, 94305, United States, brandeau@stanford.edu, Douglas Owens, Dena Bravata, David Hutton

Responses to bioterrorism require rapid procurement and distribution of medical and pharmaceutical supplies, trained personnel, and information. We describe how concepts learned from published evaluations of manufacturing and service supply chains, as well as lessons learned from responses to natural disasters, naturally occurring outbreaks, and the 2001 U.S. anthrax attacks, can be applied to design, evaluate, and improve the bioterrorism response supply chain.

2 - Avoiding the Eye of the Storm
Michael Metzger, MIT, 34 Shadetree Lane, Roslyn Heights, NY, United States, mmetzger@mit.edu

With an approaching hurricane, government decision makers face a set of action timing decisions: supply pre-positioning, mobilization and evacuation. The location, time and intensity of the hurricane at landfall are random variables governed by nature. We develop a stochastic dynamic program incorporating economic, social, and logistical impacts of alternative sequential decisions.

3 - Heavy-tails in Natural and Man-made Disasters
David Alderson, Assistant Professor, Naval Postgraduate School, Operations Research Department, 1411 Cunningham Rd, Monterey, CA, 93943, United States, dlalders@nps.edu, Jean Carlson, John Doyle

Over the last century, natural and man-made disaster events have been heavy-tailed in the number of people killed and the amount of damage caused. Focusing on earthquakes, forest fires, and hurricanes, we demonstrate features that contradict recently popular notions of universal self-organization for large-scale disasters. Understanding this structure and the mechanisms which yield it is a prerequisite for policy makers to properly incorporate this intrinsic variability in disaster planning.

4 - Models and Algorithms for Effective Emergency Supply Planning
Zhihong Shen, University of Southern California, 3715 McClintock Avenue, GER-240, Los Angeles, CA, 90089, United States, shenz@usc.edu, Fernando Ordonez, Maged Dessouky

A key ingredient in an effective response to an emergency is the prompt availability of the necessary supplies at the emergency sites. Many unique features require the creation of new models of planning in order to develop a rational deployment strategy. We model the disbursement of medical supplies in an emergency circumstance into a facility location and routing problems. Simulation results show the benefits of this formulation based on LA county data.

■ TD10

C-Room 613

Inventory Management Optimization

Cluster: Inventory
Invited Session

Chair: Retsef Levi, Robert N. Noyce Career Development Professor, Assitant Professor of Management, MIT, Sloan School of Management, 50 Memorial Drive, E53-389, Cambridge, MA, 02142, United States, retsef@mit.edu

1 - Multi-item Lot-sizing with Joint Set-up Cost
Shoshana Anily, Prof., Tel Aviv University, Faculty of Management, Tel Aviv, 69978, Israel, anily@post.tau.ac.il, Laurence Wolsey, Michal Tzur

Consider a multi-item lot-sizing problem with joint set-up costs and constant capacities. Apart from items unit production and storage costs, a set-up cost is incurred per batch, where a batch may include any mix of items. Under widely applicable conditions, namely that the production and storage costs are non-speculative, and the order of the item holding cost is identical in all periods, we present a tight linear program that solves the problem, proving that it is polynomially solvable.

2 - Approximation Algorithms for the Mulit-Item Capacitated Lot-Sizing Problem Via Flow-Cover Inequalities
Retsef Levi, Robert N. Noyce Career Development Professor, Assitant Professor of Management, MIT, Sloan School of Management, 50 Memorial Drive, E53-389, Cambridge, MA, 02142, United States, retsef@mit.edu, Maxim Sviridenko, Andrea Lodi

We study the classical multi-item capacitated lot-sizing problem with N items and T periods. The goal is to minimize the overall fixed ordering costs and holding costs. This problem is strongly NP-hard. We propose a novel LP-relaxation that is based on a subset of the well-known flow-cover inequalities, and show how to use this LP to construct a feasible solution, which cost is guaranteed to be at most twice the optimal cost.

3 - Primal Dual Schema for Capacitated Covering Problems with Lot-Sizing Applications
Tim Carnes, PhD Student, Cornell University, 206 Rhodes Hall, Ithaca, NY, 14853, United States, tac45@cornell.edu, David Shmoys

LP-rounding algorithms for the min knapsack and one-demand facility location problems were shown in Carr et al. 2000, which made use of flow-cover inequalities. We strengthen these results by showing primal-dual schema with the same performance guarantee for these problems. Further, we extend this to the single-item lot-sizing problem with linear holding costs. We believe that this is a significant step for more general lot-sizing problems, and perhaps the capacitated facility location problem.

4 - Approximate Solutions to Logistical Planning Problems in One-Warehouse Multi-Retailer Systems
Jiawei Zhang, Assistant Professor, New York University, 44 West 4th St., Suite 8-66, New York, NY, 10012, United States, jzhang@stern.nyu.edu, Max Shen, David Simchi-Levi, Chung-Piaw Teo

We consider logistical planning problems that take into account the issues of (i) inventory perishability and storage charges, (ii) management of backlog and/or lost sales, and (iii) cost saving opportunities due to economies of scale in order replenishment and transportation. We identify simple conditions and structural properties associated with these logistical planning problems and present approximation algorithms for them.

■ TD11

C-Room 614

Manufacturing

Contributed Session

Chair: Purushothaman Damodaran, Assistant Professor, Florida International University, 10555 W Flagler Street, EC 3172, Miami, FL, 33174, United States, damodarp@fiu.edu

1 - Fuzzy Aggregate Production Planning with Workforce Learning Effect

Zhixiang Chen, Associate Professor, Sun Yat-sen University, Guangzhou, P.R. of China, Guangzhou, China, zhixiang-chen@hotmail.com

Considering demand uncertainty and workforce learning effect in practice, a fuzzy aggregate production planning model is constructed; genetic algorithm is also put forward. A case application in a mosquito-repellent incense manufacturing company is demonstrated. The result shows the effectiveness and applicability of the model and algorithm.

2 - Minimizing the Makespan of Identical Batch Processing Machines at an Electronics Manufacturing Facility

Siddharth Mestry, Graduate Student, Florida International University, 10555 W. Flagler Street, Industrial & Systems Engineering, Miami, FL, 33174, United States, smest001@fiu.edu, Purushothaman Damodaran, Maria de Lourde Hulett

A mixed-integer formulation for minimizing the makespan of identical batch processing machines is presented. This class of scheduling problems is NP-hard. The processing times and sizes of the job are given. We propose a branch-and-bound approach and some heuristics. A computational study comparing the different solution approaches is presented.

3 - Product Line Competition and ICT Investments

Nobuo Matsubayashi, Assistant Professor, Keio University, Hiyoshi 3-14-1 Kohoku-ku, Yokohama, 223-8522, Japan, nobuo-m@pa2.so-net.ne.jp

We study strategic product line designs under duopoly. While a rich variety of products contribute to attract consumers, they may cause consumers' confusion resulting in their dissatisfaction. Firms are thus motivated to offer their products with ICT tools for sufficient communication about them. We present a simple game theoretic model to analyze the impact of the cost of developing these tools on product line decisions, which may be affected even by the rival's product line.

4 - Spectra Data-based Mining and Analysis: Quality Improvement of Forest Manufacturing Processes

Hyun-Woo Cho, Research Associate, Univ. of Tennessee, 315 ESH, Knoxville, TN, 37996, United States, hwcho@postech.ac.kr, Myong K. (MK) Jeong, Seung H. Baek

Spectroscopic data have been successfully used in many areas including forest products. In this talk, we present spectra-based data mining and analysis techniques that can be used for modeling complex forest manufacturing processes. Various pre-treatment schemes for spectra data are adopted and compared to evaluate their effects on highly correlated data. In addition, nonlinear and wavelet transform-based dimension reduction is considered to handle high-dimensionality of spectra data sets.

5 - A Mixed-integer Formulation and Solution Approach for Capacity Planning and Scheduling in a Make-to-order

Siddharth Mestry, Graduate Student, Florida International University, 10555 W. Flagler Street, Industrial & Systems Engineering, Miami, FL, 33174, United States, smest001@fiu.edu, Purushothaman Damodaran, Chin-Sheng Chen

A mixed-integer formulation for capacity planning and detailed scheduling for a make-to-order enterprise is presented. The model prescribes the orders to accept and how the resources (both in-house and outsourced) are scheduled to meet the order due dates. A branch-and-price algorithm is also presented with an experimental study.

■ TD12

C-Room 615

Scheduling I

Contributed Session

Chair: Fatih Safa Erenay, PhD Student, University of Wisconsin-Madison, 501 N Midvale Blvd AptC, Madison, WI, 53705, United States, erenay@wisc.edu

1 - Real World Staffing Scheduling: Optimal SLA and Variable Volume Distribution

Ai Jun Zhang, Business Planning System Consultant, Wells Fargo, 11601 N. Black Canyon Highway, Phoenix, AZ, 85029, AiJun.Zhang@wellsfargo.com, Hung-Nan Chen, Charles Reichenbach

In this presentation, we will first show you how we create a virtual volume concept to model long turn-around task using short staffing interval and how we model staffing in a multi-tasking environment. Next, we will demonstrate that an optimal SLA can be achieved under certain conditions to challenge the perception that staffing and SLA are positively correlated. Finally, we will present to you a real example how we use variable volume distribution to achieve an optimal staffing schedule.

2 - Hot Strip Rolling Scheduling: A Precedence Constrained Multi-asymmetric Traveling Salesman Problem

Peifang Tsai, Research Assistant Professor, Dept.. of Systems Science and Industrial Engineering, Binghamton University, P.O. Box 6000, Dept.. of SSIE, Vestal, NY, 13902, United States, ptsai@binghamton.edu, Subhash C. Sarin, Hanif Sherali

We consider a hot strip rolling scheduling problem encountered in a steel rolling mill. We model this problem as a precedence constrained multiple-asymmetric traveling salesman problem (PCmATSP) for which we develop new formulations and establish the tightness of these models. We define a special, pre-specified precedence order in which the slabs of the scheduling problem are processed. A modified Benders decomposition method is developed and numerical results show the efficacy of our approach.

3 - Slack Policies for Jobshop Machine Disruptions

Deepu Philip, PhD Student, M&IE Dept., IE Program, Montana State University, Bozeman, MT, 59718-3800, United States, dphilip@ime.montana.edu, Ed Mooney

Machine breakdowns can create chaos in shops whose schedules maximize machine utilization. Introducing slack can make the schedule more robust, but at a cost. This paper evaluates the effects of slack policies on the robustness/cost tradeoff for Lmax and Cmax jobshop problems. Policies are specified by the frequency, duration and location of slack in the schedule. Robustness and objectives are evaluated using a standard set of jobshop problems and efficient rescheduling algorithms.

4 - A Hybrid Algorithm of Evolutionary Computing and Simulated Annealing for Timetabling Problem

Jaime Mora Vargas,Director, Maestría en Ciencias con especialidad en Ing Indust (MII), Escuela de Graduados en Ing y Ciencias, Tecnológico de Monterrey, Campus Estado de México, jmora@itesm.mx

The timetabling problem (TTP) consists on assigning a set of events (lectures, courses, exams) to a limited group of timeslots, subject to diverse constraints; this problem comes up every semester in educational institutions. TTP is one of the most difficult problems in computer sciences and it belongs to the NP – hard class of problems. In the literature a wide variety of meta heuristics techniques have been proposed to solve these kind of problems. Recently, the interest on hybrid meta heuristics has been increased among combinatorial optimization researchers, because hybridizations provide powerful algorithms for NP problems. In this paper a very efficient hybrid genetic-annealing algorithm is proposed. The new algorithm uses a small population with a Genetic Algorithm approach and Boltzmann distribution criteria to escape from local optima. Statistics about experimentation with this algorithm is also presented in this paper.

5 - New Solution Methods for Single Machine Bicriteria Scheduling Problem: Minimization of Average Flowtime

Fatih Safa Erenay, PhD Student, University of Wisconsin-Madison, 501 N Midvale Blvd AptC, Madison, WI, 53705, United States, erenay@wisc.edu, Aysegul Toptal, Ihsan Sabuncuoglu, Manoj Kumar Tiwari

In this study, we consider the problem of minimizing number of tardy jobs and average flowtime on a single machine. We propose and analyze the efficiency of different heuristics that build on beam search, genetic algorithm and tabu search methodologies. Based on extensive computational experiments, we characterize the problem settings under which each solution methodology performs the best.

■ TD13

C-Room 616

Combinatorial Optimization

Sponsor: Optimization/ Integer Programming
Sponsored Session

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

1 - The Co-2-plex Polytope
Benjamin McClosky, Rice University, 6100 Main St. - MS 134, Houston, TX, 77030, United States, bjm4@rice.edu, Illya Hicks

2-plexes are cohesive subgraphs which were introduced to relax the structure of cliques. A co-2-plex is the complement of a 2-plex and is therefore similar to a stable set. We discuss the co-2-plex analogue for certain properties of the stable set polytope.

2 - Finding Low Diameter Clusters in Graphs
Balabhaskar Balasundaram, Assistant Professor, Industrial Engineering & Management, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, baski.balasundaram@okstate.edu, Sergiy Butenko

A k-club is a set vertices that induce a subgraph of diameter at most k. k-clubs were originally introduced in social network analysis as clique relaxations that model cohesive subgroups as cliques were impractical for real life social networks due to their restrictive nature. We focus on the special case of 2-clubs. Clustering applications of 2-clubs, preliminary complexity, polyhedral results and branch-and-cut approaches will be discussed.

3 - Modeling the View Selection Problem for Aggregate Queries as an Uncapacitated Facility Location Problem
Zohreh Asgharzadeh, Graduate Student, North Carolina State University, Graduate Program in Operations Research, NC State University, Raleigh, NC, 27695, z_asgharzadeh@yahoo.com, Rada Chirkova, Yahya Fathi

We model the view selection problem for aggregate queries in a database as an Uncapacitated Facility Location Problem (UFLP). A key difference between this model and a typical UFLP is that here we have a large (exponential) number of sites. We propose strategies to reduce the size of this model, hence allowing relatively large instances of the problem to be solved optimally. We also employ this model in the context of a heuristic procedure for solving very large instances of the problem.

4 - Redundancy and Robustness Analysis of a Structured Linear Model Using Matroid Decomposition
Jung Jin Cho, Post-Doc Research Associate, Texas A&M University, 3131 TAMU, College Station, TX, jjcho@tamu.edu, Yu Ding, Yong Chen

A general linear model y = Xb + e, is widely used in many engineering and statistics applications. X is said to be structured if there exist dependent p rows in X, where X is an n by p matrix. The cogirth (the cardinality of a minimum cocircuit) of a linear matroid associated with X is very useful for a robustness study. We show applications of the cogirth of a linear matroid in engineering and statistics and develop a new algorithm using matroid decomposition.

5 - Generalized MIR Inequalities: Facets for Group Polyhedra
Kiavash Kianfar, Assistant Professor, Texas A&M University, 239B Zachry, College Station, TX, 77843, United States, kianfar@tamu.edu, Yahya Fathi

We discuss the relationship between generalized mixed integer rounding (MIR) inequalities and integer group polyhedra. We show that generalized MIR inequalities are facet-generating for infinite group problems. We then use this result to prove that they can also generate facets for many finite group problems.

■ TD14

C-Room 617

Nonlinear Programming I

Contributed Session

Chair: Robert Mifflin, Professor, Washington State University, Mathematics 3113, Pullman, WA, 99164, United States, mifflin@math.wsu.edu

1 - Indefinite Kernels for Support Vector Machines
Ronny Luss, Princeton University, ORFE Department, Engineering Quadrangle, Princeton Univ., Princeton, NJ, 08544, United States, rluss@princeton.edu, Alexandre d'Aspremont

Similarity matrices constructed to describe the relationships in data are often indefinite. Applying these measures to Support Vector Machines loses the interpretability that positive semidefinite (PSD) kernels provide and produces nonconvex training problems. We formulate a convex max-min optimization problem to incorporate indefinite kernels into SVMs by optimizing over PSD matrices and penalizing the distance from the indefinite kernel. We detail an algorithm and give numerical results.

2 - Legendre Duality: Applications and Extensions
Thomas Jefferson, Professor, The Paul Merage School of Business, University of California, Irvine, CA, 92697-3125, United States, trjefferson@hotmail.com, Carlton Scott

A duality for nonlinear programs is developed using the Legendre transform. It extends conjugate duality to classes of nonconvex programs. Applications include geometric programming, signomial programming, and other classes of nonconvex programming. The extension from differentiable functions to a class of continuous functions is presented.

3 - Packing Spheres on a Spherical Surface
Leo Liberti, Dr., Ecole Polytechnique, LIX, Ecole Polytechnique, Palaiseau, NA, France, leoliberti@gmail.com, Sergei Kucherenko, Pietro Belotti, Nelson Maculan

The kissing number is the maximum number of unit spheres that can be adjacent to a given unit sphere. This talk gives current results based on mathematical programming formulation based techniques for computing lower and upper bounds to the kissing number.

4 - Penalty Function Approach for Compromise Mechanisms in Distributed Collaborative Design Optimization
Sandipan Ganguly, Sr. Statistical Modeler/Developer, Expedia Inc., 3150 139th Ave SE, Bellevue, WA, 98005, United States, sganguly@expedia.com, Ahmet Keha, Teresa Wu

This paper addresses the computational difficulties and inflexibility of existing collaborative distributed design optimization techniques by using penalty functions to control the designers' compromise effort. For convex and intersecting design spaces we prove that the proposed optimization technique always converges to a solution. We also investigate how various parameters in the problem formulation can be adjusted to regulate computational effort, risk attitude and rules of design compromise.

5 - An Improved VU-algorithm for General Convex Minimization
Robert Mifflin, Professor, Washington State University, Mathematics 3113, Pullman, WA, 99164, United States, mifflin@math.wsu.edu, Claudia Sagastizabal

This talk describes a modification of a recently published VU-algorithm for minimizing convex functions including infinitely-defined ones resulting from inner maximization or integration. The change allows for a certain prox-parameter to go to infinity. We show global convergence of the modified algorithm and provide a strategy for prox-parameter variation which improves performance on some numerical test problems.

■ TD15

C-Room 618

Joint Session Stochastic Optimization /OS: Stochastic Optimization Applications to Electric Power Generation and Nuclear Safety

Cluster: Stochastic Optimization/Large Scale Optimization, Optimization
Invited Session

Chair: Elmira Popova, Associate Professor, The University of Texas at Austin, 1 University Station C2200, ETC 5.120, Austin, TX, 78712, United States, elmira@mail.utexas.edu

1 - Optimal Preventive Maintenance Policy Under a Budget Constraint
Inderjeet Singh, University of Texas at Austin, Department of Mechanical Engineering, 1 University Station, C2200, ETC 5.110, Austin, TX, 78705, United States, inderjeet@mail.utexas.edu, Ernie Kee, Elmira Popova

We design optimal preventive maintenance policy for a system of N items that minimizes total expected maintenance cost under a budget constraint. The problem has finite horizon and we consider constant inter preventive maintenance times for every item. The resulting nonlinear program is reformulated as a binary integer program and computation results are presented on a real problem from South Texas Project Nuclear Operating Company in Bay City, Texas, USA.

2 - A Parallel Branch-and-price Approach for the Project Prioritization Problem
Ali Koc, University of Texas at Austin, Operations Research and Industrial, Engineering, ETC 5.120, Austin, TX, 78712, United States, alikoc@mail.utexas.edu, Ernie Kee, David Morton, Elmira Popova, Stephen Hess

We consider an annual budgeting problem from the South Texas Project Nuclear Operating Company. The portfolio of projects obtained by the classical multi-knapsack formulation proves volatile, as the problem data is uncertain. We, instead, rank the projects, considering their structural and stochastic dependencies. The problem amounts to a two-stage stochastic integer program, which in turn, is a large scale integer program. As a solution approach, we use parallel branch-and-price framework.

3 - Prioritized Interdiction Strategies in Nuclear Smuggling Networks

Dennis Michalopolous, PhD Candidate, University of Texas at Austin, Operations Research & Industrial Eng., Austin, TX, United States, dennis_m@mail.utexas.edu, David Morton, J. Wesley Barnes

A prioritized two-stage stochastic nuclear smuggling network interdiction problem is solved using CPLEX and a CPLEX/Tabu Search hybrid approach. We present computational results for both bipartite and general networks. The second problem type makes no assumptions about the network topology and is, in general, a computationally more challenging problem.

4 - Fully Polynomial Time Approximation Schemes for Stochastic Dynamic Programs

Nir Halman, Post-Doc, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA, 02139, United States, halman@MIT.EDU, Chung-Lun Li, Jim Orlin, David Simchi-Levi, Diego Klabjan

We develop a framework for obtaining (deterministic) Fully Polynomial Time Approximation Schemes (FPTASs) for stochastic univariate dynamic programs with either convex or monotone single-period cost functions. Using our framework, we give the first FPTASs for several NP-hard problems in various fields of research such as knapsack-related problems, logistics, operations management, economics, and mathematical finance.

■ TD16

C-Room 619

Global Optimization

Cluster: Optimization (Invited)
Invited Session

Chair: Archis Ghate, Assistant Professor, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98195, United States, archis@u.washington.edu

1 - Innovative Mathematical Characterizations and Algorithms for Decision Tree Analysis

Jitamitra Desai, Visiting Assistant Professor, Lehigh University, Dept. of Industrial & Systems Engineering, 200 W Packer Ave, Bethlehem, PA, 18015, United States, jdesai@lehigh.edu, Suvrajeet Sen

This paper presents novel mathematical characterizations for representing decision trees. The advantage of using optimization techniques for solving decision tree problems, as opposed to using (traditional) backward recursion or stochastic dynamic programming methods is illustrated. Next, we extend this basic characterization to a compact path-based formulation and design a branch-and-price-and-cut algorithm for solving this problem. Finally, we present some preliminary computational results.

2 - Analytical Bounds on Parameterized Improving Hit-and-Run for Adaptive Performance Enhancements

Wei Wang, Doctoral Student, University of Washington, Industrial Engineering, Box 352650, Seattle, WA, 98195, United States, wangwei@u.washington.edu, Archis Ghate, Zelda Zabinsky

We incorporate the feature of a Hit-and-Run based small world network model into Improving Hit-and-Run to obtain a parameterized IHR algorithm. We adaptively tune a parameter of this algorithm to enhance performance by maintaining a constant probability of improvement using our analytically derived lower and upper bounds.

3 - A Parallel Algorithm for Dynamic Routing and Intersection Control

Shih-Fen Cheng, Assistant Professor, Singapore Management University, 80 Stamford Road, Singapore, 178902, Singapore, sfcheng@smu.edu.sg, Robert L Smith, Marina A. Epelman

In this paper, we study the challenging problem of finding coordinated intersection control policy and routing choices simultaneously in a network with flow-dependent link travel times. We employ the game-theoretic paradigm of fictitious play to iteratively converge to a locally optimal solution. The algorithm can be parallelized to scale to realistic size networks modeled with high-fidelity simulations such as city of Troy, Michigan. Significant savings can be achieved by this approach.

4 - A Dynamic Programming Approach to Optimal Boltzmann Sampling

Archis Ghate, Assistant Professor, University of Washington, Industrial Engineering, BOX 352650, Seattle, WA, 98195, United States, archis@u.washington.edu, Robert L Smith

MCMC is widely applied to sample approximately from low-temperature Boltzmann distributions. Given phases defined by a cooling schedule and the number of iterations allowed, the key is to find the number of iterations in each phase to ensure a high-quality approximation. We present a dynamic programming approach to achieve this.

■ TD17

C-Room 620

Current Issues in IS

Sponsor: Information Systems Society
Sponsored Session

Chair: Haldun Aytug, University of Florida, ISOM Dept., Gainesville, FL, 32611, United States, haldun.aytug@cba.ufl.edu

1 - Estimating Multiple Objectives in Data Mining

John Sparks, University of Illinois, Chicago, Information and Decision Sciences, Chicago, IL, 60607, United States, jspark@uic.edu, Sid Bhattacharyya

Many data-mining situations require estimation of multiple objectives. For instance, predict which prospects will become customers, and which customers will provide more value. This study compares the performance of different statistical methods of modeling for multiple objectives using six different files from the database marketing arena.

2 - Strategic Learning with Constrained Agents

Fidan Boylu, Assistant Professor, University of Connecticut, One University Place, Stamford, CT, 06901, United States, Fidan.Boylu@business.uconn.edu, Gary Koehler, Praveen Pathak, Haldun Aytug

In Strategic Learning, the principal anticipates modification of attributes by agents. In many cases, agents are constrained on how much an attribute can be modified (modifications may need to belong to a set of possible changes like moves in checkers or chess). We explore attribute adjustment by constrained agents.

3 - Price Equilibrium of Online Advertisement and Click Fraud Problem

Wei Zhou, University of Florida, 305 Diamond VLG., Apt. 20, Gainesville, FL, 32603, United States, wzhou@ufl.edu, Praveen Pathak, Shubho Bandyopadhyay

We develop a model to find the price equilibrium for internet advertisement industry among the three parties: publisher, coordinator, and advertiser. We find the publisher-coordinator contract to be a double-sided moral hazard problem, and the coordinator-advertiser contract a double moral hazard problem with agent°Øs effort observed. We further show that an efficient pricing strategy has the power to deter click fraud, which is a major problem facing the internet advertising industry recently.

4 - Real Options and Grid Computing

Shubho Bandyopadhyay, University of Florida, 364 STZ Hall, Gainesville, FL, 32611, United States, shubho.bandyopadhyay@cba.ufl.edu, Selwyn Piramuthu, Juheng Zhang

Grid computing essentially involves transparent access to distributed computing where computing resources are pooled and shared. We study the economics of grid computing from a provider's perspective using real options for valuing strategic investment decisions. We model the consumer's choices and find the maximum price she will be willing to pay for the provider's service. The provider then uses this price to decide on his buy versus rent decisions for the grid computing infrastructure.

■ TD18

C-Room 201

Computational Approaches for Large-scale Optimization Problems

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Gino Lim, University of Houston, 4800 Calhoun Rd, E211 Engr. Bldg. 2, Houston, TX, 77204, United States, ginolim@uh.edu

1 - Fast and Robust Primal Bound Generation Techniques for the P-median Problem

Gino Lim, University of Houston, 4800 Calhoun Rd, E211 Engr. Bldg.. 2, Houston, TX, 77204, United States, ginolim@uh.edu

We discuss new solution techniques for the p-median problem with the goal of improving the solution time and solution quality of current methods. The new methods are based upon combining elements from two currently existing solution techniques. We also compare three different starting point generation techniques for the algorithms and ultimately present a new solution methodology that provides consistently good results when initialized with a particular starting point generation method.

2 - Dynamic Programming-based Cuts for the Capacitated Lot-sizing Problem

Esra Buyuktahtakin, University of Florida, Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, iesra@ufl.edu, Joseph Hartman

In this study, we analyze a dynamic programming algorithm for the single-item, capacitated lot-sizing problem. Furthermore, we utilize the associated linear programming formulation to generate cutting planes for the classical integer programming formulation of the CLSP and illustrate their computational effectiveness.

3 - Direct Solution of Systems of Linear Equations

Joseph Elble, University of Illinois, Industrial Engineering, Urbana, IL, United States, elble@uiuc.edu, Nick Sahinidis

The direct solution of Ax=b involves four main phases: ordering A for fill-in reduction and structural singularity detection, factorizing A into a product of two triangular matrices, solving for x, and optionally refining x to reduce computational error. All four phases are investigated, and multi-threading is utilized to improve performance.

■ TD19

C-Room 203

Panel on Future Research Needs in Workforce Engineering

Cluster: Workforce Engineering
Invited Session

Chair: Ronald Askin, Arizona State University, Dept. of Industrial Engineering, Tempe, AZ, 85287, United States, ron.askin@asu.edu

1 - Scheduling Issues in the Service Industry

Jonathan Bard, Professor, The University of Texas, 1 University Station C2200, Mechanical Engineering, Austin, TX, 78712-0292, United States, jbard@mail.utexas.edu

Personnel planning and scheduling problems are complicated by a host of labor laws, union rules, and aperiodic fluctuations in demand. In situations where shortages exist, such as in the health care industry, many organizations have adopted policies that give increased weight to the preferences and requests of their staff, often at considerable cost. Nevertheless, cost minimization must be the objective of any organization that expects to survive in the long run.

2 - Workforce Cross Training and the Learning Effect

David Nembhard, Faculty Advisor, Pennsylvania State University, University Park, PA, 16802, United States, dan12@psu.edu

In the modern service and manufacturing work environments, where workers are often asked to become skilled at many things, there is a need to calibrate the amount of cross training. One possible view is to balance the benefits of multi-functionality against the training costs required to achieve it. Several models are discussed in the context of simulation results in various scenarios.

3 - Productivity Based Incentives for Dynamic Work Allocation Systems

J Rene Villalobos, Associate Professor, Arizona State University, Department of Industrial Engineering, Arizona State University, Tempe, AZ, 85281, United States, rene.villalobos@asu.edu

In dynamic work allocation systems such as bucket brigades faster workers perform a higher share of the total work content than slower workers do. However, the long-term success of these systems is directly affected by the way that workers in the assembly line are compensated in terms of both, their individual effort and team effort. In this talk we discuss some approaches to design incentive plans that best accommodate the characteristics of the different dynamic work allocation systems.

■ TD20

C-Room 204

Intertemporal Preferences and Decisions II

Sponsor: Decision Analysis
Sponsored Session

Chair: Matthew Sobel, Professor, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Ave., Cleveland, OH, 44106-7235, United States, matthew.sobel@case.edu

1 - Self-Insurance Choices with INTER-period and INTRA-period Utility Functions

Matthew Sobel, Professor, Weatherhead School of Management, Case Western Reserve University, 10900 Euclid Ave., Cleveland, OH, 44106-7235, United States, matthew.sobel@case.edu, Danko Turcic

We contrast optimal self-insurance choices with alternative models having inter-period versus intra-period utility functions. After reviewing the axiomatic foundations of the models, we show that the intra-period model biases the decisions towards too little self insurance. This result has implications for diverse settings in which the chosen size of an early commitment affects the magnitude of a subsequent risky consequence.

2 - Optimism Over Time

Cade Massey, Yale, cade.massey@yale.edu

Many studies indicate people hold positive illusions about themselves, but few suggest how these illusions persist over time. We suggest this is due in part to the future being imperfectly correlated with the past, and to people being self-serving in their perception of that correlation. We find that people believe processes are more stable when they've performed well, and more unstable when they've performed poorly, and that this bias facilitates the persistence of optimistic expectations.

3 - Test for Variation in Risk Attitude Predicted by a Multiattribute Generalization of Cumulative Prospect Theory

John Miyamoto, Associate Professor, University of Washington, Dept.. of Psychology, Box 351525, University of Washington, Seattle, WA, 98195, United States, jmiyamot@u.washington.edu, Michael Perry

Fundamental to cumulative prospect theory (CPT) is the distinction between gains and losses. The value function is thought to be concave for gains and convex for losses, which accounts for the empirical finding that people are more risk averse in the domain of gains than in the domain of losses. We point out that in domains with multiattributed outcomes, the straightforward generalization of this hypothesis (risk averse for gains, risk seeking for losses) implies that the degree of risk aversion on one attribute should vary as a function of the fixed level of a second attribute. Specifically, CPT predicts that preferences for gambles among levels of Attribute 1 with Attribute 2 set at a constant desirable level should display greater aversion than preferences for these same gambles with Attribute 2 set at a constant undesirable level. We will report experimental tests of this prediction. These results have relevance to quality-adjusted life years (QALY) modeling where survival duration plays the role of Attribute 1, and health quality plays the role of Attribute 2. One should expect greater risk aversion with respect to survival risks in poor health states than in good health states. Our empirial results suggest that the predicted variations in risk attitude as a function of health state do not occur.

4 - Using Only Pencil/Paper Questions to Obtain Exact Quantitative Measurements of Time Inconsistencies

Peter P. Wakker, Erasmus University, P.O. Box 1738, Rotterdam, 3000DR, Netherlands, wakker@few.eur.nl, Kirsten Rohde, Arthur E. Attema, Han Bleichrodt

Time-tradeoff (TTO) sequences can be measured using only pencil and paper. They easily give exact quantifications of degrees of time inconsistency without need to measure utility. They, thus, allow for the empirical discrimination between several hyperbolic discounting models that have been proposed in the literature. Our findings suggest some new directions for theories of intertemporal choice.

■ TD21

C-Room 205

Joint Session DA/Technology Evaluation and Assessment: Medical Technology Evaluation and Assessment II

Sponsor: Decision Analysis, Technology Evaluation and Assessment
Sponsored Session

Chair: Jeffrey Stonebraker, GlaxoSmithKline, Five Moore Drive, Research Triangle Park, NC, 27709, United States, jeffrey.s.stonebraker@gsk.com

1 - A Multiattribute Model for Evaluating the Benefit-risk Profiles of Treatment Alternatives

James Felli, Eli Lilly and Company, Lilly Corporate Center, Drop Code 1011, Indianapolis, IN, 46236, United States, felli_james_c@lilly.com

Contrary to the expectations of physicians, patients and regulators, methodologies for making useful risk and benefit tradeoffs continue to be the subject of intense debate. We have developed a multiattribute model designed to highlight and quantify the relative merits and deficits of treatment alternatives in well-defined and specific contexts, and advocate the usefulness of the model in providing a common, transparent platform for informed and focused discussion among stakeholders.

2 - Linking Modeling & Simulation, Decision Analysis, and the Technology of Drug Formulation

Lee Hodge, Pharsight Corporation, 5625 Dillard Dr., Suite 205, Cary, NC, 27519, United States, fhodge@pharsight.com

Most pharmaceutical companies must turn chemical compounds into drugs that deliver that compound in the appropriate amount and at the right site, time, and duration. However, it is often unclear which formulation knob settings are optimal. This presentation will provide an example of linking a PD/PD modeling analysis to a formulation decision. This enabled a client to see if altering a drug's formulation could improve net patient benefit and if it was worth further investment.

3 - Making Decisions on Medical Devices at the Food and Drug Administration

Kara Morgan, Senior Advisor for Risk Analysis, US FDA, 14C-20, HFC-1, 5630 Fishers Lane, Rockville, MD, 20857, United States, kara.morgan@fda.hhs.gov, Larry Kessler, Telba Irony

This presentation will explore ideas on using Decision Analysis to improve the decision making process on approval of medical devices to be marketed in the United States. Examples will be used to illustrate the issues faced by regulators at the Center for Devices and Radiological Health at the FDA.

■ TD22

C-Room 206

Decision Analysis Theory

Contributed Session

Chair: Gordon Hazen, Professor, Northwestern University, IEMS Department, Evanston, IL, 60208, United States, hazen@iems.northwestern.edu

1 - On Multicriteria Sorting Methods with Ordinal and Nominal Categories

Clara Rocha, INESC Coimbra / University of Coimbra, Fac. Economia, U. Coimbra, Av Dias da Si, Coimbra, Portugal, clara_pr@portugalmail.pt, Luis Dias

We address multicriteria sorting problems with sorted and non sorted categories simultaneously. Formally, a partial order relation is defined among the categories; a category can be higher or lower ranked in comparison with some categories, whereas it can be considered incomparable with other different categories. The use of multi-criteria aggregation models for such problems will be discussed.

2 - Resolution of Ellsberg's Paradox

Sundeep Samson, Clemson University, O-106 Martin Hall, Box 340975, Clemson, SC, 29634, United States, ssamson@clemson.edu, James Reneke

In 1961 Ellsberg proposed two urn problems to show that rational decision makers frequently violate Savage's axioms yielding irrational decisions. We show that our methodology involving stochastic analysis and performance based multicriteria decision making under uncertainty and risk techniques yields a rational decision to the Ellsberg's urn problem without any additional conditions on the uncertainty.

3 - Operation of Expected Multiobjective Decision Analysis on Decision Tree at Multiple Stages

Fumiko Seo, Emeritus Professor, Kyoto University, Kyoto Institute of Economic Research, Yoshida-Honmachi, Sakyo-Ku, Kyoto, 606-8501, Japan, fseo@kier.kyoto-u.ac.jp

This paper discusses the operarion of expected multiobjective decision analysis on decision tree with multiple stages, where interactive correction processes in probability evaluation are included. Level-1 and Level-2 probability are constructed. For effective execution of the evaluation processes, the use of an integrated computer program MIDASS is suggested, which supports interactively the multiobjective decision processes under uncertainty. Some examples for application fields are presented.

4 - The Similarity Heuristic

Daniel Read, Professor of Behavioural Economics, Durham Business School, Mill Hill Lane, Durham, DH1 3LB, United Kingdom, daniel.read2@durham.ac.uk, Yael Grushka-Cockayne

To use the similarity heuristic (a subset of representativeness) is to judge the likelihood an object comes from a class by its similarity to members of that class. We apply the analysis of fast and frugal heuristics to the similarity heuristic. We give a quantitative model, and then use an experiment to test its accuracy (it is very high) and if it is actually used (it is). We argue the similarity heuristic is one of the cognitive tools that evolution has provided us with.

5 - Internal Rate of Return for Random Cash Flows

Gordon Hazen, Professor, Northwestern University, IEMS Department, Evanston, IL, 60208, United States, hazen@iems.northwestern.edu

The internal rate of return is a venerable technique for evaluating deterministic cash flow streams. Part of the difficulty in extending this measure to random cash flows is the lack of coherent methods for accounting for multiple internal rates of return in deterministic streams. Recently such a coherent theory has been developed, and we examine it's extension and implications for random cash flows.

■ TD23

C-Room 208

Risk Analysis II

Contributed Session

Chair: Rapik Saat, PhD Candidate, University of Illinois, 205 N Mathews, B118, Urbana, IL, 61801, United States, mohdsaat@uiuc.edu

1 - Quantitative Analysis of Serious Train Accidents in Japan

Brian Gozun, National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku, Tokyo, 106-8677, Japan, d0307@stu.grips.ac.jp, Masashi Miwa, Tatsuo Oyama

We deal with serious train accident data in Japan for the past twenty years. Statistical analysis and probabilistic models on accident frequency, types, causes and consequences (train suspension time and casualties) are presented. As a result of the quantitative analyses, we specify the accident type that brings about serious consequences for the safety and the reliability of the railway network. We then measure the effectiveness of countermeasures to prevent railway accidents.

2 - Probabilistic Modeling of Infrastructure System Performance During Disasters Using Synthetic Cities

Jacob Torres, Graduate Student, Texas A&M University, 3136 TAMU, Environmental & Water Resources Division, College Station, TX, 77843-3136, United States, jmt9442@tamu.edu, Seth Guikema, Graham Booker, Alex Sprintson, Kelly Brumbelow

The development and testing of methods for probabilistic estimation of the performance of critical infrastructure systems during large-scale hazards is vital for improving the basis for which limited resources are allocated. However, security concerns prevent wide dissemination of data from actual cities. This discussion will show how a synthetic yet realistically developed urban area can be used to create and test risk analysis models for critical infrastructure systems impacted by hurricanes.

3 - Measuring the Efficacy of Inventory in Preparedness Decisionmaking

Kash Barker, PhD Candidate, University of Virginia, Dept.. of Systems and Information Engr, 151 Engineer's Way, Charlottesville, VA, 22904, United States, kashbarker@virginia.edu, Yacov Haimes

The National Infrastructure Protection Plan [DHS 2006] highlights preparedness activities to strengthen response and recovery following a disruption. Among several preparedness considerations is the use of inventory, or a surrogate, to maintain essential services. This work provides an extension to the Dynamic Input-Output Inoperability Model (DIIM) [Lian and Haimes 2006] to measure the benefits of inventory as a preparedness strategy among interdependent economic sectors.

4 - Optimizing Railroad Tank Car Safety Design to Reduce Hazardous Materials Transportation Risk

Rapik Saat, PhD Candidate, University of Illinois, 205 N Mathews, B118, Urbana, IL, 61801, United States, mohdsaat@uiuc.edu, Christopher Barkan

This paper presents an optimization model that was used to identify the optimal tank car safety design in the risk analysis of toxic inhalation hazard (TIH) chemicals transportation for the Association of American Railroads (AAR). The model is illustrated by considering a baseline tank car design currently used to carry a TIH chemical. The utopia point method and a multi-objective decision-analytic approach are used to identify the optimal design with two conflicting objectives, safety and cost.

■ TD24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - StatPoint, Inc. - STATGRAPHICS .NET Web Services
Neil Polhemus, StatPoint, Inc., 2325 Dulles Corner Blvd. Ste. 500, Herndon, VA, 20171, neil@statgraphics.com

This talk will demonstrate the new STATGRAPHICS .NET Web Services, which allow users to perform statistical calculations from within a web browser. The web services reside on a server and may be called using the STATGRAPHICS interface or from user-written web applications using XML scripts. Output is returned as HTML with imbedded images.

2 - Oracle-Crystal Ball Global Business Unit - Crystal Ball Software
Michael Franden, Crystal Ball Global Bus.Unit-Oracle, 1515 Arapahoe St. #1311, Denver, CO, 80202, michael.franden@oracle.com

Take a tour of Crystal Ball software, the easiest tool available for performing Monte Carlo simulations and risk analysis within your own spreadsheets. Utilizing one integrated toolset, Crystal Ball allows you to automate what if analysis and build accurate models to understand any uncertainty and identify the best possible solution.

■ TD25

C-Room 210

Advanced SPC for Profile Monitoring (II)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Judy Jin, University of Michigna, Industrial & Operations Engineering Dept., Ann Arbor, MI, 48109, United States, jhjin@umich.edu

1 - On the Use of Profile Monitoring for Qality Control of Geometrical Product Specifications
Bianca Colosimo, Dipartimento di Meccanica, Politecnico di Milano, Milano, Italy, biancamaria.colosimo@polimi.it

Quality of machined items is usually related to both dimensional and geometrical specifications. Traditional control charting focuses on dimensional quality characteristics, while resulting inefficient when geometrical features have to be monitored as well. Recent approaches for profile monitoring represent a viable and effective solution for quality control of geometrical specifications.

2 - Determining Baseline Periods in Statistical Process Control
Hang Zhang, PhD Candidate, Rutgers University, Dep. of Industrial & Systems Eng., Piscataway, NJ, 08854, United States, zhangh@eden.rutgers.edu, Susan Albin

This paper addresses the problem of identifying SPC baseline data. Usually we have to determine baseline periods from long-time historical data comprising data of baseline and unsuccessful periods. We propose a distribution-robust method to choose reasonably long enough baseline periods, where the quality has stable distribution and is the best.

3 - Multivariate Profile Monitoring Using Quantile Regression
Andres Abad, Industrial and Operations Engineering, University of Michigan, Ann Arbor, MI, 48109, United States, agabad@umich.edu, Judy Jin

Hotelling's T2 control chart is one of the most widely used multivariate quality controls. However, the T2 control chart is very sensitive to the normality assumption and outliers, In this research, we proposed a multivariate monitoring method based on quantile regression, with the advantages of being robust to outliers, free of distribution assumptions.

4 - Monitoring Correlation within Nonlinear Profiles Using Mixed Models
Jeffrey Birch, Professor, Virginia Tech, 406-A Hutcheson Hall, Blacksburg, VA, 24061, United States, jbbirch@vt.edu, Willis Jensen

Previous work on profile monitoring of nonlinear profiles has assumed that the measurements within a profile are uncorrelated. We propose the use of a nonlinear mixed model (NLMM) to account for the correlation structure. Our approach results in charts with good abilities to detect changes in Phase I data.

■ TD26

C-Room 211

Mining Data to Maintain Situational Awareness

Sponsor: Data Mining (Sponsored)
Sponsored Session

Chair: Artur Dubrawski, Auton Lab, Carnegie Mellon University, 5000 Forbes Avenue, NSH 3121, Pittsburgh, PA, 15213, United States, awd@cs.cmu.edu

1 - Data and Analytics Integration for Operational Biosurveillance
Nancy Grady, AVP Data Mining, SAIC, POB 2501, 301 Laboratory Rd, Oak Ridge, TN, 37831, United States, NANCY.W.GRADY@saic.com, James Jones, Kimothy Smith

Current development of operational BioSurveillance systems has generated new requirements for integration. Newly emerging threats require the integration of data streams from many disciplines and sources. Integration of the reasoning over a suite of analytical methods is needed for the evaluation of anomalies. Using experience drawn from the National BioSurveillance Integration System (NBIS), the techniques for the development of an integrated situational awareness will be discussed.

2 - Context Aware Nuclear Evaluation System
Simon Labov, Physicist, Lawrence Livermore National Laboratory, P.O. Box 808, L-210, Livermore, CA, 94550, United States, slabov@llnl.gov, Michael Pivovaroff, Kelley Herndon Ford, Milovan Krnjajic, Doug Speck, Karl Nelson, Josep Roure, Dov Cohen, Artur Dubrawski, John Ostlund, Karen Chen, Saswati Ray

One of the most critical challenges in national security is the detection of a nuclear or radiological weapon in the midst of common radioactive materials. We are developing a unique approach that combines inputs from multiple radiation sensors with contextual information (e.g. manifest information). Our system uses physics-based techniques to reduce the measurements and contextual information into a series of feature vectors, and machine learning algorithms to classify the incident.

3 - Detecting Anomalous Patterns in Multivariate Temporal Data
Weng-Keen Wong, Assistant Professor, Oregon State University, 1148 Kelley Engineering Center, Corvallis, OR, 97330, United States, wong@eecs.oregonstate.edu

A common task in many domains involves the monitoring of routinely collected data for anomalous patterns. This task is prevalent in surveillance and also in the analysis of scientific data. We present algorithms for detecting anomalous patterns in multivariate, categorical time series. These algorithms have primarily been applied to the area of disease surveillance but they are general enough to address similar problems in other domains.

4 - Efficient Representation of Data in Support of Situational Awareness
Artur Dubrawski, Auton Lab, Carnegie Mellon University, 5000 Forbes Avenue, NSH 3121, Pittsburgh, PA, 15213, United States, awd@cs.cmu.edu, Maheshkumar Sabhnani, Josep Roure, Jeff Schneider

We argue that efficient representation of data can improve situational awareness by enabling: 1) automated exhaustive searches through large datasets for events of interest; 2) automated explanation of these events; and 3) interactive ad-hoc drill-down investigations. We support the claim using T-Cube, a structure designed to reduce response time of queries against time series of counts. Its practical utility is illustrated with applications in food- and agriculture safety, and in logistics.

■ TD27

C-Room 212

Service Industry II

Contributed Session

Chair: Reynold Byers, Clinical Associate Professor, Arizona State University, 38131 Pine Creek place, Murrieta, 92562, United States, rbyers@uci.edu

1 - Research on the Development Model for the Producer Service Value Chain
Chun Li Yang, Industry Engineering Department of Tsinghua University, Industry Engineering Department, Bei Jing, China, yangchunli@tsinghua.edu.cn, Ming YU

With the increasing outsourcing behaviors in the modern manufacturing processes, more and more producer services, as the intermediate-stage inputs, enter into the manufacturing activities. Such trend prompts to form a new value chain development model. In order to study the features of the new value chain development model, the system architecture of the value chain model was analyzed, on which, the co-existence relationships between service providers and acceptant were discussed.

2 - The Impact of Client Involvement on Business-to-business Service-operations Planning

Sheneeta White, PhD Student, Virginia Tech, Dept. of Business Information Technology, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States, sheneeta@vt.edu, Ralph Badinelli

We examine the impact of clients as co-producers of business services. Our mathematical model studies the tradeoffs among the assignments of workers to different service-creation processes and the timing and the amount of client involvement. Our goal is to assist decision makers in determining the optimal operations and workforce management plan.

3 - The Progression of Multiple Capabilities: A Service Agility Study in B-B Context

Chao Wang, PhD Programme, London Business School, Management Science and Operations Dep., Regentís Park, London, NW1 4SA, United Kingdom, cwang.phd2004@london.edu, Andrea Masini

Based on service agility literature and the Cumulative Model, this paper develops a framework to shed light on the mechanisms of service agility establishment. Specifically, this study goes beyond sand cone model by examining the impact of new added capability on companies' existing capability set. In addition, our framework introduces the concept of customer agility. The model is tested empirically on a sample of data from a major service provider in the automobile sector.

4 - Pricing and Location Games in the ATM Banking Industry

Reynold Byers, Clinical Associate Professor, Arizona State University, 38131 Pine Creek place, Murrieta, 92562, United States, rbyers@uci.edu, Shuya Yin, Xiaona Zheng

Banks with ATMs have come under fire from consumer groups and may face additional regulation. We use a multi-stage game theoretic model to address the implications of regulation on the location and pricing decisions involved in ATM competition. We show that while banks do locate ATMs closer together, thus reducing consumer travel cost, when allowed to levey surcharges, profits are higher under regulation. Additionally, consumers may or may not benefit under regulation.

■ TD28

C-Room 213

Operations Management I

Contributed Session

Chair: Bogdan Bichescu, Assistant Professor, University of Tennessee, 618 SMC, 916 Volunteer Blvd, Knoxville, TN, 37996, United States, bbichescu@utk.edu

1 - Capacity Reservation Based on Service Level and Fill Rate Measures

Amir Samii, MIT-Zaragoza International Logistics Program, 25 Gomez Laguna, Zaragoza, 50009, Spain, absamii@mit.edu, Prashant Yadav, Richard Pibernik

We consider a manufacturer who wants to reserve a certain portion of his scarce capacity for high priority customers. Rather than basing the reservation quantity on cost and revenue based measures, we assume that the manufacturer uses fill rate and service level measures to determine the optimal reservation quantity. We provide exact expressions for these measures and use a case example to illustrate our findings.

2 - Throughput Time Control by Short Term Capacity Adjustments

Henny van Ooijen, Dr., Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600MB, Netherlands, h.p.g.v.ooijen@tm.tue.nl

In job shops often a trade -off has to be made between the amount of capacity to install and the expected throughput time. If this capacity is fixed after installation, then this capacity has to be such that peaks in the workload (due to the stochastic behaviour) do not lead to throughput times that are too high. If, however, capacity can be adjusted on the short term, this might be a profitable way to control the throughput times with less capacity. This is the topic of this study.

3 - Balancing Innovation and Improvement Projects in High Velocity Environments

Aravind Chandrasekaran, PhD Candidate, University of Minnesota, Carlson School of Managment, Minneapolis, MN, 55455, United States, chan0614@umn.edu, Kevin Linderman, Roger Schroeder

Organizations increasingly confront the challenge of simultaneously improving existing processes/products and innovating new processes/products. However, little is known about the ways to achieve this balance. The purpose of this case study is to understand the organizational structure and infrastructural characteristics (e.g. decision making, incentive systems, leadership) that enable organizations operating in high velocity environments to balance innovation and improvement activities.

4 - Forecasting and Planning Diagnostic Techniques for Service Operations

Steven Myles, Operations Research Analyst, Hewlett-Packard Company, 11445 Compaq Center Drive West, Houston, TX, 77070, United States, steven.myles@hp.com, Viroj Buraparate, Atul Dhawan

The authors propose a systematic methodology to identify problems existing in the forecasting and planning processes for service operations. This procedure enables the identification of areas where improvement is needed and also helps aid the Operations Research Analyst in the selection of appropriate tool(s) to resolve these issues. This process has been deployed in several consumer electronics service operations (e.g., contact and repair centers) and examples will be shared.

5 - Workload Balancing Through Recurrent Subcontracting

Bogdan Bichescu, Assistant Professor, University of Tennessee, 618 SMC, 916 Volunteer Blvd, Knoxville, TN, 37996, United States, bbichescu@utk.edu, George Polak, Mike Fry

We model a situation where a firm wishes to balance workload requirements by creating a portfolio of recurrent contracts. We use Fourier transforms to decompose an input workload profile into a portfolio of insourcing and outsourcing contracts using sinusoidal and Walsh basis functions to better achieve a desired constant workload level. We also develop mathematical programs to refine the portfolio of contracts by placing constraints on the available contracts and considering operational costs.

■ TD29

C-Room 214

Joint Session ICS/OS: Optimization-computer Science

Cluster: INFORMS Computing Society, Optimization / Computational Optimization and Software

Invited Session

Chair: Yuntao Zhu, Arizona State University, Math Sciences & Applied Computing, Phoenix, AZ, 85069-7100, United States, Yuntao.Zhu@asu.edu

1 - Influential Multi-armed Bandits

Kemal Gursoy, Associate Professor, Kean University, Willis Hall, 305-G, 1000 Morris Avenue, Union, NJ, 07083, United States, kgursoy@kean.edu

A multi-armed bandit is a sequential decision making model, utilized to select the best one among many independent stochastic processes [Gittins and Jones, 1972]. In this work, an approach to express influences between the constituent stochastic processes of multi-armed bandits was considered.

2 - Constructing a Maximum Utility Slate of On-line Advertisements

John Tomlin, Yahoo! Research, 2821 Mission College Blvd., Santa Clara, CA, 95054, United States, tomlin@yahoo-inc.com, S. Sathiya Keerthi

We present an algorithm for constructing an optimal slate of sponsored search advertisements which respects the ordering that is the outcome of a generalized second price auction, but which must also accommodate complicating factors such as overall budget constraints. The algorithm is easily fast enough to use on the fly for typical problem sizes, or as a subroutine in an overall optimization.

3 - Stochastic Location-aided Routing in Mobile Ad-hoc Networks

Yuntao Zhu, Arizona State University, Math Sciences & Applied Computing, Phoenix, AZ, 85069-7100, United States, Yuntao.Zhu@asu.edu, K. A. Ariyawansa

Recently we have proposed a class of stochastic location-aided routing algorithms for mobile ad-hoc networks extending deterministic location-aided routing schemes. In this talk we present simulation results of our new protocol and show that our algorithms achieve better performance than existing deterministic routing schemes as our stochastic model can capture and handle the randomness in the routing problem better than deterministic models.

■ TD30

C-Room 2A

Journal of Quality Technology Paper Session

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Christina Mastrangelo, Associate Professor, Industrial Engineering, University of Washington, University of Washington, Box 352650, Seattle, WA, 98195, United States, mastr@u.washington.edu

1 - Two-stage Controlled Fractional Factorial Screening for Simulation Experiments
Bruce Ankenman, Northwestern University, 2145 Sheridan Rd., Evanston, IL, United States, ankenman@northwestern.edu, Hong Wan

Factor screening with statistical control of Type I error and Power makes sense for simulation experiments since they have random error, but can be run automatically. Here, a fractional factorial design in combination with a two-stage procedure for controlling power is proposed and compared to other available methods.

2 - Run to Run Process Ajustment Using Categorical Observations
Fugee Tsung, Dept.. of Industrial Eng & Logistics Mgt, HK Univ. of Science & Technology, Clear Water Bay, Kowloon, HK, Hong Kong - ROC, season@ust.hk, Kaibo Wang

When quality characteristics cannot be measured on a continuous scale due to either inherent or outside constraints, qualitative observations can be collected alternatively. Under these situations, most conventional run-to-run (R2R) process control algorithms that are developed based on quantitative measurements cannot be implemented. In this paper, we develop a novel run-to-run control scheme that uses qualitative information for process adjustments.

3 - Detection and Estimation of a Mixture in a Power Law Process for a Repairable System
Paul Kvam, Professor, Georgia Tech, Industrial & Systems Eng., Atlanta, GA, 30332, United States, paul.kvam@isye.gatech.edu

We present a procedure for detecting and estimating a mixture of conforming and nonconforming systems. The test of a mixture, based on a simple likelihood ratio, is illustrated with truncated failure data for copy machines. Bootstrap methods are used to gauge the estimation uncertainty, and optimal decisions for system replacement are determined based on the observed likelihood.

■ TD31

C-Room 2B

Recent Advances in Computer Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhiguang Qian, Assistant Professor, University of Wisconsin at Madison, zhiguang@stat.wisc.edu

1 - Design and Analysis Issues for Gaussian Process Models for High Dimensioanl Computer Experiments
Derek Bingham, Simon Fraser University, Dept.. Statistics and Actuarial Science, 8888 University Dr., Burnaby, BC, Canada, dbingham@stat.sfu.ca

Gaussian process (GP) models are often used for modeling computer experiment output. In many applications the number of factors is large (e.g., say 60 factors). Thus, the number of simulations carried out trials tends to be large. However, fitting a GP becomes computationally burdensome for large run sizes. Here, we describe strategies we've found useful for fitting such models when the number of simulation runs is large. The consequences of inadequate run-sizes are discussed.

2 - Orthogonal and Nearly Orthogonal Designs for Computer Experiments
Boxin Tang, Professor, Simon Fraser University, boxint@stat.sfu.ca

We construct a class of designs for computer experiments. Our designs include Latin hypercubes and two-level fractional factorials as special cases. The basic construction is simple, building larger designs based on a small design. If the base design is orthogonal, the resulting designs are orthogonal. We also present two generalizations: the first improves the projection properties of the basic method and the second produces designs with smaller correlations.

3 - On Combining Functional Experimental Data and Computer Experiments
Brian Williams, Los Alamos National Laboratory, brianw@lanl.gov, Vince Chiravalle

This work focuses on combining observations from field experiments with detailed computer simulations of a physical process. This typically involves calibration of parameters in the simulator and accounting for inadequate physics. We consider physical applications for which the field data and simulator output are multivariate and several sources of data are available. We illustrate the proposed methodology with experimental data and simulations that inform on the k-L fluid instability model.

4 - Nested and Sliced Space-Filling Designs
Zhiguang Qian, Assistant Professor, University of Wisconsin at Madison, zhiguang@stat.wisc.edu

In this talk, we will discuss two novel classes of space-filling designs for computer modeling. One is motivated by the problem of synthesis of simulations at different levels of accuary and the other is motivated by modeling computer experiments with qualitative and quantitative factors.

■ TD32

C-Room 302

Business Applications II

Contributed Session

Chair: N. Ravichandran, Professor, Indian Institute of Management, Vastrapur, Ahmedabad, India, nravi@iimahd.ernet.in

1 - The Impact of HRM Practices on the Perceived Organizational Performance : A Study of Telecom Sector
Adnan Riaz, Lecturer, Allama Iqbal Open University Colony, Dep. of Business Administration, Room No. 102, Block No. 13, Islambad, 009251, Pakistan, adnan.aiou@gmail.com, Majed Rashid

This study was conducted to investigate the impact of HRM practices on perceived organizational performance. Total six HRM practices such as training, performance appraisal, job definition, compensation, selection, career planning, were taken as independent variables while perceived organizational performance as dependent variable. The results of questionnaire survey showed that HRM practices are the key contributor to the enhanced organizational performance in telecom sector of pakistan.

2 - A Two-dimensional Transportation Pricing Model
Lama Moussawi, Assistant Professor, American University of Beirut, PO Box 11-0236 Riad el Solh, Beirut, Lebanon, lm34@aub.edu.lb, Metin Cakanyildirim

This paper addresses the issue of pricing the transportation service for a two-dimensional air cargo capacity with the objective of maximizing revenues subject to weight and volume capacity constraints. For a linear demand function, we first ignore the capacity constraints and develop an algorithm to compute the optimal solution. Then, the capacity constraints are added and a closed-form solution when there are two cargo types is derived.

3 - Value Focused Thinking in Development of the Army's Environmental Management Budget
Stephen Gauthier, Instructor/Analyst, United States Military Academy, 571A Connor Loop, West Point, NY, 10996, United States, stephen.gauthier@usma.edu, Michael Kwinn

The Office of the Director of Environmental Programs (ODEP) is required to submit a budget projection for POM 08-13 that captures all Environmental Quality (EQ) costs for Army installations. This study utilizes Value Focused Thinking in order to determine the most effective methodology to creating a defensible and auditable budget plan that sustains all Active Army, Army Reserve, and Army National Guard installations' EQ needs.

4 - Bayesian Mortgage Default Models
Feng Xu, The George Washington University, 2201 G Street NW, Funger 415, Washington, DC, 20052, United States, fengxu@gwu.edu, Refik Soyer

In this paper we present discrete time mortgage default models and their Bayesian analyses. Our development requires use of Markov chain Monte Carlo methods. We apply the models to actual mortgage default data and illustrate what type of insights can be obtained from the Bayesian approach.

5 - A Simple Model to Design New Products in the Context of Indian Mobile Telephones
N. Ravichandran, Professor, Indian Institute of Management, Vastrapur, Ahmedabad, India, nravi@iimahd.ernet.in

In this work we present a simple spredsheet based model to design new products in the most competitive mobile telephone market.The model considers a host of relevant parmeters to maximise the overall revenue to the firm.The possibility of extending this model with a dynamic intraction by competition and their products is discussed.

■ TD33

C-Room 303

Models for Facilities and Warehouse Design

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ananth Krishnamurthy, Rensselaer Polytechnic Institute, CII 5015, 110 8th Street, Troy, NY, United States, krisha@rpi.edu

1 - A New Facility Layout Model with Congestion and Rerouting
Rakesh Nagi, Professor and Chair, University at Buffalo, 438 Bell Hall, Department of Industrial and Systems Eng, Buffalo, NY, 14260, United States, nagi@buffalo.edu, Rajan Batta, Min Zhang

We present a facility layout model that explicitly considers flow congestion and alternate path routing to simultaneously minimize total expected travel time. We demonstrate that our model is capable of generating superior layouts to QAP with a 10% improvement in true material handling (MH) time if only routing is considered and a 14% improvement in true MH time if both layout and routing are designed simultaneously.

2 - A Stochastic Framework for Modelling Material Handlig Activities
Kai Furmans, Universitaet Karlsruhe (TH), Kaiserstr. 12, Karlsruhe, 76131, Germany, kai.furmans@ifl.uni-karlsruhe.de, Marc Schleyer

Warehousing activities are subject to a lot of stochastic influences. The system load is usually dependent on customer behaviour, resulting in changing quantities and structure of orders and tasks. When humans are involved, the time needed to perform those tasks is varying. We present a framework of stochastic elements, that by combining these elements, allows a fast modelling and calculation of percentiles of throughput time distributions, taking the above mentioned issues into account.

3 - Integrated Analytical Performance Evaluation Models of Warehousing Systems
Manjunath Kamath, Professor, Oklahoma State University, School of Industrial Engr. & Mgmt., 322 EN, Stillwater, OK, 74078, United States, m.kamath@okstate.edu, Karthik Ayodhiramanujan

We develop queueing approximations of warehouse operations that can handle features such as planned inventory and limited storage capacity. We present an approximate model of a shared server that stores and retrieves material from a finite capacity rack. We discuss how this shared-server model can be used as a building block to develop comprehensive warehouse performance evaluation models.

4 - Lift Queue Dynamics in Automated Vehicle Storage and Retrieval System Cycle Time Estimation
Li Zhang, Rensselaer Polytechnic Institute, CII 5015, 110 8th Street, Troy, NY, United States, zhangli@rpi.edu, Ananth Krishnamurthy, Charles Malmborg

An embedded M/G/V model is proposed for estimating the performance of automated vehicle storage and retrieval (AVSR) systems as functions of the major variables defining a storage system configuration. We consider a system consisting of V vehicles, each of which works together with a lift conditionally. The lift queue dynamics are described as a GI/G/L/V queue model nested in a general M/G/V queue model. The results of simulation validation studies illustrate the accuracy of this approach.

■ TD34

C-Room 304

Traffic Modeling for Network Applications

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. 2nd St., Tucson, AZ, United States, chiu@email.arizona.edu

1 - Theoretical Extensions of the Graph Theoretic Cell Transmission Model
Srinivas Peeta, Professor, Purdue University, Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, peeta@purdue.edu, Georgios Kalafatas

The Graph Theoretic Cell Transmission Model (GTCTM) provides an exact graph theoretical structure for modeling traffic flow and production planning. We show that the GTCTM is a generalized dynamic graph structure. We also show that for the single destination GTCTM, the following are equivalent: a) minimization of the total time to serve all flows in the network, b) maximization of the output for the first p periods for each p<t, and c) minimization of the average travel time.

2 - Anisotropic Mesoscopic Simulation Model for Interrupted Traffic Flow
Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. 2nd St., Tucson, AZ, United States, chiu@email.arizona.edu, Jorge Villalobos

We developed a lane-group based anisotropic mesoscopic simulation model for interrupted traffic (AMS-I). The AMS-I model explicitly considers the driver's anticipation of signals and the flow interruptions caused by signals. Both analytical and computational analysis conducted on shockwave propagation and flow discharges under various timing configurations are presented.

3 - Optimal Sensor Locations for Providing Freeway Travel Times
Jeff Ban, Assistant Research Engineer, CCIT, University of California, Berkeley, 2105 Bancroft Way, Berkeley, CA, 94804, United States, xban@calccit.org, J.D. Margulici, Ryan Herring, Alexandre Bayen

In this presentation, we show that determination of the optimal sensor locations for providing travel times can be modeled using dynamic programming. The model can be solved via a shortest-path search on an acyclic network constructed via available information from vehicle trajectories. Some results are shown for applying the model on two simple and widely used travel time calculation methods: the instantaneous and dynamic travel times using loop detectors.

■ TD35

C-Room 305

Development and Management of Transportation Infrastructure I

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ivan Damnjanovic, Assistant Professor, Texas A&M University, TAMU 3136, College Station, TX, 77843, United States, idamnjanovic@civil.tamu.edu

1 - Revisiting the Estimation of Marginal Cost of Highway Pavement Maintenance
Shadi B. Anani, PhD Candidate, University of California, Berkeley, anani@berkeley.edu, Samer Madanat

In order for highway pavement marginal cost pricing to achieve its objectives, accurate estimates of pavement deterioration marginal costs are needed. This paper reviews an approach used for estimating these costs, questions three common assumptions and relaxes one of them, namely the assumption that pavement deterioration is deterministic.

2 - New Approach to the Maintenance of Long Range Radars
Jasenka Rakas, PhD, University of California at Berkeley, Nextor, 107B McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu, Chenyun Wang

Currently, FAA is facing a significant budget deficit that impacts maintenance funding for many of its facilities. In this paper, a reliability-centered maintenance model, based on Markovian transition probabilities and dynamic programming, is introduced to minimize the life cycle maintenance costs for FAA's Long Range Radars. We also explore the feasibility of privatizing maintenance tasks to companies that can perform maintenance activities.

3 - Valuing Strategic Network Improvements for Highway BOT Projects Under User Equilibrium
Jennifer Duthie, University of Texas, 6.506 ECJ Hall, Austin, TX, 78751, United States, jduthie@mail.utexas.edu, Ivan Damnjanovic, S. Travis Waller

This paper investigates the effects of network recourse on toll road revenues. The proposed model utilizes a two-stage stochastic network design formulation under user equilibrium constraints. Sensitivity analysis is conducted on an illustrative network where the bi-level design formulation is simplified with a closed-form solution of the user equilibrium constraint.

4 - Determining Optimal Maintenance Strategies for Mixed Public-private Transportation Networks
Avinash Unnikrishnan, Graduate Research Assistant, The University of Texas at Austin, 1 University Sta. C1761, ECJ Hall 6.2, Austin, TX, 78731, United States, avinash@mail.utexas.edu, Ivan Damnjanovic, Varunraj Valsaraj, S. Travis Waller

This research focuses on the problem of scheduling maintenance in mixed public-private transportation networks. The problem is formulated as a multi-objective optimization problem and trends in social welfare and toll road revenue are studied. The research approach utilizes Non-dominated Sorting Genetic Algorithm (NSGA) to obtain Pareto optimality.

■ TD36

C-Room 306

Transportation III

Contributed Session

Chair: Lihui Bai, Valparaiso University, 1909 Chapel Drive, Valparaiso, IN, 46383, United States, lihui.bai@valpo.edu

1 - Solutions for the Integrative Freight Market Simulation for Integrated Shipper-Carrier Operations
Ning Xu, PhD Candidate, Department of Civil and Environmental Engineering,Rensselaer Polytechnic Institute, 110 Eighth Street, 4037 Jonsson Engineer Center, Troy, NY, 12180, United States, xun@rpi.edu, Jose Holgiun-Veras

This research focuses on the development of analytical formulation to estimate urban freight-related flows for integrated shipper-carrier operations in the framework of IFMS. The work contains two key components: (1) the modeling of the entire process, including integrated shipper-carriers' production decisions, market competition, and routing; and (2) the development of solution heuristics that ensure market equilibrium.

2 - The Network Evolution Problem in Transportation Planning
Lei Zhang, Assistant Professor, Oregon State University, School of Civil & Construction Eng., 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

In response to increased transportation system preservation costs and insufficient funds for needed system expansion, this paper formulates the Network Evolution Problem (NEP) that considers strategic resource allocation between system preservation and expansion. The proposed analytical framework allows certain parts of the system to grow and certain other parts to degenerate in response to changing demand patterns. Solutions to the NEP are demonstrated on several stylized networks.

3 - Circuit Routing Strategy for Forced Transfer Busing

Jennifer Ferguson, University of Arkansas, 4207 Bell Engineering Center, Fayetteville AR 72701, United States of America, jaf05@uark.edu, Scott Mason

Forced transfer busing occurs when students cannot attend their neighborhood ("base") school due to insufficient capacity. The student is force transferred to an alternate district school with available capacity. Once forced transfer students arrive to their base school, they ride another bus to their alternate school, resulting lost educational time. We analyze a circuit routing strategy for forced transfers, presenting both optimization- and heuristic-based solutions approaches.

4 - Combinatorial Benders' Cuts for the Minimum Toll Booth Problem

Lihui Bai, Valparaiso University, 1909 Chapel Drive, Valparaiso, IN, 46383, United States, lihui.bai@valpo.edu, Paul Rubin

We consider the minimum toll booth problem for determining a tolling strategy in a transportation network that requires the least number of toll locations, and simultaneously causes the most efficient use of the network. A solution method using combinatorial Benders' cuts is proposed and numerical results on real networks are reported.

■ TD37

C-Room 307

Military Applications I

Contributed Session

Chair: Michael Armstrong, Associate Professor, Sprott School of Business, Carleton University, Ottawa, ON, K1S 5B6, Canada, michael_armstrong@carleton.ca

1 - Threat Evaluation and Weapon Assignment (Tewa) - An Application

Ynci Yüksel, ASELSAN A.fi., Ankara, Turkey, iyuksel@aselsan.com.tr, Sakine Batun, Zeynep Kirkizölu, Taner Gülez, Meysun Özgün, Dilek Arslan, Seçeil Arslan, Ömer Kyrca, Sedef Meral

A TEWA algorithm is developed for allocation of defense weapons to attacking threats in the most efficient way. Analytical hierarchy process (AHP) based method is used to make threat evaluation and the effectiveness parameters are calculated. Total effectiveness is maximized by a mathematical model. The static model produces valid results for the environmental picture and is used in an algorithm with several rules to form the dynamic model. The algorithm has been verified by the scenario tests.

2 - Presented and Exposed Target Area Estimation via Line-of-sight Analysis

Steven Yuhaski, Operation Research Analyst, Natick Soldier Research, Development, and Engineering Center, 1 Kansas Street, Natick, MA, 01760, United States, steven.yuhaski@us.army.mil, Robert Auer

In military operational effectiveness simulations, determining presented and exposed areas of complex human forms concealed by barriers is a critical element needed for target acquisition and engagement. A heuristic has been developed that provides accurate estimates of these target areas, from the perspective of an observer. Computationally efficient line-of-sight methodologies are used to perform area integration by using line-of-sight contact points on the projected target surface areas.

3 - Network Induced Situation Awareness and Power Base: A Comparison

Herman Monsuur, Associate Professor of Mathematics and OR, Netherlands Defence Academy, P.O.Box 10000, Den Helder, 1780 CA, Netherlands, H.Monsuur@nlda.nl, René Janssen

We consider two metrics to evaluate the usability of military networks and corresponding flow of information: situation awareness due to the position within the network, and power base of individual nodes. The power base may be used to identify the margin of nodes to decide and act on their own. We will present some interesting properties and compare these, to some extent complementary network induced metrics. We also investigate the dependence of these two metrics on changes in the network.

4 - Fastest Path Problems for Direction-dependent Speed Functions with Applications to Vessel Routing

Irina S. Dolinskaya, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, dolira@umich.edu, Robert L Smith

We discuss fastest path problems for direction-dependent (anisotropic) speed functions. We present analytical solutions in general problem settings without any restriction on either structure of the speed functions or possible obstacles. An application is discussed in vessel path planning under operability constraints.

5 - Effective Attacks in the Salvo Combat Model

Michael Armstrong, Associate Professor, Sprott School of Business, Carleton University, Ottawa, ON, K1S 5B6, Canada, michael_armstrong@carleton.ca

We consider two related questions of tactics within the salvo model of naval missile combat. For a given set of targets, how many missiles should be fired to produce an effective attack? For a given available salvo size, how many enemy targets should be engaged? In the deterministic version of the model we derive a simple relationship between the number of missiles to fire and the number of targets to engage. We then extend this as a heuristic to the stochastic version of the model.

■ TD38

C-Room 308

Marketing II

Contributed Session

Chair: Monic Sun, Boston University, 270 Bay State Road, Boston, MA, 02215, United States, monic@bu.edu

1 - Managing Market-level Expectation of a New Product

Sangyoon Yi, PhD Candidate, Business School, Korea Advanced Institute of Science and Technology, SUPEX 291, KAIST Business School, 207-43, Cheongnayngri-2, Dongdaemoon-gu, Seoul, Korea, Republic of, upily@business.kaist.ac.kr, Jaehyeon Ahn

In this paper, an agent-based simulation model is developed to link individual-level purchase and post-purchase behavior of consumers regarding a new product to its market-level expectation and diffusion in the presence of advertising and word-of-mouth. With complex network models, expectation-confirmation theory and prospect theory are adapted to represent consumers' purchase and communication behaviors. Important implications for launching and selling a new product are provided.

2 - Customer Satisfaction: Do You Know What You are Measuring?

Ilaria Dalla Pozza, Assistant Professor in residence, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States, ilaria.dallapozza@business.uconn.edu

The scope of this study is to provide a classification of all the academic studies investigating the consequences of customer satisfaction. The study identifies the pitfalls in the measurement of customer satisfaction, and provides guidance on what leads to different results.

3 - Joint Optimization of Retail Price and Shelf Space Allocation with Stochastic Demands

Chase Murray, University at Buffalo, SUNY, 416 Bell Hall, Department of Industrial & Systems Engr, Buffalo, NY, 14260, United States, cmurray3@buffalo.edu, Debabrata Talukdar, Abhijit Gosavi

We present an optimization model for the multi-product retail pricing and shelf space allocation problem with stochastic demand. We consider an objective function that incorporates a retailer's profit generated from sales, as well as its opportunity costs for unsatisfied demands and holding costs for unsold inventories. Our solution approach combines a meta-heuristic for pricing with a near-optimal method for shelf-space allocation. Theoretical and numerical results are provided.

4 - Strategic Marketing-mix Decisions in Mature Consumer Markets

Ji-eun Cha, None, #1807 Hyosung Intellian, 733 A-hyun-dong Mapo-gu, Seoul, Korea, Republic of, orangeun@gmail.com, Soo-young Kim

Marketing decision at the point of new product launching has been supported by several methodologies. However, few are interested in analytical approaches that effectively modify the marketing-mix of products currently in markets. Adopting preference map of multidimensional scaling method and influence-satisfaction matrix, this paper aims at developing an analytical framework that facilitates marketing-mix modification and steers marketing direction in mature consumer markets.

5 - The Sound of Variance: Theory and Some Evidence on Product Ratings and Market Outcomes

Monic Sun, Boston University, 270 Bay State Road, Boston, MA, 02215, United States, monic@bu.edu

The paper studies how consumers extract information from the variance of product ratings. The model predicts that profit is U-shaped in the variance. Evidence from the motion picture industry confirms the U-shape. In an extension of the model, I compare prices when variance is and is not observable and find that price is higher in the previous case for products with extreme variances. Evidence from two online sellers supports the theory.

■ TD39

C-Room 309

Operations Research in the Emergency Department

Sponsor: Health Applications Section
Sponsored Session

Chair: Mike Carter, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, carter@mie.utoronto.ca

1 - Evaluation of Ambulance Transfers into UCCs to Improve Ambulance Availability & Reduce Offload Delay

Ali Vahit Esensoy, Doctoral student, University of Toronto, Mechanical & Industrial Engineering, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, ali.esensoy@utoronto.ca, Mike Carter

Through the Urgent Care Centre initiative, selected patients with low risk of inpatient admission traveling via ambulance will be transported to a UCC instead of being sent to an emergency department. In our study, using a probabilistic linkage between EMS and ambulatory care databases we propose changes to the patient mix, operating hours and catchment areas of these facilities given their constraints as well as recommendations for expansion of the UCCs across key areas in Ontario.

2 - Which is Better: Adding More Beds to Your ED or Reducing Inpatient Holding Times?

Gilles Reinhardt, Associate Professor, DePaul University, Department of Management, Chicago, IL, 60604, United States, greinhar@condor.depaul.edu

Using simulations based on data from a busy academic ED we compare adding more beds to reducing inpatient holding times. We conclude that although increasing beds improves ED performance, speeding up inpatient admissions out of the ED is a more effective lever against all congestion effects (lenght-of-stay, leave-without-being-seen, overcrowding).

3 - How Many Doctors Does it Take?

Les Vertesi, Simon Fraser University, 8888 University Dr, Burnaby, BC, V5A 1S6, Canada, les_vertesi@sfu.ca

The Ministry of Health and BC's doctors have discovered discrete event simulation and are currently using it to resolve a long-standing contractual dispute about emergency departments. The model demonstrates some unusual characteristics in that too much detail actually destroys the model and prevents it from achieving its purpose. The experience provides insight into the more generic question of what makes modeling activity useful to health care providers, and what does not.

4 - Cost of Priority - Is Triaging Preferable in an Emergency Department?

Arvind Sainathan, PhD Candidate, University of Rochester, Simon School, Rochester, NY, United States, sainathana2@simon.rochester.edu, Gregory Dobson

The ED systems with and without triage are compared where, first with an exogenous budget, waiting costs are minimized and then the total of labor and waiting costs are minimized. We conclude that there are 4 cases favoring triage: intermediate fraction of urgents, reasonably high cost ratio, low triage nurse's salary and tight budget.

■ TD40

C-Room 310

Service Theory, Work ReDesign and Simulation: From Theory to Practice

Sponsor: Health Applications Section
Sponsored Session

Chair: John Fontanesi, Professor, University of California, San Diego, 9500 Gilman Drive, #0821, La Jolla, Ca, 92093-0821, United States, jfontanesi@ucsd.edu

1 - Applying Service Theory and Work ReDesign in an Academic Internal Medicine Program

Jessica Chen, Professor, UCSD School of Medicine, 9500 Gilman Drive, #0821, La Jolla, Ca, 92010, United States, j38chen@ucsd.edu, John Fontanesi

Service Theory and work redesign were used to improve services in an academic Internal Medicine program. Following detailed workflow observations using a standardized instrument, registration/intake process's and information flow were redesigned. With no additional expenditures, efficiency (ratio of patient-provider time to all other time in the clinic) improved more then 25%, patient and staff satisfaction by more then 30% and clinical outcomes more then 10%.

2 - Data Mining, Modeling, and Forecasting for Healthcare

Kwok-Leung Tsui, Professor, H. Milton Stewart School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, GA, United States, ktsui@isye.gatech.edu

In this talk we will discuss data mining, modeling, and forecasting methods in healthcare applications. First we will illustrate data mining methods with patient arrival, waiting time, and operation flow data. Second we will explain exponential smoothing methods for patient arrival forecasting. Finally, we will address the challenges of spatial temporal modeling of health care problems.

3 - Improving Patient Compliance Using Work ReDesign in an Ambulatory Pediatric Nephrology Clinic

Vivian Reznik, Associate Dean, UCSD School of Medicine, 9500 Gilman Drive #0821, La Jolla, Ca, 02010, United States, vreznik@ucsd.edu, John Fontanesi

Treating nephritic disease is complex with dire results when treatment recommendations re not followed. Following detailed workflow observations using a standardized instrument, patient instruction, urine testing and discharge process's were redesigned. With no additional expenditures, efficiency (ratio of patient-provider time to all other time in the clinic) improved more then 18%, patient and staff satisfaction by more then 15% and clinical outcomes more then 30%.

4 - Simulation Applications in Healthcare Systems

David Goldsman, Professor, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States, sman@isye.gatech.edu

Healthcare management operates in an environment of aggressive pricing, tough competition, and rapidly changing guidelines. We show how computer simulation models can be used by healthcare institutions to meet these challenges. For example, we describe a low-cost, generic, discrete-event simulation model populated by a workflow observation Excel spreadsheet that can be completed by clinic staff themselves, thus customizing the simulation model for their own purposes.

■ TD41

C-Room 3A

Matching Demand and Supply in Medical Care

Sponsor: Health Applications Section
Sponsored Session

Chair: Sergei Savin, Associate Professor, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, svs30@columbia.edu

1 - Improving Primary Care Access Using Simulation-Optimization

Hari Balasubramanian, Post-doctoral Research Associate, Mayo Clinic, 200 2nd Street SW, Rochester, MN, United States, balasubramanian.hari@mayo.edu, Ritesh Banerjee, Brian Denton

We consider the problem of panel design for physicians in primary care. A physician's panel consists of a set of patients and each patient belongs to one of many different health-related categories. Using real data collected at the Mayo Clinic, we propose a multi-period simulation optimization model for determining the panel design of a set of physicians working in a group practice. The model seeks to maximize patient visits to their own providers and reduce waiting times.

2 - Advanced Access and Patient Panels in Primary Care
Sergei Savin, Associate Professor, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States, svs30@columbia.edu, Linda Green

We model appointment system as a queueing system in which customers about to enter service have a state-dependent probability of rejoining the queue. We derive stationary distributions of the queue size as well as identify stability conditions. We use our results to provide means to identify the maximum panel sizes for a medical practice consistent with a policy of advanced access.

3 - Is it Really Jackson? Evidence-based Design of Queues & Modeling Transplant Waiting Times
Donald Lee, Stanford University, Terman Engineering Center #494, Stanford, CA, 94305, United States, dkklee@stanford.edu, Chris P. Lee, Stefanos Zenios

In simulating critical systems such as organ allocation policies, parametric models like Jackson networks may not be accurate enough. We introduce a method for inferring the actual arrival process and service rates of a queuing system from data to enable accurate modeling. Instead of using customer classes to capture heterogeneity in arrivals and transitions, we work at the finest resolution by predicting individual customer behavior based on a set of covariates associated with each client.

■ TD42

C-Room 3B

Healthcare Allocation

Contributed Session

Chair: Monali Malvankar, PhD Student, Richard Ivey school of Business, University of Western Ontario, 1151 Richmond Street N, London, ON, N6A 3K7, Canada, mmalvankar@ivey.ca

1 - Constructing Surgery Schedules Using an Optimization and Visualization Tool
Brecht Cardoen, Katholieke Universiteit Leuven, FETEW, KBI, Naamsestraat 69, Leuven, 3000, Belgium, brecht.cardoen@econ.kuleuven.be, Erik Demeulemeester, Jeroen Beliën

A software tool will be presented for sequencing patients in an operating theater. The software embeds diverse algorithms (e.g. branch-and-price and branch-and-bound) in order to optimize multiple objectives and visualizes the schedule outcome. Flexibility in changing the surgery schedule and the settings will be incorporated.

2 - Capacity Management of Intensive Care Units in a Multi-specialty Hospital in India
Goutam Dutta, Professor, IIM Ahmedabad, Wing - 3, IIM Campus, Vastrapur, Ahmedabad, Gu, 380015, India, goutam@iimahd.ernet.in, Seema Vohra, D.K. Ghosh

In this paper, we describe the capacity management of Intensive Care Units (ICUs) in a 300-bed multi-speciality hospital where the alternative ICU is utilized when the appropriate ICU is full for a set of two types of ICUs. Inter-arrival time and service time distributions in these ICUs have been tested and found to be exponentially distributed. Based on real data available from a hospital in India, the results demonstrate that the utilization of the ICU beds will improve up to 28 percent when admissions to the alternative ICU are permitted.

3 - Hospital Bed Capacity Allocation Problem
Elif Akcali, Assistant Professor, University of Florida, Industrial & Systems Engineering, Gainesville, FL, United States, akcali@ise.ufl.edu, Chin-I Lin

When bed capacity in a hospital is not managed effectively, patients that require beds in a particular medical service may have to be rejected while there are empty beds in other services. This, in turn, not only reduces the quality of service provided to the patients, but also decreases the potential profit of the hospital. In this paper, we consider the allocation of bed capacity across different medical services to maximize the overall hospital profit.

4 - Combining Simulation and DEA to Obtain Stable Estimates for Hospital Surgery
Liam O'Neill, Assistant Professor, Univ of North Texas Health Science Center, 3500 Camp Bowie Blvd., 709-C, Fort Worth, TX, 76107, United States, loneill@hsc.unt.edu, Lei Xin, Johannes Ledolter, Franklin Dexter

Repeated sampling of multiple hospitals was used to determine the sensitivity of DEA results to a few hospitals. The distribution of super-efficiency scores was shown to follow a hyper-geometric distribution for samples of n= 10,000. Median gaps were found to increase as a function of sample size.

5 - Incentives for Optimal Multi-level Allocation of HIV Prevention Resources
Monali Malvankar, PhD Student, Richard Ivey school of Business, University of Western Ontario, 1151 Richmond Street N, London, ON, N6A 3K7, Canada, mmalvankar@ivey.ca, Gregory Zaric

Funds for HIV prevention traverse multiple-levels of distribution and decision-making. The main goal of HIV-prevention is to prevent as many new HIV infections as possible. This requires efficient allocation of funds. However, many organizations allocate funds using equity-based heuristics. We model a single-region multi-level incentive-based approach that promotes efficient allocation of resources.

■ TD43

S-Grand Ball. A (Lev. 2)

Stochastic Optimization in Aviation

Sponsor: Aviation Applications

Sponsored Session

Chair: Senay Solak, Georgia Institute of Technology, School of Industrial and Systems Eng., Atlanta, GA, United States, ssolak@isye.gatech.edu

1 - A Stochastic Programming Approach for Sector Level Traffic Flow Management
Yu-Heng Chang, GaTech ISyE, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States, gth795b@mail.gatech.edu, Ellis Johnson, Senay Solak, Earl Barnes, John-Paul Clarke

We study the single sector traffic flow management problem and develop a solution methodology based on a stochastic programming model. Given the probability distributions for sector capacity, which are calculated by probabilistic weather forecasts, the number of aircraft to send towards a given sector is determined in the first stage. The second stage decisions are the re-routing options for the aircraft according to the capacity of the sector under the realized weather and traffic conditions.

2 - A Robust Algorithm for Planning Ground Delay Programs Under Uncertainty
Dr. Avijit Mukherjee, University of California, avijit@ucsc.edu

A new algorithm, which considers both equity and efficiency goals, for planning ground delay programs under uncertainty is presented. Experimental results with realistic flight schedules and airport capacity indicates that the algorithm produces an efficient frontier of solutions compared to a distance-based flight exemption policy, which is a standard practice.

3 - Portfolio Optimization for Aviation Technology Development
Senay Solak, Georgia Institute of Technology, School of Industrial and Systems Eng., Atlanta, GA, United States, ssolak@isye.gatech.edu, John-Paul Clarke, Earl Barnes, Paul Collopy, Ellis Johnson

We study the problem of determining an optimal investment policy for a portfolio of aviation technologies. The problem is a large scale stochastic optimization model, which is not amenable to any specific method. In this study, we develop a multistage stochastic programming model which, however, differs from classical stochastic programming models since the times of realizations of uncertainty are dependent on the investment decisions. Efficient formulation and solution procedures are described.

■ TD44

S-Grand Ball. B (Lev. 2)

Pedagogical Research: Closing Session - A Panel of Researchers

Sponsor: INFORM-ED

Sponsored Session

Chair: Donna Llewellyn, Director, Georgia Tech, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@cetl.gatech.edu

1 - Pedagogical Research – Closing Session - A Panel of Researchers
Moderator: Donna Llewellyn, Director, Georgia Tech, CETL, 225 North Avenue, Suite 4, Atlanta, GA, 30332-0383, United States, donna.llewellyn@cetl.gatech.edu

This is the final of a series of four sessions at this conference on pedagogical research. Feel free to come even if you missed all or some of the earlier ones. We will host a panel of INFORMS folks who are doing educational research – they will give their advice and talk of their experiences. We will also have the editor of Informs Transaction on Education to talk about getting your work published.

■ TD45

S-Capitol Hill (Lev. 3)

Optimization Approaches in Finance

Cluster: Financial Engineering
Invited Session

Chair: Stanislav Uryasev, University of Florida, uryasev@ufl.edu

1 - Generalized Deviations are Counterparts to Risk Measures
Stanislav Uryasev, University of Florida, uryasev@ufl.edu, R. Tyrrell Rockafellar, Sergey Sarykalin, Michael Zabarankin

This paper overviews results on generalized deviations, including CVaR Deviation. It covers the following topics: 1) Generalized Deviations versus Risk Measures; 2) Coherent Deviations; 3) Portfolio Optimization with Generalized Deviations; 4) Optimal Portfolio Policies with Multiple Deviations; 5) Betas for Optimal Portfolios; 6) Market Equilibrium with Investors Having Different Deviations; 7) Statistics with Generalized Deviations.

2 - Calibration of Deviation Measures in General Portfolio Theory
Sergey Sarykalin, University of Florida, saryk@ufl.edu, R. Tyrrell Rockafellar, Stanislav Uryasev

We will make a connection between the portfolio theory with general deviation measures and the classical asset pricing theory by examination of CAPM-like relations. In particular, we derive discount factors, corresponding to the CAPM-like relations and consider the risk-neutral pricing form of CAPM-like relations. This will lead to a method of calibrating deviation measures from market data.

3 - Pricing Scheduling Flexibility of Electricity Generation Facilities
Valeriy Ryabchenko, valeriy@ufl.edu, Stanislav Uryasev

The paper presents a heuristic for valuation of tolling agreement contracts on power generation assets. We build a LP model to find approximations of optimal operating boundaries. We consider different operational constraints, such as start-up and shut-down costs, ramp-up period etc. We consider general markovian martingale processes for electricity and fuel price dynamics. In order to make the model robust we incorporate a set of optimal boundary shape constraints.

4 - Pricing American Options By Numerical Replication: Quadratic Programming Approach
Timofey Turko, University of Florida, jk13@ufl.edu, Stanislav Uryasev, Valeriy Ryabchenko

The paper considers a quadratic programming approach to pricing American options in an incomplete market. The algorithm replicates an option by a portfolio consisting of the underlying security and a risk-free bond. To make the model robust we incorporate a set of American option specific monotonicity constraints that are theoretically justified for general price dynamics processes. We populate the model with historical sample paths of the underlying security or with Monte Carlo simulated paths.

■ TD46

S-Ballard (Lev. 3)

Benefits and Costs of Transmission Expansions in Power Systems

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Enzo Sauma, P. Universidad Catolica de Chile, Ave. Vicuña Mackenna #4860, Santiago, RM, Chile, esauma@ing.puc.cl

1 - Transmission Investment Incentives: Economic Analysis by Example
Robert Entriken, Manager Policy Analysis, EPRI, 3420 Hillview Avenue, Room B-1007, Palo Alto, CA, 94304-1338, United States, rentrike@epri.com

This paper summarizes the use of agent-based simulation as a tool for studying transmission investment incentives, and it is meant to illuminate the source and reasoning for the difficulties in aligning incentives for enhancing the transmission system. The technology behind this tool can be broadly applied to help negotiators in transmission planning quantify their counterparties benefits and costs, as well as their own.

2 - A Method to Assess Benefits of Transmission Expansions in the Italian Electricity Market
Paola Bresesti, Technical Director, CESI Ricerca, Via Rubattino, 54 - 20134, Milano, Italy, Paola.Bresesti@cesiricerca.it, Riccardo Vailati, Maria Vittoria Cazzol

The paper presents a novel method to assess simultaneously some technical and economic benefits of transmission expansions. The innovative feature of the method consists in integrating a power system reliability model and a market model. The paper reports the results of an application of the method that involves the Italian system.

3 - A Matrix Game Approach for FTR Allocation in Electric Power Networks
Tapas K. Das, Professor, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, das@eng.usf.edu, Cihan Babayigit

We develop a matrix game theoretic modeling approach for allocation of financial transmission rights in electric power networks. The model considers the usual network constraints, contingencies, variability and the risk factor associated with the estimation of congestion cost, and the revenue adequacy condition. A learning based solution approach yields a multidimensional equilibrium bid vector for FTRs consisting of price, quantity, and mix of options and obligations.

4 - A Stochastic Dynamic Programming Approach for Transmission Investments
Enzo Sauma, P. Universidad Catolica de Chile, Ave. Vicuña Mackenna #4860, Santiago, RM, Chile, esauma@ing.puc.cl

We reformulate a previously-developed static model of transmission investments in restructured electricity systems using a stochastic dynamic framework. In particular, we study the optimal transmission investment strategy of a network planner based on equilibrium models characterizing the dynamic competitive interaction among oligopolistic generation firms.

■ TD47

S-Admiral (Lev. 3)

Operations Management in Agribusiness

Cluster: Operations Management in Commodity Markets and Agribusiness
Invited Session

Chair: Timothy Lowe, Professor, University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52242, United States, tlowe@uiowa.edu

1 - Pricing and Production Planning Under Supply and Demand Uncertainty
Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, Syracuse, NY, 13244, United States, bkazaz@syr.edu

We provide a comprehensive review of pricing and production planning decisions under supply and demand uncertainty. Two modeling approaches are presented for the price-setting behavior. The paper identifies how these decisions change with backlogging and lost sales independently, and later with the yield-dependent purchasing cost. The results are generalized by considering: 1) linear and iso-elastic demand functions, and 2) additive and multiplicative forms of supply and demand uncertainty.

2 - To Market, To Market, To Sell A Fat Pig
Jeffrey Ohlmann, Assistant Professor, University of Iowa, Tippie College of Business, 3749 Donegal Ct., Iowa City, IA, 52246, United States, jeffrey-ohlmann@uiowa.edu, Philip Jones

Pork producers must determine when to sell pigs, which and how many pigs to sell, and to which packer(s) to sell them. We model the decision-making problem as a linear mixed-integer program and implement a spreadsheet-based decision support system that determines the marketing strategy that maximizes expected annual profit. Utilizing data provided by Cargill Animal Nutrition, we validate the model and demonstrate significant strategic departures from industry rules-of-thumb.

3 - Coordinating the Supply Chain in the Agricultural Seed Industry
Timothy Lowe, Professor, University of Iowa, S210 Pappajohn Business Building, Iowa City, IA, 52242, United States, tlowe@uiowa.edu, Philip Jones, Samuel Burer

We present and analyze contract parameters used between suppliers and retailers in the agricultural seed industry. Many of these contracts include certain "bonus" and penalty features. We establish sufficient conditions for contract parameters to guarantee coordination. Under the assumption of uniform demand, we fully characterize all coordinating contracts.

■ TD48

S-Fremont (Lev. 3)

Risk in Business

Contributed Session

Chair: Cigdem Gurgur, Assistant Professor, Colorado School of Mines, 1500 Illnois Street, Golden, CO, 80401, United States, cgurgur@mines.edu

1 - Empirical Likelihood for Value at Risk and Expected Shortfall

Evren Baysal, IE/MS Department, Northwestern University, 2145 Sheridan Rd, Room C151, Evanston, IL, 60208-3119, e-baysal@northwestern.edu

When estimating risk measures, whether from historical data or by Monte Carlo simulation, it is helpful to have confidence intervals that provide information about statistical uncertainty. We provide asymptotically valid confidence intervals and confidence regions involving value at risk, conditional tail expectation, and expected shortfall (conditional value at risk), based on three different methodologies. One is an extension of previous work based on robust statistics, the second is a straightforward application of bootstrapping, and we derive the third using empirical likelihood. We then evaluate the small-sample coverage of the confidence intervals and regions in simulation experiments using financial examples. We find that the coverage probabilities are approximately nominal for large sample sizes, but are noticeably low when sample sizes are too small (roughly, less than 500 here). The new empirical likelihood method provided the highest coverage at moderate sample sizes in these experiments.

2 - Determining Aggregate Distributions of Financial and Insurance Risk in the Presence of Correlation

Huybert Groenendaal, PhD, MBA, M.Sc., Partner, Vose Consulting, 2891 20th Street, Boulder, CO, 80304, Huybert@voseconsulting.com, David Vose

The banking and insurance industries often need to determine the aggregate distribution for the loss, credit and operational risk they are exposed to in order to set aside sufficient capital to cover that risk with high probability. Most methods assume individual or partial aggregate loss distributions are uncorrelated. This lecture demonstrates some techniques that combine copula methods of modeling correlation with aggregate distribution methods like Panjer and de Pril recursion and FFTs.

3 - Portfolios of Real Options

Arnd Huchzermeier, Professor, WHU - Otto Beisheim School of Management, Burgplatz 2, Vallendar, 56179, Germany, ah@whu.edu, Rainer Brosch, Lenos Trigeorgis

Corporate investment decisions typically involve portfolio decisions about several underlying assets and several real options on these assets. We explicitly consider an overall budget constraint in which interdependencies between decisions, at each point in time and dynamically over time, are crucial. We set up a portfolio valuation framework as a multi–dimensional real options problem which involves path–dependent investment decisions. We provide new insights into portfolio effects.

4 - Methodology for Measuring Operational Risk in Financial Institutions

Alvaro Mendoza, Instructor, University of Los Andes, Calle 19A No. 1-37 Este, Bogota, DC, 11111, Colombia, a-mendoz@uniandes.edu.co, Mario Castillo

Considering the interest of important financial organizations at world-wide level and of regulating organizations like the Basel Committee on Banking Supervision in the operational risk management process, this work develops a methodology to identify and measure operational risk in financial institutions. The methodology developed is supported in Bayesian Networks and MonteCarlo Simulation, and it was applied in a Colombian financial institution.

5 - An Optimum Policy Rule For Dynamic Cash Management of Warranty Reserves

Cigdem Gurgur, Assistant Professor, Colorado School of Mines, 1500 Illnois Street, Golden, CO, 80401, United States, cgurgur@mines.edu

It is common for many companies to create a reserve fund to cover future liabilities arising from product warranties. We propose an optimal policy rule to guide dynamic cash management of warranty reserves along two lines: (1) The amount of cash additions or subtractions at the beginning of each period; (2) The amount to contribute to the reserve after each sale. Numerical examples show that this policy indeed captures the current practices.

■ TD49

S-Greenwood (Lev. 3)

Revenue Management & Pricing in Operations

Sponsor: Revenue Management & Pricing- Invited/Sponsored

Sponsored Session

Chair: Philipp Afeche, Asst. Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca

1 - Design of an Aggregated Marketplace Under Congestion Effects

Ying-Ju Chen, Assistant Professor, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, United States, ychen0@stern.nyu.edu, Gustavo Vulcano, Costis Maglaras

We study an aggregated marketplace where potential buyers arrive and submit requests-for-quotes (RFQs). There are n independent suppliers modelled as M/GI/1 queues that compete for these requests. Each supplier submits a bid that comprises of a fixed price and a dynamic target leadtime, and the cheapest supplier wins the order as long as the quote meets the buyer's willingness to pay.

2 - Dynamic Allocation to Multiple-class Demand with Continuous Review

Joseph Milner, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, milner@rotman.utoronto.ca, Panos Kouvelis, Qing Ding

We consider how a firm should dynamically allocate inventory to different customer classes that are differentiated by price and willingness to wait for delayed delivery as well as reorder in a continuous review environment with positive lead times. We establish the optimal policy and introduce efficient and robust heuristics.

3 - Usage Restriction and Subscription Services: Operational Benefits with Rational Users

Ramandeep Randhawa, The University of Texas at Austin, Austin, TX, United States, ramandeep.randhawa@mccombs.utexas.edu, Sunil Kumar

We study a rental firm, e.g. Netflix or Blockbuster, that offers reusable products to price and quality-of-service sensitive customers. We study the alternatives of offering either a subscription option that limits the number of concurrent rentals in return for a flat fee per unit time or a pay-per-use option with no such restriction. In each option, customers adjust their request rate to obtain a nominal usage rate. We show that offering the subscription option is more profitable for the firm.

4 - Response Time and Revenue Mangement Under Competition and Customer Choice

Philipp Afeche, Asst. Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca

Consider the problem of two providers who compete for heterogeneous and time-sensitive customers with private information about their preferences. How should they design price-delay menus and schedule their resources? We characterize the price-delay equilibria and discuss how they depend on capacity levels, competition, and the value of market segmentation.

■ TD50

S-Issaquah A & B (Lev. 3)

Revenue Management with Demand Uncertainty

Sponsor: Revenue Management & Pricing- Invited/Sponsored

Sponsored Session

Chair: Vivek Farias, Stanford University, vivekf@stanford.edu

1 - Correlated Multiarmed Bandits

Adam Mersereau, Assistant Professor, Kenan-Flagler Business School, University of North Carolina, Campus Box 3490, McColl Bldg., Chapel Hill, NC, 27599-3490, United States, amersere@chicagogsb.edu, Paat Rusmevichientong

The multiarmed bandit problem is a classic example of the exploration vs. exploitation dilemma faced by decision-makers in environments with data uncertainty. To date, most research on the problem assumes the arms are statistically independent. Consequently, performances of known algorithms scale with the number of arms. We consider a setting when the arms have an assumed correlation structure, and present algorithms whose convergence rates are independent of the number of arms.

2 - Bid-Price Controls for Network Revenue Management
Mustafa Akan, PhD Student, Kellogg School of Management, Managerial Economics & Decision Sciences, Leverone 581, Evanston, IL, 60201, United States, m-akan@kellogg.northwestern.edu, Baris Ata

We consider a network model of revenue management and propose an optimal bid-price control, where the bid prices form a martingale. We also propose a predictable bid-price control where bid prices used in each period are last updated in the previous period and establish its near optimality as the periods get small while the planning horizon and the other model primitives remain unchanged. Near-optimal bid-prices form a martingale too. Finally, we provide an upper bound on the optimality gap.

3 - Dynamic Cost-Per-Action Mechanisms and Applications to Online Advertising
Hamid Nazerzadeh, Stanford University, Terman Eng. Center #395, Stanford, CA, United States, hamidnz@stanford.edu, Amin Saberi, Rakesh Vohra

We examine the problem of allocating a resource repeatedly over time among a set of agents. The utility that each agent derives from consumption of the item is private information to that agent, and prior to consumption, may be unknown to that agent. We describe a mechanism based on a sampling-based learning algorithm that under suitable assumptions is asymptotically individually rational, asymptotically Bayesian incentive compatible and asymptotically ex-ante efficient.

4 - Dynamic Pricing with Uncertainty in Market Response
Vivek Farias, Stanford University, vivekf@stanford.edu, Benjamin Van Roy

We consider a single resource revenue management model with uncertainty in demand statistics. We present a simple heuristic that addresses the tradeoff between 'exploratory' pricing that attempts to learn quickly and pricing that attempts to hedge against the possibility of a highly popular product. In addition to promising computational results we present a uniform performance guarantee.

■ TD51

S-Kirkland (Lev. 3)

Queueing Systems in Heavy Traffic

Cluster: Queueing Models
Invited Session

Chair: Amy Ward, USC, Marshall School of Business, BRI 401 H, Los Angeles, CA, 90089-0804, United States, amyward@marshall.usc.edu, Chair: Wuqin Lin, wuqin-lin@kellogg.northwestern.edu

1 - A Single-server Queue with a Delayed Service Option and Abandonment
Amy Ward, USC, Marshall School of Business, BRI 401 H, Los Angeles, CA, 90089-0804, United States, amyward@marshall.usc.edu, Sriram Dasu, Vasiliki Kostami

We consider a single-server queueing model in which customers may choose between waiting for service in real-time, and returning for service at a dynamically specified future time. Some of the customers that promise to return for service do not return. We show the system exhibits state-space collapse in the heavy-traffic limit, and develop a one-dimensional diffusion approximation with state-dependent drift.

2 - Rental Duration Distributions and Stock-levels: Why Deadlines May be Bad for Rental Firms
Achal Bassamboo, Kellogg School of Management, 2001 Sheridan Rd., Evanston, IL, 60208, United States, a-bassamboo@kellogg.northwestern.edu, Sunil Kumar, Ramandeep Randhawa

We consider a rental system, like Netflix, where a fixed number of users rent one product at a time from a collection of re-usable products. We study transient behavior in this system following the introduction of a new product. Analyzing the usage process for this product, we show that an increase in the variability can allow the firm to set lower capacity levels to meet a desired QoS. We also show that the firm is better off not imposing any deadlines for the return of the product.

3 - MaxWeight Scheduling in Stochastic Processing Networks
Wuqin Lin, wuqin-lin@kellogg.northwestern.edu

We consider a large class of stochastic processing networks under Maxweight scheduling policies in heavy traffic. We show that these greedy policies are asymptotically optimal for networks that have a single bottleneck resource pool. We also study the fluid model for networks with multiple bottleneck resource pools.

4 - A Workload Averaging Principle for Tandem Polling Stations
Otis Jennings, Professor, Duke University, 1 Towerview Dr, Durham, NC, 27705, United States, otisj@duke.edu

Consider a sequence of multiclass, two-station queueing systems in heavy traffic. Jobs visit station 1, a polling station that employs exhaustive service and incurs no setup time, and then station 2, which has an arbitrary non-idling service discipline. We prove that although the sequence of diffusion-scaled, immediate workload processes for station 2 does not converge in general, the sequence does in fact admit an averaging principle.

■ TD52

S-Leschi (Lev. 3)

Reinforcement Learning in Business and Economics

Sponsor: Artificial Intelligence
Sponsored Session

Chair: Sid Bhattacharyya, University of Illinois, Chicago, Information and Decision Sciences, Chicago, IL, 60607, United States, sidb@uic.edu

1 - Risk-sensitive Reinforcement Learning
Abhijit Gosavi, University at Buffalo, SUNY, 317 Bell Hall, Buffalo, NY, United States, agosavi@buffalo.edu

Concepts such as variance and downside risk have been used by economists as measures of risk. In the field of artificial intelligence, the use of risk measures is a relatively new development. We present some reinforcement learning algorithms that employ risk measures, along with some numerical results from industrial problems.

2 - Price-discovery vs. Profit-taking: The Market-maker's Exploration-exploitation Tradeoff
Sanmay Das, Rensselaer Polytechnic Institute, Dept.. of Computer Science, 110 8th St, Troy, NY, 12180-3590, United States, sanmay@cs.rpi.edu

This paper studies the profit-maximization problem of a monopolistic market-maker in a market model based on that of Glosten and Milgrom. I introduce an entropy-based algorithm for trading off exploration and exploitation that outperforms both myopic profit maximizing algorithms and previous heuristics. Surprisingly, price discovery is quicker than in a competitive model, because the market-maker is willing to absorb losses following a valuation shock to learn the new valuation more rapidly.

3 - A Leader-follower Reinforcement Learning Approach to Adaptive Mechanism Design
Kurian Tharakunnel, University of Illinois, Chicago, Information and Decision Sciences, Chicago, IL, 60523, United States, kthara1@uic.edu, John Sparks

We consider an adaptive mechanism design process in which the mechanism learns to adapt its parameters from past agent responses to maximize certain objective, while the agents learn to adapt their behavior to maximize their individual utilities. A reinforcement learning approach based on a leader-follower framework is proposed and illustrated.

4 - Effects of Learning in Call Double Auctions with Uniform Pricing
Mridul Pentapalli, Graduate Student, Iowa State University, 1207 Delaware Ave, Apt# 3, Ames, IA, 50014, United States, mridul@cs.iastate.edu

This study conducts computational experiments to compare reinforcement and neuro-evolution learning representations for traders participating in a call double auction with uniform pricing. Two test cases are examined: a simple repeated auction; and an auction embedded within an empirically-based wholesale power market framework developed by Sun and Tesfatsion (2007).

■ TD53

S-Medina (Lev. 3)

Facilities Layout & Design

Contributed Session

Chair: Dima Nazzal, Assistant Professor, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States, dnazzal@mail.ucf.edu

1 - A Genetic Algorithm for a Constrained Dynamic Plant Layout Problem
Chun-Hung Cheng, Associate Professor, The Chinese University of Hong Kong, Dept. of Systems Engineering &, Engineering Management, Hong Kong, China, b616717@mailserv.cuhk.edu.hk, Jaydeep Balakrishnan, Chun-Ming Lau

In this research we consider a constraint on the amount of funds that may be spent on rearrangement of layout over a fixed planning horizon. To solve this layout problem, we extend and improve the use of genetic algorithms. An extensive computational study is carried out to compare the proposed algorithm with the existing genetic algorithms and dynamic programming. The results show that the proposed algorithm is more effective. Thus our algorithm may be useful in solving larger layout problems.

2 - Optimal Class Structure in an ABC Inventory System
Robert E. Stanford, Dept.. of FEQM, UAB School of Business, Birmingham, AL, 35294-4460, stanford@uab.edu

The total maintenance cost for a large ABC inventory system is expressed as a function of the numbers of inventory classes and the proportions of SKUs assigned to each class. Assuming a specific analytical form for the system's Distribution-by-Value Curve, we derive the optimal class structure.

3 - A Multiple-criteria Approach to the Unpaced Synchronous Line-balancing Problem
Tim Urban, The University of Tulsa, Operations Management, 600 South College Avenue, Tulsa, OK, 74104, United States, urbantl@utulsa.edu, Wen-Chyuan Chiang

An unpaced synchronous production line is one in which the line advances only when all of the stations have completed their tasks. Existing research has investigated the unpaced synchronous line-balancing problem with stochastic task completion times by utilizing an objective of minimizing the number of stations. We consider an extension to that model by incorporating a second objective, that of maximizing the expected throughput for a given number of stations.

4 - A Queuing Model of Vehicle-based Material Handling Systems
Ahmed El-Nashar, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States, aelnasha@mail.ucf.edu, Dima Nazzal

This analysis proposes an analytical approach to performance modeling of multi-vehicle material handling system operating on a unidirectional track network. The network is composed of multiple loops with shortcuts inside the loop to reduce the travel times. We propose the analytical model as a quick, relatively accurate alternative to simulation modeling. A probabilistic model is developed to provide estimates for the expected throughput capacity of the material handling system.

■ TD54

S-Queen Anne (Lev. 3)

Operational Planning in Call Centers

Sponsor: Applied Probability
Sponsored Session

Chair: Auke Pot, Assistant Professor, Vrije Universiteit, De Boelelaan 1081a, Amsterdam, 1081HV, Netherlands, sapot@few.vu.nl

1 - Simulation-based Local Search for Large-scale Workforce Scheduling Problems
Alex Fukunaga, Tokyo Institute of Technology, Ookayama 2-12-1, Meguro, Tokyo, Japan, fukunaga@is.titech.ac.jp

With millions of people working at call centers worldwide, workforce scheduling for call centers is an important, industrial problem. This talk will describe a simulation-based, local search approach to workforce scheduling. In contrast to traditional approaches that decomposes staff scheduling into a muti-stage problem, this approach is a monolithic approach which solves the problem in a single stage. This approach is used in a highly successful commercial system.

2 - Staffing Algorithms for Multi-skill Call Centers
Wyean Chan, PhD Student, Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal, Qc, H3C 3J7, Canada, chanwyea@iro.umontreal.ca, Pierre L'Ecuyer, Athanassios Avramidis

We compare the performance of different staffing optimization algorithms for various multi-skill call center scenarios. We also look at other optimization aspect such as skillset construction and routing policies, and how to optimize them jointly with staffing.

3 - Call Center Performance Indicators and Computations
Ger Koole, Professor, VU University Amsterdam, De Boelelaan 1081 a, Amsterdam, 1081 HV, Netherlands, koole@few.vu.nl

Call center performance is usually measured by a number of performance indicators such as abandonment rate, service level, productivity, first-time-fixed ration, etc. However, different definitions are used for the same performance indicators. For example, how to account for abandonment in teh service level definitions? We discuss the different options and show the pros and cons of different choices, both from the managerial and the computational perspectives.

4 - A Real-time Routing Policy for Call Centers
Auke Pot, Assistent Professor, Vrije Universiteit, Amsterdam, Netherlands, pot@ccmath.com

We consider a multi-skill call centers, having different job types and several agent groups. A routing policy is presented that can handle unexpected fluctuations in the arrival intensities. We show that the policy yields the best achievable service levels under certain circumstances.

■ TD55

S-Ravenna (Lev. 3)

Airline Optimization at Boeing and Jeppesen

Sponsor: Aviation Applications
Sponsored Session

Chair: Stefan Karisch, VP Operations Research, Jeppesen Systems AB, 1800 McGill College Avenue, Suite 1930, Montreal, QC, H3A 3J6, Canada, stefan.karisch@jeppesen.com

1 - Flight Crew Economic Analysis at Boeing
Dan Abraham, The Boeing Company, P.O. Box 3707, MC 21-33, Seattle, WA, 98124-2207, United States, daniel.p.abraham@boeing.com, Roman Fresnedo, Sharon Arroyo, Scott Ryan

Boeing acquires and develops methods and tools to estimate the value of flight deck commonality for business case analysis. Current focus is on the development of models to efficiently estimate the number of crew needed to fly a schedule, approximate the cost of crew ladders (or how crew are promoted through the ranks), and estimate the benefits (as related to crew) of mixed fleet flying under irregular operations. An overview of the activities in these three areas will be given.

2 - Operations, Disruptions and Recovery
Goran Stojkovic, Senior Operations Research Analyst, Jeppesen, 1800 McGill College Avenue, Suite 1930, Montreal, QC, H3A 3J6, Canada, Goran.Stojkovic@jeppesen.com

In operations disruption management, multiple parties are changing data simultaneously and the preferred approach to solve the disruption recovery problem usually varies by user. The lack of industry best practices and standards makes it hard to evaluate generated solutions and perform convincing benchmarks. We propose a standard benchmarking process based on an automated testing environment and a Recovery Performance Indicator (RPI) model in order to show the added value to the customer.

3 - Flight Planning - The Forgotten Field in Airline Operations
Stephen Altus, Enterprise Manager, Technical Sales, Jeppesen, 225 West Santa Clara Street, Suite 1600, San Jose, CA, 95113, United States, steve.altus@jeppesen.com

Although it is a central part of the operation of every flight, and includes multiple challenging optimization problems, flight planning has been largely ignored by the OR field. This presentation broadly introduces the flight planning problem and topics of current research. Relevant aspects of the domain are described, specific problems are identified, and various approaches to resolving them are discussed.

4 - Aircraft Schedule Recovery with Crew Connection Protection
Darren Hang, Optimization Specialist, Jeppesen, Odinsgatan 9, Gothenburg, SE-411 03, Sweden, darren.hang@jeppesen.com

The aircraft schedule recovery problem is solved daily by airlines. The objective is to minimize the impact of disruptions on the airline schedule taking into account essential aircraft and crew constraints, as well as passenger values. We present a fast metaheuristic algorithm for solving the aircraft schedule recovery problem. It protects crew connections and produces structurally different solutions within seconds. Results on production data will be presented.

■ TD56

S-Wallingford (Lev. 3)

Energy

Contributed Session

Chair: Elisabeth Gilmore, Carnegie Mellon University, 129 Baker Hall, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, eagilmor@andrew.cmu.edu

1 - An Investigation on the Installation, Use, and Performance of Natural Gas Service Risers in Ohio
Hisham Choueiki, Senior Energy Specialist, PUCO, 180 East Broad Street, 6th Floor, Columbus, OH, 43215, United States, hisham.choueiki@puc.state.oh.us, David Wang

A gas service riser, the vertical portion of the gas service line that connects the distribution system to the customer's gas meter was the focus of a statewide commission-ordered investigation over the past two years. This was the result of a series of incidents reported to the staff of the PUCO. We present some of the results from a controlled experiment that was conducted where several variables; such as torque, tensile load, and temperature, were tested as possible causes for riser failure.

2 - A Multi-period Stochastic Programming Model for a Day Ahead Electricity Market with Shortage Pricing

Jichen Zhang, PhD Student, Dept.. of Management Sciences, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, j36zhang@uwaterloo.ca, Samir Elhedhli, David Fuller

We present a multi-period stochastic mixed integer programming model for power generation scheduling in a day-ahead electricity market. The model considers various scenarios and the idea of reserve shortage pricing in real time. A scenario rolling heuristic algorithm is developed to overcome computational difficulties that make exact methodologies and commercial software inappropriate. Numerical results show that the proposed method provides high quality solutions within reasonable time.

3 - A Combined Electric Power System Planning Model in Deregulated Markets

Yang He, PhD Student, Systems and Industrial Engineering Department, The University of Arizona, hey@email.arizona.edu, Pitu Mirchandani

We present a model for studying capacity expansion decisions of both electricity generation and transmission sectors in deregulated electric power markets. This model may be used to analyze how future uncertainties may affect the market participants' capacity expansion decisions and the associated revenues. This model is compared with the case where two electric power sectors make capacity expansion decisions in a separately.

4 - The Air Quality and Health Effects of Emerging Electricity Storage Technologies in New York

Elisabeth Gilmore, Carnegie Mellon University, 129 Baker Hall, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States, eagilmor@andrew.cmu.edu, Rahul Walawalkar, Peter Adams, Jay Apt, Lester Lave

The difference between on peak and off peak zonal prices in New York City - Long Island offsets the cost of installing emerging electricity storage (EES) technologies. We evaluate the change in air quality using a 'state of science' chemical transport model, and estimate the health damage to calculate social cost. Displacing polluting peaking oil combustion turbines yields a net benefit for EES technologies of 0.005 dollar/kWh.

■ TD57

S-Columbia (Lev. 4)

O.R. in Sports

Sponsor: O.R. in Sports
Sponsored Session

Chair: Celso Ribeiro, Universidade Federal Fluminese, Department of Computer Science, Niteroi, RJ, Brazil, celso@inf.puc-rio.br

1 - A Branching Scheme Fixing Breaks First

Dirk Briskorn, University of Kiel, Olshausenstr. 40, Kiel, 24105, Germany, briskorn@bwl.uni-kiel.de

We consider single round robin tournaments (SRRT) with minimum number of breaks. We associate cost with each possible match. Finding a minimum cost SRRT turns out to be intractable for 10 teams employing standard IP solvers. We propose an approach fixing breaks for teams before matches are arranged. Here, breaks already fixed for teams restrict the set of possible breaks for the team the next break is assigned to. We present ideas to take this into account when choosing the next break to assign.

2 - Modelling Soccer Matches Using Bivariate Discrete Distributions with General Dependence Structure

Phil Scarf, Dr, University of Salford, Centre for OR and Applied Statistics, Salford Business School, Salford, M5 4WT, United Kingdom, p.a.scarf@salford.ac.uk

The outcome of a soccer match can be recorded in a number of ways: as scores (goals for, goals against); or with more detail such as shots for, shots against, possession statistics, and other within match events. We will briefly consider the former. For the latter, we generate bivariate distributions using copulas, and fit these to data from the English Premier League. Our aim is to explore the effect of playing strategy on match outcome.

3 - Data Clustering for Fitting Parameters of a Markov Probability Model of Multi-Game Playoff Series

Christopher Rump, Assistant Professor, Applied Statistics & Operations Research, Bowling Green State University, Bowling Green, OH, 43403, United States, cmrump@bgsu.edu

We use data clustering algorithms to group transition probabilities in Markov chain models of a 7-game playoff series. The models provide an extremely good statistical fit to historical playoff outcomes in the NBA and NHL, improving significantly on models based solely on home-away game dependence.

■ TD58

S-Pike (Lev. 4)

Behavioral Issues in TM and NPD

Cluster: New Product Development
Invited Session

Chair: Svenja Sommer, Assistant Professor of Management, Purdue University, Krannert School of Management, West Lafayette, IN, United States, ssommer@purdue.edu

1 - An Empirical Investigation of the B2B e-Service Chain

Pedro Oliveira, School of Economics & Management, Catholic University of Portuga, Palma de Cima, Lisboa, Portugal, poliveira@fcee.upc.pt, Aleda Roth

This paper addresses the e-service capability in a B2B environment. Empirical results indicated that companies with a service orientation are more apt to have better performance.

2 - The Siren Call of Difficult Tasks: Career Concerns and Operational Autonomy

Enno Siemsen, Assistant Professor, University of Illinois at Urbana-Champaign, 350 Wohlers Hall, 1206 S. Sixth Street, Champaign, IL, 61820, United States, siemsen@uiuc.edu

We examine how economic incentives can lead agents to prefer difficult tasks to simple ones. We model a decision context in which agents have the operational autonomy to choose between easy or more difficult solutions to their task. We demonstrate that highly capable agents prefer moderately difficult tasks to showcase their capability, while less-capable agents prefer highly difficult tasks to mask their lack of capability.

3 - Motivation and Performance in Professional Groups

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, christoph.loch@insead.edu, Yaozhong Wu

We show empirical evidence from experiemnets with human subjects that a balance of individual and team-oriented motivation mechanisms leads to highest performance in knowledge tasks.

4 - The Effect of Team Diverity and Structure on Project Termination

Stylianos Kavadias, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, NW, Atlanta, GA, 30308-0520, United States, Stylianos.Kavadias@mgt.gatech.edu, Nektarios Oraiopoulos

In this presentation we analyze the impact of new information interpretation (interpretative scheme) on the project stopping decision. We view NPD teams as groups of decision makers that evaluate the incoming information differently, and therefore result in diverse proposals on the project continuation. Our results reveal an interpretation regime under which the team diversity delays stopping consistently. Thus, we offer an alternative explanation to escalation of commitment phenomena.

■ TD59

S-Seneca (Lev. 4)

Empirical Studies of Capacity Management and Technology Acquisition

Cluster: Capacity and Technology Management
Invited Session

Chair: Serguei Netessine, Associate Professor, University of Pennsylvania, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States, netessin@wharton.upenn.edu

1 - Capacity Estimation and Optimal Staffing for an Email Contact Center

Sameer Hasija, University of Rochester, 4-341 C. G. Simon Hall, University of Rochester, Rochester, NY, 14627, United States, HASIJAS1@simon.rochester.edu, Edieal Pinker, Robert Shumsky, Sanjog Misra

In this paper we present a staffing rule for an email contact center, as well as a method to estimate agent capacity parameters using agent productivity data, given that the historical data is truncated at an upper limit. The staffing rule has been implemented by an actual vendor that provides email-based customer support for a major e-retailer. The implementation results demonstrate that the method provides accurate staffing recommendations for a real-world contact center.

2 - Demand Distortions and Capacity Allocation Policies

Aliza Heching, IBM TJ Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, ahechi@us.ibm.com, Paul Kleindorfer, Jayanth Krishnan

We describe a study of the consequences of capacity allocation mechanisms at a large semiconductor manufacturer. We use a panel data set with 300,000 observations spanning five years of forecasting and order transactions between a supplier and all of the customers at his manufacturing facility.

3 - The Impact of New Product Introduction on Assembly Productivity in the N.A. Automotive Industry

Manu Goyal, mgoyal@rhsmith.umd.edu, Matthew Reindorp, Serguei Netessine

Choosing the right manufacturing facility is a key element in the launch of a new or updated automotive product. From a study of recent data on North American automobile production, we find that prior productivity is a significant predictor of productivity during launch and positively influences a plant's chances of being chosen as a launch site. We also demonstrate that productivity during launch is improved when the launch is larger and/or flexible production methods are employed.

4 - Market Heterogeneity and Local Capacity Decisions in Services

Dennis Campbell, Harvard Business School, Soldiers Field, Boston, MA, 02153, United States, dcampbell@hbs.edu, Frances Frei

We empirically document factors that influence how local managers balance the tradeoff between service capacity costs and customer sensitivity to service times. We find that (1) customer-sensitivities to service time vary predictably with market characteristics; (2) capacity supply decisions of local managers reflect market specific sensitivity to service time; and (3) experience affects how local managers evaluate the tradeoff between capacity costs and customer sensitivity to service time.

■ TD60

S-University (Lev. 4)

Knowledge, Learning, Intellectual Capital-IV: Knowledge Horizons

Sponsor: Technology Management
Sponsored Session

Chair: Erica Fuchs, Post-Doctoral Fellow, M.I.T., 73 Magazine Street, Apartment 401, Cambridge, MA, 02139, United States, erhf@mit.edu

1 - Interaction Effects of Knowledge Component Interdependence and Uncertainty on R&D Scope

Sebastian Fixson, MIT Sloan School of Management, 30 Wadsworth St, E53-343, Cambridge, MA, 02142, United States, fixson@mit.edu, Won Hee Lee

With this paper we investigate how firms change their R&D scope as a response to changes of technological uncertainty. We suggest that the relationship between technological uncertainty and R&D scope is moderated by the interdependence of knowledge components in a product. In an empirical study we find that the decrease of firms' R&D scope with increasing uncertainty is much stronger in high component interdependence regimes than in regimes of low component interdependence.

2 - Fuzzy Cognitive Maps for Decision Making and Learning in New Product Development Teams

Antonie Jetter, Assistant Professor, Portland State University, P.O. Box 751, Eng. & Tech. Management, Portland, OR, 97207, United States, jettera@cecs.pdx.edu

In the early planning stages of a new product, decision-makers need to make sense of a multitude of mainly qualitative, uncertain and oftentimes contradicting information about future business environments. Fuzzy Cognitive Maps (FCMs) are a powerful means to elicit qualitative expert knowledge, to translate it into quantitative models of business scenarios, and to learn about interdependencies and dynamic properties of the business environment.

3 - TMS Dissertation Runner-up: Innovation in the Life Science: Impact of IP Right on Scientific Knowledge Diffusion, Growth and Use

Kenneth Huang, Assistant Professor of Management, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Rd. #05-01, Singapore, SG, 178899, kennethhuang@smu.edu.sg

I examine the role of patenting in life sciences addressing: (1) the impact of institutional IP policies on knowledge dissemination, utilization and commercialization; (2) the unique attributes of life science innovations captured by patents generated under different institutional settings; and (3) how patenting impacts rate and trajectories of knowledge accumulation.

Wednesday, 8:00am - 9:30am

■ WA01

C-Room 602

Supply Chain III

Contributed Session

Chair: Mohammad Bsat, Associate Professor, Jackson State University, 5201 Lakeland Dr., Suite 169, Jackson, 39232, United States, mdbsat@yahoo.com

1 - Short-term Planning and Scheduling of a Refinery in an Integrated Oil Company

Jens Bengtsson, Norwegian School of Economics and Business Administration, Helleveien 30, Bergen, 5045, Norway, jens.bengtsson@nhh.no, Sigrid-Lise Nonas

Coordination of activities along the supply chain of an integrated oil company is important in order to draw advantages from process flexibility and an active trading and sales department. To make this possible refinery planning and scheduling must be based on market information, refinery status, and relevant use of decision support systems and their outputs. In this paper the coordination issue is analyzed further and the analysis is also partly carried out on a real life case.

2 - An Exploratory Empirical Study Logistic and Supply Chain Performance in Chinese Firms

Zhiyong Xu, Xi'an Jiaotong University, Xianning West Road, 28, Xi'an, 710049, China, zhiyongxu@mail.xjtu.edu.cn, Linyan Sun

As the business environment becomes more and more uncertain and competitive, many organizations come to deal with these problems through logistics and supply chain management. The study conducted by survey of 207 Chinese firms on logistic and supply chain (LSC) performance with a scorecard, which has 4 factors and 22 measurement items. The study's findings provide managerial insights for firms to understand and improve their LSC performance.

3 - Dynamics of Relationship Specific Investments: Evidence from RFID Adoption by Suppliers

Miti Garg, Research Engineer, TLI-AP, Blk E3A, Level 3, 7 Engineering Drive, Singapore, 117574, Singapore, tlimg

Does RSI really matter? This question is most commonly asked in literature which explores the theory. Academicians demonstrated that scope & size of RSI determine the governance structure. We argue that not only scope & size of RSI but specificity of investment such as RFID matters & moulds longstanding relationships. We explore the impact of asset specific investments such as RFID on evolving supplier relationships through case studies of the world's largest retail & aeronautics suppliers.

4 - E-commerce Usage among Supply Chain Partners in the Services Sector

Mohammad Bsat, Associate Professor, Jackson State University, 5201 Lakeland Dr., Suite 169, Jackson, 39232, United States, mdbsat@yahoo.com, dewaynna cates

Organizations are integrating the flow of information and decision processes across the supply chain to provide better customer service and improved business performance. In the current study, we examine e-commerce usage among supply chain partners in the student loan industry and empirically investigate the salient characteristics of an e-commerce system that impact a school's decision to use e-commerce to facilitate transactions among suppliers of student loans.

■ WA02

C-Room 603

Quantitative Models for CLSC Design and Operation

Cluster: Closed-Loop Supply Chains and Sustainable Operations

Invited Session

Chair: Sila Cetinkaya, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77845-3131, United States, sila@tamu.edu

Co-Chair: Elif Akcali, Assistant Professor, University of Florida, Industrial & Systems Engineering, Gainesville, FL, United States, akcali@ise.ufl.edu

1 - Impact of Consumer Behavior on the Profitability of Remanufactured Products

Ana Muriel, Associate Professor, University of Massachusetts Amherst, 160 Governors Drive, Amherst, MA, 01003, United States, muriel@ecs.umass.edu, Yue Jin, Yihao Lu

We investigate the profitability of remanufactured products for a monopoly firm in a single period. We find a threshold for the remanufacturing cost below which it is optimal to offer remanufactured products, and analyze its dependence on the consumer profile. This allows us to identify the conditions under which it is customer segmentation and not cost differences that drive the decision. The results are applicable to the evaluation of the common marketing practices of branding and generics.

2 - Multi-product Closed-loop Supply Chain Network Design: Models and Solution Approaches

Gopalakrishnan Easwaran, Texas A&M University, 303k Zachry Engg Center, 3131 TAMU, College Station, TX, 77843-3131, United States, gopal@tamu.edu, Elif Akcali, Halit Uster, Sila Cetinkaya

We consider a general class of multi-product closed-loop supply chain network design problems motivated by the practice of an original equipment manufacturer in the automotive service parts industry. We present MIP formulations with various realistic considerations, develop efficient solution approaches, and present computational results.

3 - Single Item Lot Sizing Problem with Remanufacturing

Ibrahim Karakayali, Research Assistant, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, ibrahimk@ufl.edu, Elif Akcali, Sila Cetinkaya, Halit Uster

We consider a single item lot sizing problem for a hybrid manufacturing and remanufacturing system. We develop a mixed integer linear programming model to determine the optimal timing of manufacturing, remanufacturing, and disposal setups and the associated lot sizes. We develop efficient solution procedures based on decomposition techniques and conduct extensive computational tests to investigate the efficiency of the proposed solution procedures.

4 - Optimal Pricing, Ordering, and Return Policies

Michael Ketzenberg, MKetzenberg@mays.tamu.edu, Rob Zuidwijk

Our research addresses a firm that sells a product to consumers who are sensitive to both price and return policy. The operational decisions of interest are the selling price, return policy, and quantity of new product to purchase. We conceptually model a single selling season that is split into two periods where the boundary between periods is delineated by the opportunity to recover product returns and resell them.

■ WA03

C-Room 604

Supply Chain Research

Cluster: Supply Chain

Invited Session

Chair: Ananth. V. Iyer, Professor, Purdue University - Krannert Graduate School of Management, 403 W. State Street, West Lafayette, IN, 47907-2056, United States, aiyer@mgmt.purdue.edu

1 - Supply Contracts in the Face of Production Disruptions

Suleyman Demirel, PhD Student, University of Michigan, Ann Arbor, 701 Tappan Ave, Ann Arbor, MI, 48104-1234, United States, sdemirel@umich.edu, Ching-hua Chen-Ritzo, Roman Kapuscinski

Firms operating in global markets often rely on suppliers located in several locations and are vulnerable to any risks faced by their suppliers. To hedge against disruptions, firms rely on inventories or maintain multiple suppliers, often at a cost. We analyze a multi-period model where a reliable supplier and an unreliable one compete for the buyer's business. In the equilibrium, the buyer could be sole-sourcing from either of the suppliers, or keep the reliable one as a backup supplier, while carrying no inventories.

2 - On the Service Performances of Shipment Consolidation Policies

Fatih Mutlu, Texas A&M University, Mays Business School, College Station, TX, 77843-4217, fmutlu@mays.tamu.edu, Sila Cetinkaya

We develop analytical expressions of various service performance measures in order to compare the performances of alternative shipment consolidation policies. We prove that hybrid policies provide superior service compared to both quantity- and time-based policies when the probability distributions of the maximum delay times and the expected values of the average delay times for the shipment of orders are considered.

3 - Inventory Management During Product Upgrade in Closed Loop Supply Chains

Asima Mishra, Doctoral Student, Purdue University, 1310 Krannert Building, West Lafayette, IN, 47907, United States, asima@purdue.edu, Ananth Iyer, Vinayak Deshpande

In this paper, we consider management of spare parts during product upgrade in a closed loop supply chain when both old' and new' version parts co-exist in the system. The objective is to find a policy to allocate the new' and old' version

parts to products when products fail, that maximizes the product uptime. We develop a periodic review inventory system in which the number of parts that fail in a period depends on the number of products in operation. It is shown that a threshold type of policy is optimal for certain class of demand distributions.

■ WA04

C-Room 606

Tutorial: Social Networks: Theory and Applications

Cluster: Tutorials
Invited Session

1 - Social Networks: Theory and Applications

Yong Tan, University of Washington, Business School, Box 353200, Seattle, WA, 98195-3200, United States, ytan@u.washington.edu

A social network is a map of formal/informal relationships among people, organizations, or other entities. It plays an important role in information dissemination and knowledge sharing, and is becoming increasingly popular in business research. This tutorial aims to cover social networks theory from the perspective of economics, sociology, and physics. Empirical methods and models will be introduced. Related work in the areas of Operations Management, Information Systems, Management, Marketing, and Finance will be discussed.

■ WA05

C-Room 607

Operations Research in Vehicle Development—Panel Discussion by Women in General Motors R&D: OR, Vehicle Development, and Design & Technology Fusion

Sponsor: Women in OR/MS
Sponsored Session

1 - Operations Research in Vehicle Development - Panel Discussion by Women in General Motors R&D: OR, Vehicle Development, and Design & Technology Fusion

Moderator: R. Jean Ruth, General Motors Research & Development, MC 480-106-256 R&D VDR, 30500 Mound Rd., Warren, MI, 48090-9055, United States, rjean.ruth@gm.com, Panelist: Hallie Kintner, Peiling Wu, Gulcin Sengir, Qi Hommes, Janet Goings

What is it like to work in an R&D lab in industry? In the auto industry? To start the discussion, we'll give a brief overview GM R&D and some of our O.R.-related projects in vehicle development, business strategy and planning, and design and technology. Most of the session will be open discussion with Q&A, for example, about projects, vehicle development, working in industry, women in R&D, career paths and choices, and the automotive business.

■ WA06

C-Room 608

Empirical Research in Retail Operations

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Vishal Gaur, Cornell University, vg77@cornell.edu

1 - Operations Decisions and the Value of the Firm: Perpetuities in a World Without Bankrupcy Cost

Santiago Kraiselburd, Executive Director/Professor, Zaragoza Logistics Center/Instituto de Empresa, Avda Gomez Laguna 25, 1ra planta, Zaragoza, ZA, 50009, Spain, skraiselburd@zlc.edu.es, Alejandro Serrano

Authors within the world of Operations Management have usually focused their efforts on minimizing operational costs or maximizing profits from operations. On the other hand, researchers within the financial world have developed methods to calculate the value of firms. In this paper, we unite both perspectives. Specifically, this paper answers the question of what is the order quantity that maximizes the value of a company for shareholders when the cost of capital is not exogenous to operations.

2 - A Replenishment Policy for Perishable Products Based on Estimated Aging and Retrieval

Karel van Donselaar, TU Eindhoven, P.O. Box 513 Pav E03, Eindhoven, NB, 5600 MB, Netherlands, K.H.v.Donselaar@tue.nl, Rob Broekmeulen

Due to new information technologies like RFID, it now becomes economically feasible to register the age of the inventory in the system. We suggest a replenishment policy for perishable products which takes into account the age of inventories and which requires only very simple calculations. It will be shown that in a real-life retail environment, this new policy leads to substantial cost reductions compared with a base policy that does not take into account the age of inventories.

3 - A Method to Detect Out of Stock Incidences from POS Data

Daniel Corsten, Professor of Operations & Technology Management, IE Business School, Mara de Molina, 11, 28006 Madrid, daniel.corsten@ie.edu, Andreas Ruckstuhl, Christoph Heitz

Despite increased interest no reliable measurement has yet been developed to estimate lost sales from POS data. In this paper we describe the demand process as a Poisson process, removing non-stationarity by a novel time transformation method. Statistical analysis of the transformed inter-arrival times allows detection of out-of-stock periods. We apply this method to a new POS dataset which is complemented with manually measured data on OOS incidents and compare the results.

4 - An Empirical Study of Ordering Behavior of Retail Stores

Vishal Gaur, vg77@cornell.edu, Karel van Donselaar, Rob Broekmeulen, Tom van Woensel, Jan Fransoo

We study whether store managers in a supermarket chain deviate from orders generated by an automated replenishment system. Using orders, item characteristics, and POS data for 19,417 skus over 5 stores, we show that store managers systematically advance orders from peak days to preceding non-peak days, resulting in higher inventory but a more balanced handling workload. This behavior is consistent with their incentives, addresses system shortcomings, and predictably varies across items.

■ WA07

C-Room 609

Inventory Problems with Dual Supply Sources/Modes

Cluster: Inventory
Invited Session

Chair: Ganesh Janakiraman, Assistant Professor, Stern School of Business, NYU, 44 West Fourth St., Room 8-71, New York, NY, 10012, United States, gjanakir@stern.nyu.edu

1 - Optimal Policies for an Unreliable Serial System with Dual External Sourcing

Amar Sapra, University of Florida, Industrial and System Eng. Department, Weil Hall, Gainesville, FL, 32611, United States, sapra@ise.ufl.edu

We consider a two-stage serial system in which the supply to the the upstream stage from the external supplier is prone to disruptions. As a result, the upstream stage is unable to ship to the downstream stage. The downstream stage continues functioning by ordering directly from an emergency supplier. We show that the optimal policy takes a simple form only when all the lead-times are equal.

2 - Responding to Shipment Delays

Aditya Jain, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, AP, 500032, India, Aditya_Jain@isb.edu

For an inventory system with random delays in shipments, we analyze various response strategies to mitigate the risk that differ in operational flexibility and lead-time visibility. Effects of operational flexibility and lead-time visibility are studied on the optimal ordering policies and costs. While the former mitigates the adverse effect of long lead-times, the latter provides protection from the risk of lead-time uncertainty. Further, we show that these two components are complementary.

3 - Asymptotic Optimality of Order-up-to Policies in Lost Sales Inventory Systems

Ganesh Janakiraman, Assistant Professor, Stern School of Business, NYU, 44 West Fourth St., Room 8-71, New York, NY, 10012, United States, gjanakir@stern.nyu.edu, Paat Rusmevichientong, John Muckstadt, Woonghee Tim Huh

We study a single-location inventory system under periodic review, where excess demand is lost. The lead time is positive. For a large class of demand distributions, we show that when the lost sales penalty becomes large compared to the holding cost, the relative difference between the cost of the optimal policy and the best order-up-to policy converges to zero.

4 - Stochastic Inventory Control with Multiple Sources
Anshul Sheopuri, asheopur@stern.nyu.edu, Ganesh Janakiraman, Sridhar Seshadri

We study a backordering inventory system under periodic review in the presence of two suppliers with different lead times and per-unit purchase costs. For this system, it is well known that a base-stock policy is not optimal (in general). We suggest several heuristic policies for this system. Our work builds on connections that we establish between the system with two suppliers and the Lost Sales inventory control system.

■ WA08

C-Room 611

Capacity and Inventory

Contributed Session

Chair: Jo Min, Iowa State University, IMSE Department, 2019 Black, Ames, IA, 50011, United States, jomin@iastate.edu

1 - Purchasing Decisions for Multi-item Multi-supplier Systems with Finite Capacity
Ue-Pyng Wen, Professor, Dept.. of IEEM, National Tsing Hua Univeristy, 101, Kuang Fu Road, Sec. 2, Hsinchu, 300, Taiwan - ROC, upwen@ie.nthu.edu.tw, Ching-Ya Chou

In this paper, we consider the multi-item, multi-supplier, finite capacity and price discount condition, and propose a unified model for both supplier selection and quantity to be ordered. The two-stage method is presented and compared with the software package, LINGO, to verify that it is an effective tool for solving these purchasing decisions. In addition, we employ the two-stage method to test the fixed cycle approach and the independent cycle approach in the proposed model, respectively.

2 - Demand versus Capacity Driven Replenishments
Rob Broekmeulen, TU Eindhoven, P.O. Box 513, Pav.E10, Eindhoven, 5600 MB, Netherlands, r.a.c.m.broekmeulen@tm.tue.nl, Gudrun Kiesmuller

We present a coordinated replenishment policy for a stochastic multi-item inventory problem at a retailer that exploits the cost structure for the handling at the warehouse by enlarging the quantities of the order lines of the original, uncoordinated order and by adding order-lines for products that are already on the original order picking route. The decision on how to enlarge the order quantities is based on a myopic approach. We show the effectiveness of our approach with a simulation study.

3 - A Production Control Model Under Environmental Uncertainties
Esmail Mohebbi, University of West Florida, 11000 University Parkway, Pensacola FL 32514, United States, emohebbi@uwf.edu

We present a stochastic production control model which takes into account the impacts of environmental uncertainties on production and demand processes. The model characterizes the probabilistic behavior of on-hand inventory under the assumption that shortages are lost. Some numerical results are provided.

4 - An International Student Team Project on Global Supply Chains
Jo Min, Iowa State University, IMSE Department, 2019 Black, Ames, IA, 50011, United States, jomin@iastate.edu

We present the teaching and learning experience for a large scale student team project on global supply chains that is based on the teamwork of domestic students as well as international students at foreign universities. The enabling technology is an Internet-based platform for collaboration and communication. Specifically, we will show how the student teams are organized and managed. We will also discuss the learning outcomes regarding team dynamics and leadership.

■ WA09

C-Room 612

Homeland Security

Contributed Session

Chair: Jing Shi, Assistant Professor, North Dakota State University, 1410 14th Av N, Fargo, ND, 58105, United States, jing.shi@ndsu.edu

1 - Cognitive and Emotional Representations of Terror Attacks: A Cross-cultural Exploration
Gulbanu Guvenc, PhD Candidate, Bilkent University, Ankara, Turkey, gulbanui@bilkent.edu.tr

The present cross-cultural research between Turkey and Israel aims to explore individuals' cognitive and emotional representations of terror attacks. A questionnaire measuring risk perception of terror attacks was developed and tested in both countries. Our findings show that risk perception of terror attacks is inherently subjective and represents a blending of science and judgment with psychological, social and cultural factors.

2 - Intelligent Decision Support System for Multi Agent, Large Scale, Effective Crisis Management
Vangelis Katsaros, Research Associate, University of Thessaly, Pedion Areos 1, Volos, 38334, Greece, ekatsaro@uth.gr

Crisis management means mutual aid situation where public safety organizations do not act effectively. Mutual aid is done in vivo by multiple groups without plans or anyone in charge. A Decision Support System with certain intelligent characteristics can become an enabler for the new form of security network emerging. A combination of advanced tools with commercially diffused proven technologies can increase society's resilience and capabilities to successfully manage security crisis.

3 - Smallpox Attack Rate and Incubation Period from Historical Data
Lisa Patvivatsiri, Production Modeling Corporation, 15726 Michigan Avenue, Dearborn, MI, 48126, lpatviv@pmcorp.com, Milton Smith

The smallpox incubation period distribution and attack rate are modeled using historical data over the last 60 years when the disease was active in nature. Several statistical approaches are used and result in selection of a normal distribution to model the incubation period. The attack rate is modeled using a nonlinear regression model. Incubation period and attack rate are necessary elements for modeling the spread and control of the disease.

4 - Locating the Agents with Consideration of Homogenous Workload
Zeynep ERKIN, PhD Student, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, zee2@pitt.edu, Larry Shuman, Bopaya Bidanda, Shengnan Wu

We study the problem of locating predetermined number of agents to give a timely response in case of a disaster. The objective is to minimize the weighted response time. We also consider a homogeneous workload asmong the agents.

5 - A Framework for Food Defense System Based on RFID/Sensor/Wireless Communication Technologies
Jing Shi, Assistant Professor, North Dakota State University, 1410 14th Av N, Fargo, ND, 58105, United States, jing.shi@ndsu.edu, Xiuli Qu, Junyi Zhou, Gong Li

To addresses the national need, we developed a framework for food defense system, by incorporating RFID/GPS/sensor network with wireless communication. The prototype system can continuously monitor environmental conditions that may vary due to a natural breakdown of machinery, but it can also provide food defense in the case of purposeful sabotage and intrusion. The system will provide tracking, monitoring, and localization capability, and hence the complete visibility for the cold chain.

■ WA10

C-Room 613

Inventory Management with Radio Frequency Identification

Cluster: Inventory

Invited Session

Chair: Diego Klabjan, University of Illinois at Urbana-Champaign, 205 North Mathews Avenue, Urbana, IL, 61801, United States, klabjan@uiuc.edu

1 - Optimal Policy for Expediting Under Stochastic Lead Time and Demand
Chiwon Kim, PhD Student, MIT, 77 Massachusetts Ave., Building 1-151, Cambridge, MA, 02139, United States, chiwon@mit.edu, David Simchi-Levi, Diego Klabjan

We study a single item periodic review inventory problem, where regular delivery lead time is stochastic. RFID is used to get information on the distribution of outstanding orders in the pipeline and the outstanding orders can be expedited instantaneously to the final stage according to demand situation that is also stochastic. We find the optimal expediting and regular ordering policy under a certain assumption on expediting cost structure.

2 - Optimal RFID Reader Placement in a Supply Chain Network
Thomas Vossen, Leeds School of Business, University of Colorado, Boulder, CO, 80309-0419, United States, vossen@colorado.edu, Diego Klabjan, Seokcheol Chang

We consider a supply chain network where different commodities are routed from their origins to their locations, but where items may be lost as they traverse various locations. The use of RFID can reduce these losses, and we provide models to determine where to position RFID readers to capture item location or loss. The resulting models capture the trade-offs imposed by the various recourse options that are available when items are lost.

3 - Inventory Control for a Distribution System with Real-time Visibility

Diego Klabjan, University of Illinois at Urbana-Champaign, 205 North Mathews Avenue, Urbana, IL, 61801, United States, klabjan@uiuc.edu, Jinxiang Pei

RFID enables suppliers to have complete visibility of their shipments. We assume that the underlying distribution system is serial and we study the related inventory control policies that exploit full shipment information such as the location.

■ WA11

C-Room 614

Flexible Manufacturing

Contributed Session

Chair: Dan Steffy, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, desteffy@gatech.edu

1 - Condition-based Robust Supervisory Control of Manufacturing Systems with Unreliable Resources

Song Chew, Assistant Professor, Southern Illinois University Edwardsville, Southern Illinois University Edwardsvill, Edwardsville, IL, 62026, United States, schew@siue.edu

In this paper, we aim to incorporate the resource operating health condition into the control of flexible manufacturing systems. A Markov model capturing the condition is developed. Based on this model, we will establish condition-based robust supervisory control policies for guaranteeing smooth and continuous operation in the systems. We expect our results to be significantly more flexible and practical than the existing results.

2 - A Branch and Bound Approach for Allocation Problem in Flexible Manufacturing Systems

Selin Bilgin, Middle East Technical University, Middle East Technical University, Industrial Engineering Department, Ankara, Turkey, selin@ie.metu.edu.tr, Meral Azizoölu

We consider capacity and tool allocation problem in flexible manufacturing systems. We assign the operations with their tools to parallel machines having time and tool magazine capacities so as to maximize the total weight. The tools are available at limited quantities and there is no operation splitting. We show that the problem is strongly NP-hard and develop a branch and bound algorithm. Our computations reveal that our algorithm solves moderate-sized instances in reasonable times.

3 - A Partial Ordering Enumeration Scheme for Solving the Minimization of Tool Switches Problem

Horacio Yanasse, Researcher PhD, INPE, Avenida dos Astronautas 1758 - INPE/LAC, S„o José dos Campos, SP, 12227010, Brazil, horacio@lac.inpe.br, Rita Rodrigues

In the minimization of tool switches problem we seek to determine a sequence to process a set of jobs so that the number of tool switches required is minimized. In this work we propose an enumeration scheme based on partial ordered sequences of jobs. An optimal sequence is obtained expanding the most promising partial sequences. Computational test results are presented.

4 - Applications of Advanced Manufacturing Technologies Within Turkish Education and Industry

Nermin Cicek, Graduate Student, Kirikkale university, Kirikkale Universitesi, Muhendislik, Fakultesi,Yahsihan, Kirikkale, 71451, Turkey, nermin025@yahoo.com, Suleyman Ersoz, Mustafa Yuzukirmizi

Advanced manufacturing technologies (AMT) are different from traditional ones in terms of process, equipment and methodology. New technologies, are faster, more integrated and more flexible. In this study, applications of AMT's in Turkish education institutes and industries are investigated. In this context, the flexible manufacturing systems (FMS) laboratories at Kirikkale University and other universities are examined. In addition, a survey of FMS in Turkish industry is presented.

5 - Robust Manufacturing Decision Making

Dan Steffy, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive, Atlanta, GA, 30332-0205, United States, desteffy@gatech.edu, Lynn Truss, Aditya Karnik

When planning automotive production across multiple factories some decisions must be made before the exact demands are known. We present a model to make some of these flexibility decisions with uncertain demands using stochastic programming for a short term multi-period production model.

■ WA12

C-Room 615

Scheduling II

Contributed Session

Chair: Melih Ozlen, Hacettepe University, Department of Industrial Engineering, Beykent, Ankara, 06800, Turkey, mozlen@hacettepe.edu.tr

1 - Batch-size Based Line Segmentation

Manuel Nunez, Associate Professor, University of Connecticut, School of Business, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States, mnunez@business.uconn.edu, Jose Cruz

We study the allocation of machines in a job shop environment to groups of jobs so as to obtain a collection of separate lines minimizing overall production cycle time. Jobs are often grouped according to similarities, but we group jobs according to batch size to exploit different technologies and machine types. We formulate a model to find an optimal group partition of jobs and assignment of machines to groups, and present a heuristic to find approximate solutions.

2 - LP Based Approximation Algorithm for the Minimum Makespan Job Shop Problem

Tal Raviv, Lecturer, Tel Aviv University, Ramat Aviv, Tel Aviv, 69978, Israel, talraviv@eng.tau.ac.il, Michael Masin

We present a pseudo polynomial approximation algorithm for a high multiplicity job shop scheduling problem. Our algorithm rounds the solution of an LP relaxation of the problem. The makespan we obtained is within a constant from the optimum and its guarantied optimality gap is smaller than the ones of previously known methods. Numerical study shows that it delivers better solutions than previously best known solutions of OR-Lib benchmark instances with moderate multiplicity.

3 - Multiple-lot, 2-Machine, Flow Shop Lot Streaming Problem to Minimize Makespan and Handling Costs

Liming Yao, PhD Student, Virginia Tech, 307 Apartment Heights Dr, Apt M3, Blacksburg, United States, lyao@vt.edu, Subhash C. Sarin

In this paper, we address a multiple-lot, 2-machine, flow shop lot streaming problem. Given an order in which to process the lots, our objective is to minimize a joint function of the makespan and sublot handling costs by varying the number of sublots and sublot sizes. We also address a more general problem of simultaneously determining an optimal number of sublots, sublot sizes and the sequence in which to process the lots for the above objective function.

4 - Time-Constrained Project Scheduling

Marco Schutten, Assistant Professor, University of Twente, P.O. Box 217, Enschede, Ov, 7500AE, Netherlands, j.m.j.schutten@utwente.nl, Johann Hurink, J.J. Paulus, T.A. Guldemond

We propose a new approach for scheduling with strict deadlines and apply this approach to the Time-Constrained Project Scheduling Problem (TCPSP). The key of the approach is to construct partial schedules in which jobs may be scheduled for a shorter duration than required. The second stage uses an ILP formulation of the problem to turn a partial schedule into a feasible schedule, and to perform a neighborhood search.

5 - Parallel Machine Scheduling with Planned Downtimes to Minimize Total Flow Time with Preemption

Melih Ozlen, Hacettepe University, Department of Industrial Engineering, Beykent, Ankara, 06800, Turkey, mozlen@hacettepe.edu.tr, Scott Webster

This study considers the flow time minimization problem on identical parallel machines, where the machines are subject to planned downtimes. Preemption is allowed without loss of machine time or incurring additional costs. We identify optimality properties, develop upper and lower bounding procedures, and present a branch and bound (B&B) methodology based on the proposed properties, and bounds. The computational efficiency is tested on problems with up to 30 jobs and 4 machines.

■ WA13

C-Room 616

Recent Advances in Integer Programming

Sponsor: Optimization/ Integer Programming

Sponsored Session

Chair: Anureet Saxena, Tepper School of Business, CMU, 5624 Fifth Ave, Appt C13, Pittsburgh, PA, 15232, United States, anureets@andrew.cmu.edu

1 - Recent Progress in Disjunctive Programming
Anureet Saxena, Tepper School of Business, CMU, 5624 Fifth Ave, Appt C13, Pittsburgh, PA, 15232, United States, anureets@andrew.cmu.edu, Egon Balas

Given a polyhedron P, a disjunction D whose terms are systems of linear inequalities, and a point x in P, we address the problem of finding an inequality that separates x from the convex hull of the intersection of P and D . We state this separation problem as minimizing a convex piecewise linear function of the multipliers associated with the inequalities of D, and give an iterative row generation procedure for solving it.

2 - Generalized MIR Cuts
Santanu Dey, Purdue University, 105 East Oak Street, West Lafayette, IN, United States, sdey@purdue.edu, Jean-Philippe Richard

In this talk, we present a generalization of the MIR procedure so as to generate cutting planes using multiple rows of a simplex tableau. To this end, we study an extension of the simple MIR set with three unstructured constraints that contains two integer and one continuous variable. Using the facet-defining inequalities of this constraints set, a technique is presented to generate valid cutting planes that consider three rows of a simplex tableau simultaneously.

3 - Branch-and-cut for Piecewise Linear Optimization
Ismael Regis de Farias JR., State University of New York, Dept.. of Ind. and Syst. Eng., 403 Bell Hall, Buffalo, NY, 14260, United States, defarias@buffalo.edu, Ming Zhao

We present new inequalities that define facets of the continuous separable piecewise linear polytope. We also present computational results that demonstrate the effectiveness of the inequalities.

■ WA14

C-Room 617

Nonlinear Programming II

Contributed Session

Chair: Zaiwen Wen, Department of IEOR, Columbia University, New York, NY, 10027, United States, zw2109@columbia.edu

1 - Improving Nonlinear Solutions by Using AIMMS' Presolve and Multi-start Algorithms
Marcel Hunting, Paragon Decision Technology, Julianastraat 30, 2012 ES, Haarlem, Netherlands, Marcel.Hunting@paragon.nl

We have implemented a presolve algorithm for nonlinear programming problems in AIMMS that uses techniques like bound tightening and inversion of non-linear expressions. This presolve algorithm can be combined with a new multi-start algorithm that we implemented in AIMMS. This multi-start algorithm is written as a user-customizable procedure within the GMP library, allowing modelers to adapt the algorithm to their own needs.

2 - Solving Multiobjective Programs Using Scalarization and Cone Programming
Alexander Engau, Postdoctoral Researcher, University of Waterloo, Management Sciences, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, aengau@uwaterloo.ca

Scalarization approaches to solving multiobjective programs for Pareto optimal points are reviewed and modified for the generation of solutions that are nondominated with respect to convex cones. The corresponding single objective problems are formulated and characterized as nonlinear cone programs. Possible solution techniques for these new problem formulations are discussed.

3 - Primal-dual Augmented Lagrangian Methods for Nonlinear Optimization
Daniel Robinson, UC San Diego, 9500 Gilman Drive, # 0112, La Jolla, CA, 92093-0112, United States, drobinso@math.ucsd.edu, Philip Gill

We consider methods for large-scale nonlinear non-convex optimization. A class of primal-dual augmented Lagrangian active-set methods is proposed in which optimization occurs simultaneously with respect to both the primal and the dual variables. This class includes second-derivative sequential quadratic programming methods with guaranteed convergence.

4 - A Curve Search Method for the p-Harmonic Flow Into Spheres
Zaiwen Wen, Department of IEOR, Columbia University, New York, NY, 10027, United States, zw2109@columbia.edu, Donald Goldfarb, Wotao Yin

In this paper, we propose a new curve search method based on Vese-Osher's approach for minimizing p-Harmonic energies over spheres. We generate a curve on the sphere along a descending direction, and determine the next point by searching over the curve. We show that this curve search method with the Armijo-Wolfe condition achieves global convergence even though the problem is non-convex. Comprehensive computational examples are presented.

■ WA15

C-Room 618

Stochastic Programming I

Cluster: Stochastic Optimization/Large Scale Optimization

Invited Session

Chair: Gautam Mitra, Distinguished Professor and Director, CARISMA-Brunel University/ Optirisk Systems, John Crank Building, Uxbridge, UB8 3PH, United Kingdom, gautam.mitra@brunel.ac.uk

1 - Mathematical Programming Models for Asset Liability Management (ALM)
Katharina Schwaiger, Doctoral Candidate, CARISMA, Brunel University, John Crank Building, Uxbridge UB8 3PH, United Kingdom, Katharina.Schwaiger@brunel.ac.uk, Cormac Lucas, Gautam Mitra

We present an ALM model for pension funds focusing on matching and outperforming liabilities. We look at two approaches: a deterministic linear programming model which is then extended to a stochastic programming (SP) model. For the SP model, we generate scenarios which take into account the uncertainties in interest rate and RPI which affect both assets and liabilities. Furthermore, we introduce chance constraints and integrated chance constraints to directly manage risk and incorporate risk aversion. We contrast all approaches and analyze the corresponding mismatches.

2 - Life-cycle Asset Allocation Using Stochastic Linear Programming
Alexander Weissensteiner, University of Innsbruck, Dept. of Banking and Finance, Universitaetsstr. 15, 6020 Innsbruck, Austria, alex.weissensteiner@uibk.ac.at, Alois Geyer, Michael Hanke

We consider optimal consumption and (strategic) asset allocation of an investor with uncertain lifetime in the context of time-varying investment opportunities. The objective is to maximize the expected utility of consumption over the lifetime and of bequest at the time of death of the investor. To solve this problem we use a multi-stage stochastic linear programming (SLP) model. In our numerical examples we first show that available closed-form solutions can be accurately replicated with the SLP-based approach. Second, we add elements to the problem specification which are usually beyond the scope of closed-form solutions.

3 - Handling Second Order Stochastic Dominance through Cutting Plane Representations of CVaR
Diana Roman, Research Assistant, CARISMA/Brunel University/Optirisk, Uxbridge, Uxbridge, UB8 3PH, United Kingdom, diana.roman@brunel.ac.uk, Csaba Fabian, Gautam Mitra

We consider the problem of constructing a portfolio, which is non-dominated with respect to second order stochastic dominance and thus optimal for risk-averse investors. In addition, this portfolio has a return distribution close to a user-specified, target distribution. Thus, this return distribution can be shaped and crafted to a desirable form, to the extent that is achievable. The model is formulated as a multi-objective conditional-value-at-risk minimization problem and represented as a LP of large size. Further on, a cutting plane representation of CVaR is used. This approach dramatically increases the execution speed and makes the model solvable even for very large number of scenarios. The performance of the model on real data drawn from the FTSE 100 index is investigated.

4 - Capacity Booking in a Transportation Network with Stochastic Demand and a Secondary Market for Transportation Capacity
Asgeir Tomasgard, Dr, NTNU, Gloeshaugen, Trondheim, NA, 7491, Norway, asgeir.tomasgard@iot.ntnu.no

We present an equilibrium model for transport booking in a gas transportation network. The booking regime is similar to the regime implemented in the North-Sea. The model looks at the challenges faced by the network operator in regulating such a system. There are some privileged players in the network, with access to a primary market for transportation capacity. The demand for capacity is stochastic when the booking in the primary market is done. There is also an open secondary market for transportation capacity where all players participate including a competitive fringe. We consider different objective functions for the network operator, and the difference between setting fixed capacities and modeling the pressure constraints in a sub-sea pipeline-network. This is modelled as a Generalized Nash Equilibrium using a stochastic complementarity problem where each players optimization problem is a stochastic program.

■ WA16

C-Room 619

Nonconvex MINLP Theory & Algorithms

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Kevin Furman, ExxonMobil, 1545 Route 22 East, Annandale, NJ, 08801, United States, kevin.c.furman@exxonmobil.com

1 - Packing Circles and Polygons into Rectangles
Steffen Rebennack, PhD Student, University of Florida, Center of Applied Optimization, Gainesville, FL, 32611, United States, steffen@ufl.edu, Panos Pardalos, Josef Kallrath

We propose a packing of circles and polygons into an area minimizing rectangular plate. A new method for modeling the non-overlapping constraints is discussed. To consider the optimal assignment of some objects to a set of rectangular plates, we propose a decomposition algorithm which can be generalized to a special class of non-convex MINLP problem. If the assignment decisions are decoupled from the remaining constraints of the optimization problem, we propose a column enumeration approach.

2 - Global Optimization of MAINLP Problems Containing Signomial Functions
Tapio Westerlund, Professor, Abo Akademi University, Biskopsgatan 8, Turku, FIN-20500, Finland, tapio.westerlund@abo.fi

The techniques discussed are based on exact power transformations and the use of approximate inverse transformations, modeled by piecewise linear functions. By the transformations the non-convex MINLP problem can be transformed to convex form with a feasible region overestimating that of the original one. The optimal solution of the original problem is obtained by solving a sequence of convex sub-problems, in which new grid points in the PL functions are added in the subsequent problems.

3 - A Reformulation-based Branch-and-bound for Non-convex Mixed-integer Nonlinear Programming
Pietro Belotti, Tepper S. of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, United States, belotti@andrew.cmu.edu, Françeois Margot, Pierre Bonami, Lorenz Biegler, Andreas Waechter, Jon Lee, Ignacio Grossmann

We describe a spatial Branch-and-Bound for non-convex MINLP. At the core of the algorithm is a reformulation approach inspired by the work of Sherali and Adams. Bound tightening and special branch rules are applied to improve the lower bound, while an upper bound is sought with an NLP solver. The procedure is implemented as a specialized cut generator for the Bonmin MINLP solver, in the COIN-OR framework (www.coin-or.org). We present some preliminary results on real-world MINLP instances.

4 - Global Equilibrium Search Applied to the Unconstrained Binary Quadratic Optimization Problem
Shylo Oleg, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, shylo@ufl.edu, Panos Pardalos, Oleg Prokopyev, Volodymyr Shylo

We describe heuristic approaches for solving the unconstrained binary quadratic optimization problem based on a global equilibrium search (GES) framework. We investigate performance of the proposed approaches and compare them with the best available solver on well-known benchmarks instances. The reported computational results indicate a high efficiency of the developed algorithm.

■ WA17

C-Room 620

Information Systems and Healthcare Practice

Sponsor: Information Systems Society
Sponsored Session

Chair: Roopa Raman, Emory University, 1300 Clifton Road, Atlanta, GA, United States, roopa_raman@bus.emory.edu

1 - Isolating the Effects of Health IT on Performance: Empirical Test of Complementarities and Learning
Ritu Agarwal, University of Maryland, ragarwal@rhsmith.umd.edu, Corey Angst

We examine HIT adoption and process-level value, incorporating the effects of learning that occurs through complementarities. We use a dataset of HIT adopted by almost 400 nationally-representative hospitals in the US, matched with quality and financial performance data to examine a specialty IT application related to cardio care. Results show that when a temporal learning component is introduced into the model as a complementary effect, the IT-Performance link becomes stronger.

2 - Adaptability to Hospital Information Systems: The Missing Link in Healthcare Quality Improvement?
Roopa Raman, Emory University, 1300 Clifton Road, Atlanta, GA, United States, roopa_raman@bus.emory.edu

Quality improvement via clinical information systems requires the ability to adapt the day-to-day practice of clinical care with these technologies. In a multi-method study, conducted via socio-metric surveys and multiple-case studies in a large urban hospital, I seek to understand how hospital units can successfully adapt to technology-induced change. Two complementary frameworks, social networks and organizational routines, are used to provide a comprehensive understanding of the phenomenon.

3 - Differential Impacts of Information Technology on Managing Organizational Risk
Nirup Menon, Assistant Professor, University of Texas Dallas, menon@utdallas.edu, Rajiv Kohli, Asunur Cesar

We examined the effect of transactional, administrative, and clinical IT on organization risk. Organizational risk considered are the ability to take risk (length of stay of patients), the outsourced risk (malpractice insurance taken), and the realized risk (ratio of expected to actual mortality rate, and ratio of expected to actual complication rate). Using data from 47 hospitals from 1998 to 2001, we found that IT has differential impacts on organizational risk.

■ WA18

C-Room 201

Optimizing Your Optimizer

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Mary Fenelon, ILOG, Inc., 889 Alder Avenue, Incline Village, NV, 89451, United States, mfenelon@ilog.com

1 - Interactions between Modeling Systems and Advanced Solvers
Michael Bussieck, GAMS Development Corp., 1217 Potomac St NW, Washington, DC, 20007, United States, mbussieck@gams.com, Steven Dirkse, Alex Meeraus

Some years ago the classical interface between a modeling system and a MP solver consisted of passing on information about the constraint matrix and function and derivative evaluations for non-linear problems. With emerging new model types and advanced solver technology the need increased for exchanging more structural model information in the name space of the original model. In this paper we will discuss some recent additions to the GAMS system and their communication requirements.

2 - Using Decomposition to Solve Extremely Large Scale & Dense LP Models
Peter Nieuwesteeg, Senior AIMMS specialist, Paragon Decision Technology, 5400 Carillion Point, Kirkland, WA, 98033, United States, Peter.Nieuwesteeg@aimms.com

Based on a customer case, we show the power of AIMMS' Generated Mathematical Program library (GMP) to solve large scale and dense LP problems. The case requires solving large problems (>35 million non-zeroes) several times within a limited time frame, something standard LP solving techniques were unable to do. By using the GMP functionality, a customized decomposition approach has been build which takes advantage of problem structure. It now allows the customer to solve the problem on time.

3 - Achieving Optimal Solution Performance for Your Optimization Modeling Project
Bjarni Kristjansson, President, Maximal Software, Inc., 2111 Wilson Boulevard, Suite 700, Arlington, VA, 22201, United States, bjarni@maximalsoftware.com

When working with real world, large-scale models there are many factors that come into play how to gain the optimum speed. In addition to choosing the correct solver algorithms and tuning solver parameters, other factors include how the model is formulated for sparsity, what hardware (Intel, AMD, Unix, 64-bit) gives best results, and what type of datasources (text, binary, spreadsheet, databases, etc.) are used. In this presentation, we will report on our experiences and performance tests.

4 - Automatic Parameter Tuning for ILOG CPLEX
Mary Fenelon, ILOG, Inc., 889 Alder Avenue, Incline Village, NV, 89451, United States, mfenelon@ilog.com, Zonghao Gu

The default values of the many CPLEX parameters provide good performance over a wide variety of problems but there may be better values for a particular set of problems. CPLEX is now providing a tool which automatically tunes the parameter values for a set of problems. This presentation will cover some of the decisions made in the design of this feature and some typical results.

■ WA19

C-Room 203

Stochastic Control in Workforce Engineering

Cluster: Workforce Engineering
Invited Session

Chair: Nilay Argon, University of North Carolina, 205 Smith Building CB#3260, Chapel Hill, NC, United States, nilay@unc.edu

1 - Self-organizing Transportation Systems
Donald Eisenstein, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, don.eisenstein@ChicagoGSB.edu, Peter Francis, John Bartholdi

Transportation systems such as elevators suffer from what is commonly known as bunching, resulting in long and variable wait times. We explore a new, somewhat counter-intuitive, way to reduce bunching. Our approach is simple, yet very effective.

2 - Insensitivity of Effective Server Assignment Policies to Service Time Distributions
H. Eser Kirkizlar, Georgia Tech, H. Milton Stewart School of ISyE, Atlanta, GA, 30332, United States, ekirkizl@isye.gatech.edu, Sigrun Andradottir, Hayriye Ayhan

We consider a tandem line with infinite supply of jobs in front of the first station, infinite storage room after the last station, and finite buffers between the stations. We study heuristic and optimal server assignment policies when the service time distributions are not necessarily exponential and the servers are cross-trained to work at different stations.

3 - Dynamic Routing of Customers with General Delay Costs in a Multi-server Queuing System
Serhan Ziya, University of North Carolina, 213 Smith Building CB#3260, Chapel Hill, NC, United States, ziya@unc.edu, Li Ding, Kevin Glazebrook, Nilay Argon

We consider a network of parallel heterogeneous service stations each modeled as a single server queue. Each station serves its own dedicated customers as well as generic customers who are routed from a central controller. With the objective of minimizing the long-run average waiting costs, we develop two heuristic routing policies based on dynamic programming policy iteration and Lagrangian relaxation. A numerical study demonstrates the superior performance of the Lagrangian heuristic.

4 - Optimal Control of a Flexible Server in an Assembly System with Setups
Nilay Argon, University of North Carolina, 205 Smith Building CB#3260, Chapel Hill, NC, United States, nilay@unc.edu, Yi-Chun Tsai

We consider an assembly system with a single flexible server, multiple feeder stations, and an instantaneous assembly operation. For such a system, we are interested in the optimal control of the server with the objective of minimizing the long-run average holding and setup costs. We provide several sets of conditions under which we can characterize the optimal policy.

■ WA20

C-Room 204

Valuing Risk and Flexibility in New Product Development

Sponsor: Decision Analysis
Sponsored Session

Chair: Yael Grushka-Cockayne, London Business School, Regent's Park, London, UK, United Kingdom, ygrushka.phd2003@london.edu

1 - New Product Development: The Impact of Competition
Janne Kettunen, Researcher, Helsinki University of Technology, Systems Analysis Laboratory, P.O. Box 1100, Espoo, 02150, Finland, jkettunen@london.edu, Ahti Salo, Bert De Reyck, Zeger Degraeve, Yael Grushka-Cockayne

We examine how the intensity and the type of competition affect the value of managerial flexibility in new product development projects and the value of obtaining information as to the market requirements. Uncertainties in our model are product performance, which is influenced by the company's technological capabilities, and market requirements, which is driven by the competition. We draw managerial insights regarding the decisions to enhance development, abandon production, and launch product.

2 - Valuing Flexibility in Multi-generation New Product Development
Yael Grushka-Cockayne, London Business School, Regent's Park, London, UK, United Kingdom, ygrushka.phd2003@london.edu, Janne Kettunen, Bert De Reyck, Zeger Degraeve, Ahti Salo

We value managerial flexibility in a new product development program consisting of multiple product generations, accounting for uncertainties regarding product performance and market requirements, and incorporating cannibalization affects across product generations. We derive managerial insights regarding possible decisions the firm can make throughout the program, in the form of product line abandonment, development enhancement and flexible launching times of each product generation.

3 - Standard-setting Organizations and Innovation
Ping (Amy) Wu, Carlson School of Management, University of Minnesota, 321 Nineteenth Avenue South, Suite 3-365, Minneapolis, MN, 55455, United States, pwu1@csom.umn.edu

One task for standard-setting organizations (SSOs) is to increase innovation, because member firms can avoid redundant investments in standards-related technology and spend them in more innovative technology. Patent policies of SSOs, however, discourage members' incentive to innovate. Because they require members to disclose their technology patents related to the promoting standards. This paper empirically investigates the impacts of SSOs on both innovation quantity and innovation quality.

■ WA21

C-Room 205

DA Arcade III

Sponsor: Decision Analysis
Sponsored Session

Chair: Luis Dias, PhD, University. Coimbra, INESC Coimbra and Faculty of Economics, Rua Antero Quental 199, Coimbra, 3000-033, Portugal, lmcdias@fe.uc.pt

1 - Effect Size and Utility Theory
Bob Bordley, General Motors Operations Research, M/C 480-106-256, 30500 Mound Road, Warren, MI, 48090, United States, robert.bordley@gm.com

This paper shows that the utility of a decision is mathematically equivalent to a widely used measure for evaluating the effect of experimental treatments. This formal equivalence between these two measures suggests ways of diffusing utility theory into experimental fields in medicine, psychology and the social sciences.

2 - A MAUT-based DEA Approach: Evaluating Retail Stores Performance Considering Corporate Preferences
Luis Dias, PhD, University Coimbra, INESC Coimbra and Faculty of Economics, Rua Antero Quental 199, Coimbra, 3000-033, Portugal, lmcdias@fe.uc.pt, Pedro Almeida

Data Envelopment Analysis (DEA) has been widely used to assess the relative efficiency of homogeneous units such as schools, hospitals, bank branches, etc. We propose MAUT-based variants of Additive-DEA to incorporate preferences. As a pilot study, we evaluated stores from a retailing chain in Portugal. The top executives' preferences shaped the conversion of inputs and outputs into value scales, constrained the acceptable trade-offs, and constrained the benchmark targets that were defined.

3 - Getting the Right Mix of Experts
Jason Merrick, Virginia Commonwealth University, 1001 W Main Street (P.O. Box 843083), Richmond, VA, 23230, United States, jrmerric@vcu.edu

We propose a Bayesian approach to aggregating expert judgment that treats the experts' judgments as if they were drawn from Lindley's hierarchical mixture, but we treat the mixing distribution non-parametrically with a Dirichlet process. This makes our overall model a Dirichlet process mixture. One interesting feature of this approach is that the decision maker's posterior need not be a uni-modal distribution lying between the experts' assessed distribution, but can be multi-modal.

■ WA22

C-Room 206

Decision Analysis Applications I

Contributed Session

Chair: Ludmila Zheltova, Case Western Reserve University, 11119 Bellflower Road, Peter B. Lewis Building, Cleveland, OH, 44106, United States, ludmila.zheltova@case.edu

1 - Asset Selling Problem with an Uncertain Deadline, Quitting Offer and Search Skipping Option
Mong Shan Ee, Assistant Professor, The University of Nottingham Malaysia Campus, Jalan Broga, Selangor, Semenyih, 43500, Malaysia, Mong-Shan.EE@nottingham.edu.my

This paper presents a discrete time sequential stochastic asset selling problem with an infinite planning horizon where the process of selling the asset may reach a deadline at any point in time with a probability. This paper assumes that

a quitting offer is available at every point in time and search skipping is permitted. Thus, decisions must be made as to whether or not to accept the quitting offer, to accept an appearing buyer's offer, and to conduct a search for a buyer.

2 - Balancing Security versus Accessibility of Army Research Databases

Tim Elkins, Chair, Force Transformation, United States Military Academy, Department of Systems Engineering, West Point, NY, 10996-1779, United States, timothy.elkins@usma.edu

The Army maintains a number of research databases that are unclassified and available to the public. The intention was to allow the DoD as well as the non-DoD community to utilize this knowledge. However, as our adversaries have become more technically capable, there has been a growing concern over security of the information contained in these databases and its potential malicious use. A systems decision analysis approach is employed to ascertain the correct balance.

3 - Real Option Analysis in an Acquisition Transaction with Optimal Investment Timing

Yongma Moon, PhD Candidate, The Pennsylvania State University, 355 Leonhard Building, University Park, PA, 16802, United States, yongma@psu.edu, Tao Yao

Under uncertainty of the value of a project or company, an acquisition transaction is studied by applying a real option method in this paper. We provided a condition using the concepts of zone of possible agreement in negotiation that the project acquisition would be successfully contracted between two firms. And the probability corresponding to a success of an acquisition is provided in a closed form solution.

4 - Evaluating Real Options for Source Selection in Multi-stage Competitions Under Budget Uncertainty

Jeremy Eckhause, Research Fellow, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States, jeckhause@lmi.org, Danny Hughes

Employing a real options framework for determining source selection in government R&D programs, we formulate a stochastic dynamic program for obtaining optimal acquisition strategies when vendors may operate at multiple funding levels. We then extend the model for mitigating risk for a commonly occurring case – when acquisition decisions occur under future-year budget uncertainties.

5 - Structured Maintenance Policies in Case of Stochastic Repair

Ludmila Zheltova, Case Western Reserve University, 11119 Bellflower Road, Peter B. Lewis Building, Cleveland, OH, 44106, United States, ludmila.zheltova@case.edu

Our research focuses on discrete-time, Markovian deterioration system for which at each decision epoch three actions available: stochastic repair, no action, inspection. With variations in outcomes of stochastic repair actions and in information available about the deterioration state of the system after such a repair, we model the problem as a partially observed Markov decision process. We investigate the structure of optimal policy along interior sample paths for such a process.

■ WA23

C-Room 208

Risk Analysis III

Contributed Session

Chair: Laura Dinitz, Operations Research Analyst, US Geological Survey, 345 Middlefield Rd., MS 531, Menlo Park, CA, 94025, United States, ldinitz@usgs.gov

1 - Risk Estimation of Processing Acid Crude in a Distillation Unit Using Monte Carlo Simulation

Carlos Hernando Patino Villamizar, Reliability Engineer, Ecopetrol S.A., Complejo Industrial Barrancabermeja ATP, Cavipetrol II, Torre 2 ap. 104., Barrancabermeja, Santander, Colombia, carlos.patino@ecopetrol.com.co, Mario Castillo, Haydee Quiroga Becerra

Processing acid crude is associated with failures in Distillation Units produced by corrosion. The risk associated, defined as expected losses caused by failures, is estimated using a Monte Carlo Simulation Model. It estimates future crude's properties and corrosion rates using as inputs rates recovered from API 581, expert's elicitations and historical information. The result is the risk over the time which it is useful to identify needs of changes in plant design or in maintenance strategies.

2 - Portfolio Selection Under Downside Risk

Hariharan Kandasamy, Clemson University, O106 Martin Hall, Box 340975, Clemson, 29634, United States, harihak@clemson.edu, Michael Kostreva

Portfolio selection under downside risk is appropriate in practice. We handle portfolio selection with multiple risk measures simultaneously leading to a multi-objective approach. We also talk about multi-period portfolio selection under multiple risk measures.

3 - An Incident Management System Model – Decision Support Tool for Risk-Informed Regulatory Decision Making

Srikanth Mangalam, Team Leader, Public Safety Risk Management, Technical Standards and Safety Authority, 3300 Bloor Street West, Center Tower, 14th Floor, Toronto, ON, M8X 2X4, Canada, srikanth.mangalam@gmail.com, Lency Mulamootil

Maintaining objectivity in decision making in the areas of environment, health and safety poses significant challenges to regulatory agencies worldwide. Risk management has emerged as a viable framework that provides regulatory decision makers with the necessary tools and structures. This paper demonstrates the application of an incident management information system, as an effective decision support tool in the delivery of risk-informed public safety regulatory decisions.

4 - The Land Use Portfolio Model: A Geospatial Natural-hazards Risk-analysis Tool

Laura Dinitz, Operations Research Analyst, US Geological Survey, 345 Middlefield Rd., MS 531, Menlo Park, CA, 94025, United States, ldinitz@usgs.gov, Richard Bernknopf, Anne Wein

Existing geospatial natural-hazard loss-estimation tools estimate physical damages, replacement costs, and business interruption for specific hazard scenarios. Complementing these methods, the Land Use Portfolio Model (LUPM) is a geospatial scenario-based risk-analysis tool that incorporates hazard-event uncertainties. The LUPM offers an approach to estimate and compare expected returns and risks from investments in loss-reduction measures for hazard-preparedness decision-making.

■ WA24

C-Room 209

Software Demonstration

Cluster: Software Demonstrations
Invited Session

1 - XJ Technologies - AnyLogic - Multi-Approach Simulation Tool

Timofey Popkov, XJ Technologies, Office 410, 49 Nepokorennykh PR., St. Petersburg, 195220, Russia, tim@xjtek.com

AnyLogic is a simulation tool supporting process-centric (discrete event), system dynamics and agent-based modeling approaches. The flexibility of the modeling language enables the user to capture the complexity and heterogeneity of business, economy and social systems at any desirable level of details. AnyLogic set of primitives and library objects allows you to model manufacturing, logistics, business processes, human resources, and consumers' and patients' behavior in their natural interaction. AnyLogic object-oriented model design paradigm provides for modular and incremental construction of large models.

2 - DecisionWare Ltda. - Optex Mathematical Modeling System Design Implementation and Set up of Optimization Models

Camilo Valero, Managing Director, DecisionWare Ltd., Cra 7a n. 88-16 of 202, Bogotá, Colombia, camilo.valero@decisionware-ltd.com, Jesus Velasquez

Optex Mathematical Modeling System Design Implementation and Set up of Optimization Models Optex is a software tool for design and implementation of DSS systems. It provides visual interfaces based on MS-Windows, information systems integrated with optimization models, as well as model formulation with database and algebraic computer languages. Optex can generate models in GAMS, AMPL, MathProg and C ANSI. It can also link to libraries such as: CoinMP, GLPK, LPSOLVE, SYMPHONY, CPLEX and XPRESS. Finally, Optex provides automatic design and development of data models and visual interfaces.

■ WA25

C-Room 210

Reliability I

Contributed Session

Chair: Vikram Ganesan, Engineering Specialist, General Dynamics Land Systems, 38500 Mound Road, Sterling Heights, MI, 48310, United States, ganesanv@gdls.com

1 - Approximations for Heterogeneous Weighted J-Binomial Probability Distributions

Aysun Taseli, Northeastern University, Boston, MA, taseli.a@neu.edu, James Benneyan

The distribution of sums of heterogeneous weighted Bernoulli trials has important uses in quality control, healthcare, revenue management, and elsewhere. Real-world applications, however, can necessitate scores of computationally expensive convolutions to obtain exact solutions. We investigate several approximations, including discrete Fourier transformations, Monte Carlo routines, and a modified Gram-Charlier expansion using lower order cumulants, Hermite, and other polynomials.

2 - An Ant Colony Reliability Optimization Algorithm for Constrained RAP in Complex Systems

Manju Agarwal, Professor & Head, Department of Operational Research, University of Delhi, Delhi, Delhi, 110007, India, agarwal_manjulata@yahoo.com, Vikas Sharma

We use ACS coupled with a local optimizer to solve constrained RAP for a general complex reliability system with each subsystem consisting of identical components. The objective is to select the redundancy-levels to maximize system reliability meeting the given constraints on cost, weight etc. ACS-RAP algorithm has been tested on a suite of well-known problems and has been found to be competitive with the best-known existing methods in terms of both solution quality and computation.

3 - Servicing Strategies for Products Sold Under Iso-cost and Triangular Warranty Policies

Raja Jayaraman, Texas Tech University, Department of Industrial Engineering, P O 43061, Lubbock, TX, 79409, United States, r.jayaraman@ttu.edu, Timothy Matis

We study two special cases of two-dimensional warranty policies; Iso cost policy where the producer offers a set of different combinations of usage and age limits and the consumer has the option to choose based on their preference and triangular warranty policy characterized by three parameters can be considered as special case of commonly used rectangular warranty policy. We derive expressions for minimizing the total expected warranty costs and compare the effect of each policy.

4 - A Reliability and Robust Design Management Plan

Vikram Ganesan, Engineering Specialist, General Dynamics Land Systems, 38500 Mound Road, Sterling Heights, MI, 48310, United States, ganesanv@gdls.com, Charles M. Roe, Philip G. Morgan

This paper defines a Reliability and Robust Design Management Plan, spanning conducting market research and gathering customer requirements to ensuring reliable performance and continuous improvement. Sample tools and techniques, and synergies with other strategies such as Design for Six Sigma are identified. The overall intent is to present implementation roadmaps for quality and reliability that position an organization for significant growth and continuous improvement.

■ WA26

C-Room 211

Optimization in Data Mining

Sponsor: Data Mining (Sponsored)

Sponsored Session

Chair: Onur Seref, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, seref@ufl.edu

1 - Solving Order-Preserving Submatrix Problem via Integer Programming

Oleg Prokopyev, University of Pittsburgh, 1048 Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States, prokopyev@engr.pitt.edu, Andrew Trapp

For a given data matrix, discovering the largest submatrix obeying an unknown linear ordering is known to be strongly NP-hard. Although in recent years several good heuristic methods have been presented to find this Order Preserving Submatrix (OPSM), they lack the guarantee of optimality. We discuss application of the problem in data mining and present exact solution approaches based on linear mixed 0-1 programming formulation.

2 - 2-Club Clustering

Sergiy Butenko, Industrial and Systems Engineering, Texas A&M University, College Station, TX, butenko@tamu.edu, Oleksii Ursulenko

We consider the problem of partitioning an unweighted network into clusters of diameter at most 2, so called 2-clubs. This method of clustering is preferable in applications where the length of the shortest path between the nodes is the most relevant measure of similarity. We provide several heuristic approaches for this computationally intractable problem, and present numerical results.

3 - Clustering Multiple Instance Data

Erhun Kundakcioglu, University of Florida, 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States, erhun@ufl.edu, Onur Seref, Panos Pardalos

The multiple instance (MI) setting was introduced by Dietterich et al. for drug activity prediction and became a popular concept in supervised learning applications where incomplete information is available. We propose a novel MI setting for clustering, where a subset of data points are to be neglected during the regular clustering procedure. This approach is useful for biomedical applications where the aim is to discover the time of stimulus and detect the semantic features.

4 - Selective Generalized Eigenvalue Classification

Onur Seref, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, seref@ufl.edu, Mario R. Guarracino, Erhun Kundakcioglu, Panos Pardalos

In this study, we introduce the selective generalized eigenvalue classifier (SelGEC), which is a multiple instance extension of the generalized eigenvalue classifier. We provide alternative variations including kernelized formulations for nonlinear classification. We compare the performance and accuracy of SelGEC with selective support vector machine classifiers on simulated data and on a real life neuroscience problem, and also with other methods on multiple instance classification problems.

■ WA27

C-Room 212

Service Industry III

Contributed Session

Chair: Dennis Dietz, Qwest Communications, 1855 S. Flatiron Ct., Boulder, CO, 80301, United States, dennis.dietz@qwest.com

1 - A Risk/Cost Decision Model for Call Center Minimum Payment Management

Yikang Li, Staff Forecasting Analyst, Hewlett-Packard, 20555 SH 249, Houston, TX, 77345, United States, yikang.li@hp.com, Viroj Buraparate

Outsourcing service operations becomes increasingly important business issue for many US companies. One of the most important partner management tasks is the decision of min-payment. The decision is involved with the trade off between risk and min-payment budget. This paper proposes a multi-product/multi-period stochastic program which minimizes the risk of underestimating future demands subject to the budget constraint. A heuristic solution has been developed for business applications.

2 - Managing Changing Service Capacity Based on Agent Performance Data

Geoff Ryder, PhD Candidate, University of California - Santa Cruz, 4190 Sophia Way, San Jose, CA, 95134, United States, gryder@gmail.com, Kevin Ross

We analyze service agent performance data and model the role experience plays in service rates. Our goal is to advise management on the extent to which they should structure work assignment policies to maximize agent learning and minimize detrimental forgetting. The analysis is informed by the literature on cross-training and agent skill development as well as recent analytical models on the subject.

3 - A Practical Model for Call Center Scheduling

Dennis Dietz, Qwest Communications, 1855 S. Flatiron Ct., Boulder, CO, 80301, United States, dennis.dietz@qwest.com

A spreadsheet model enables efficient scheduling of repair service agents at Qwest Communications. Optimal distributions of agent start times and tour types are determined via linear programming and stored for several scenarios. A simple one-dimensional search algorithm generates the approximate optimal schedule for the specified scenario and number of agents.

■ WA28

C-Room 213

Operations Management II

Contributed Session

Chair: John Yi, Assistant Professor, San Jose State University, One Washington Sq., San Jose, CA, 95192, United States, john.yi@sjsu.edu

1 - Capacity Reservation for Time-sensitive Service Providers
Jeff Hong, Assistant Professor, Hong Kong University of Science and Technology, Department of IE and Logistics Mgmt., Clear Water Bay, Kowloon, Hong Kong - ROC, hongl@ust.hk, Xiaowei Xu

We study the problem in which a facility provider faces two service providers. We give conditions that capacity reservation for service providers is preferrable to the facility provider.

2 - A Capacity Trading and Evaluation Model for Short-term Capacity Shortage
Ai-Hsuan Chiang, Graduate Institute of Business Administration, National Taiwan University, No. 1, Sec. 4, Roosevelt Road, Taipei, 10617, Taiwan - ROC, d92741004@ntu.edu.tw, Yon Chou, Wun-Hwa Chen

This research is to address the pricing and trading problem of factory's capacity for semiconductor plants to solve short-term capacity shortage. Firstly, the module of factory schedule lets a planner make the capacity outsourcing decision. Secondly, the module of economic workload analysis is to identify the capacity requirements and evaluate the capacity. Thirdly, the optimal resource allocation will be gotten using auction procedure embedded in capacity trading platform.

3 - Controlling Smarter Employees via Operational Levers
Steve Yoo, Student, UCLA Anderson School, 110 Westwood Plaza, Gold Hall Suite B501, Los Angeles, CA, 90095, United States, onyoo@anderson.ucla.edu, Felipe Caro

We consider the setting of a vertically integrated retailer, where there exists an unalterable misaligned financial compensation contract that favors the information-superior store manager. We quantify the level of control each store managers has of his/her operations, and show how the retailer can leverage this control level to indirectly align the incentives. We present a simple non-financial operational mechanism, and investigate its effectiveness.

4 - VCG Auctions and Market Equilibria for Linear Models
Jose Prina, Assistant Professor, Pontificia Universidad Catolica de Chile, Department of Industrial and Systems Eng, Vicuna Mackenna 4860, Santiago, Chile, jprina@ing.puc.cl, Robin Roundy

We study the application of VCG auctions in a setting where a class of linear optimization models is appropriate, specifically, in markets where profit maximizing agents bid to be selected as providers of specific goods or services. The agents receive payments from an auctioneer. We also investigate the incorporation of reserve prices in this auction, and compare the allocation of revenue under this mechanism with the allocation produced by a pricing scheme that leads to market equilibria.

5 - A Knowledge-based Approach to Management of Sales Operations
John Yi, Assistant Professor, San Jose State University, One Washington Sq., San Jose, CA, 95192, United States, john.yi@sjsu.edu, Anand Anandalingam

Sales force is one of the most expensive marketing investments companies make to promote their products to potential consumers. Traditionally, sales representatives are given the call plan by the headquarters to follow in detailing their target consumers. We propose a knowledge-based approach that leverages consumer-level data, domain expertise, and operations research methodology to improve the effectiveness of the sales operations.

■ WA29

C-Room 214

Joint Session OS/ICS: Latest Developments in SDP Software

Cluster: Optimization /Computational Optimization and Software, INFORMS Computing Society

Invited Session

Chair: Makoto Yamashita, Kanagawa University, 3-27-1 Rokkakubashi Kanagawa-ku, Yokohama, Japan, Makoto.Yamashita@is.kanagawa-u.ac.jp

1 - CSDP: Open Source Software for Semidefinite Programming
Brian Borchers, New Mexico Institute of Mining and Technology, Department of Mathematics, 801 Leroy Place, Socorro, NM, 87801, United States, borchers@nmt.edu

CSDP is a software package for semidefinite programming that implements a primal-dual interior point method. The software is available as an open source project through COIN-OR. CSDP has been ported to many different operating systems and hardware architectures. This talk will highlight recent improvements to CSDP including parallelization on shared memory parallel architectures.

2 - New Features of SDPA (semidefinite programming algorithm)
Kazuhide Nakata, Tokyo Institute of Technology, 2-12-1 Oh-okayama Meguro-ku, Tokyo, Japan, knakata@me.titech.ac.jp, Mituhiro Fukuda, Kazuhiro Kobayashi, Masakazu Kojima, Makoto Yamashita, Katsuki Fujisawa, Maho Nakata

SDPA is a software of a primal-dual interior-point method for solving the semidefinite program and its dual. At present. we implement new version of SDPA in order to solve large scale problems with specific structure or obtain high accuracy solutions. In this talk, we report new features of it and show numerical results to evaluate its performance.

3 - Computational Time Estimation of SDP Solvers
Makoto Yamashita, Kanagawa University, 3-27-1 Rokkakubashi Kanagawa-ku, Yokohama, Japan, Makoto.Yamashita@is.kanagawa-u.ac.jp

When solving extremely large SemiDefinite Programs (SDPs), it is favorable to have some knowledge of computational time in advance. From some information of input SDP files and its result files of SDP solvers, we specify parameters to compute estimation time. We formulate the computational time estimation model into an SDP. By solving this SDP, we obtain acceptable estimations of SDPA (SemiDefinite Programming Algorithm) and SDPARA (its parallel version).

■ WA30

C-Room 2A

Quality Control and Improvement for Multistage Systems I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53711, United States, szhou@engr.wisc.edu

1 - A Data-mining Guided Heuristic Approach for Sensor Distribution in Multi-station Assembly Processes
Yuan Ren, Research Assistant, Industrial and Systems Engineering, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, renyuan@tamu.edu, Yu Ding

This paper presents a data mining guided evolutionary approach, which borrows strength from both data mining and evolutionary algorithm and compensates limitations of one another, and thus produces better solutions in less time. The proposed method is used to solve an optimal sensor distribution problem in multi-station assembly processes.

2 - Automatic Control in Multistage Assembly Based-on Stream of Variation Modeling
Jing Zhong, University of Michigan, Ann Arbor, 1782 IOE Building, 1205 Beal Ave., Ann Arbor, MI, 48109, United States, jzhong@umich.edu, Jian Liu, Jianjun (Jan) Shi

Applying automatic control to reduce dimensional variation in multistage assembly is complicated. This paper presents an automatic control strategy that achieves the best quality in final product rather than in current station, and shows that under this control scheme, the precision requirement of tooling and incoming part can be relaxed.

3 - Surrogate Modeling of Multistage Compliant Assembly Processes for Optimal Engineering Design
Jean-Philippe Loose, University of Wisconsin - Madison, 1513 University Ave, Madison, 53706, United States, jploose@wisc.edu, Shiyu Zhou

This paper presents a surrogate model for compliant assembly processes. The proposed modeling technique uses a limited number of samples from a computationally expensive model and approximates the relationship between the product quality and process design parameters, such as fixture layout, or joining schemes. Because of its analytical form and low computational cost, the surrogate model can be used for design optimization and analysis. A case study is used to illustrate the procedure.

4 - Local Recurrence Model for Performance Prediction in Multi-stage Manufacturing Systems

Satish Bukkapatnam, Associate Professor, Oklahoma State University, School of IE and Mgt., Stillwater, OK, 74078, United States, satish.t.bukkapatnam@okstate.edu, Hui Yang

Nonlinear stochastic dynamics of manufacturing systems leads to distinct recurrence behavior of system evolution. We present a local recurrence model for predicting throughputs in multistage manufacturing assembly lines. The model captures the nonstationarity as well as the nonlinearity of the dynamics, and yields around 35% performance improvement in the prediction of throughputs from a manufacturing system compared to any global predictor.

■ WA31

C-Room 2B

Statistical Process Control Methods for Autocorrelated Processes

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Marcus Perry, Assistant Professor, Florida International University, 10555 West Flagler Street EC 3172, Miami, FL, 33174, United States, perrym@fiu.edu

1 - On the Investigation of Economic Performance of the Partial Overlapping Batch-Means Control Charts

Yi-chun Chen, National Tsing Hua University, 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan - ROC, d937817@oz.nthu.edu.tw, Wheyming Song

Of the model-free SPC approaches for monitoring autocorrelated data, the unweighted batch-means control chart (UBM) is an effective one which groups the autocorrelated data into batch means, and then monitors the batch-means plotted on the control chart. In this research, we extend the idea of UBM to include the partial overlapping batch-means (PBM). We show empirically that the PBM performs as good as UBM for all cases studied and performs better than UBM for some cases.

2 - The Analogues and Changepoint Methods for Poisson Data

Wenny Chandra, Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States, wenny@psu.edu, Elisabeta Vergu, Harriet Nembhard

We consider Poisson-distributed Influenza-Like-Illness (ILI) data at national and regional levels, that have an unknown baseline, exhibit non-stationarity and high correlation. The (nonparametric) analogues and (parametric) changepoint methods are applied to this data and compared based on sensitivity and specificity. Implications on monitoring and decision-making in public health are discussed. Keywords: analogues, changepoint, influenza-like-illness

3 - Monitoring and Adjusting Industrial Processes Simultaneously in One Control Chart

Sin-Long Liu, National Tsing Hua University, 101, Section 2, Kuang-Fu Road, Hsinchu, Taiwan - ROC, d907806@oz.nthu.edu.tw, Wheyming Song

Statistical process control and engineering process control are widely used to monitor and adjust industrial processes. Assuming that EWMA scheme which is one kind of EPC is adopted and there are shifts and drifts in the processes, one problem from combination of SPC and EPC appears. Motivated by the problem that shifts can't be easily found due to the fact that EWMA scheme is adopted, we obtain some properties to both monitor and adjust processes simultaneously in one control chart.

4 - Identifying the Time of Step Change in the Mean of an ARMA(1,1) Process

Marcus Perry, Assistant Professor, Florida International University, 10555 West Flagler Street EC 3172, Miami, FL, 33174, United States, perrym@fiu.edu

In this talk, a maximum likelihood estimator for the time of step change in the mean of an ARMA(1,1) process is presented. We outline the development of the estimator under the general ARIMA framework, and provide illustrative examples to demonstrate the application of the proposed estimator. We also present results of a Monte Carlo simulation study used to evaluate the performance of the estimator following EWMAST control chart signals.

■ WA32

C-Room 302

Business Applications III

Contributed Session

Chair: Mohd Ali Rauf, CIIT, Lahore campus, Pakistan, ali_549189@yahoo.com

1 - Distribution Network Redesign for Glaxo Smith Kline

Tuba Pinar Yildirim, University of Pittsburgh, 1048 Benedum hall, Pittsburgh, 15232, United States, tyildirim@katz.pitt.edu, Lawrance Brown, Vikas Mittal, Jennifer Shang, Pandu Tadikamalla

In this study we report a marketing initiative aimed at reengineering GSK's distribution network with particular emphasis on determining the optimal number and locations of regional distribution centers, and allocating the demands of retailers' warehouses to the various distribution centers. Combining both group partitioning methods and a mixed-integer programming model, we develop a distribution network that minimizes the total distribution costs.

2 - Hybrid Approaches to Business Process Discovery and Improvement

Guido Dedene, Professor, K.U.Leuven ETEW DSIM, Naamsestraat 69, Leuven, Belgium, guido.dedene@econ.kuleuven.be, Chris Houck, Edward M. Peters

ICT has been used extensively to improve business processes in organizations. Understanding how to accomplish such improvements is not evident, as seen in many failures of both information systems as well as business process reengineering projects. A hybrid approach to discover and diagnose as-is processes is presented here, combining probabilistic finite state machines with clustering algorithms. Some of the patterns that are discovered give effective guidelines for process improvements.

3 - Performance Evaluation of Pakistani Mutual funds

Mohd Ali Rauf, CIIT, Lahore campus, Pakistan, ali_549189@yahoo.com

Extensive research has evaluated mutual fund performance in different financial markets which led to mixed results (Soderlind et al., 2000; Korkeamaki, 2004) however, limited work has been done to evaluate Pakistani mutual funds. The purpose of this study is to benefit small investors by pointing out the significant variables influencing the fund performance. An effort has been made to measure the fund performance by using Sharpe ratio with the help of time-series cross-sectional data and focusing on different fund attributes such as fund size, expenses, age, turnover, loads and liquidity. The quarterly sample data is collected for all the open-ended mutual funds listed on Mutual Fund Association of Pakistan (MUFAP), for the years 1999–2006. The results indicated that lagged return, liquidity and 12B-1 had significant impact on fund performance.

4 - Product Investment in Rent-to-own Industry

Soheil Sibdari, University of Massachusetts, Dartmouth, MA, 02747, ssibdari@umassd.edu, Michael Anderson

This study uses the queuing theory literature, and data from a random sample of rent-to-own customers, in order to calculate the optimal inventory investment of the firms performing in rent-to-own industry. The initial investment on the number of rental items is a critical decision that the firm should make in order to maximize expected profit. In rent-to own situation, the arrival process of new customers, the total number of times that an item will be rented, and the length of each customer keeps the time each item are all random variables.

■ WA33

C-Room 303

Challenges in Vehicular Ad Hoc Networks

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Satish Ukkusuri, Assistant Professor, Rensselaer Polytechnic Institute, 4032 JEC, Troy, NY, 12180, United States, ukkuss@rpi.edu

1 - Vehicular Ad Hoc Networks: Introduction to Research Problems

Satish Ukkusuri, Assistant Professor, Rensselaer Polytechnic Institute, 4032 JEC, Troy, NY, 12180, United States, ukkuss@rpi.edu, Lili Du

This talk will introduce some challenging research problems in the emerging area of vehicular ad hoc networks. Specifically, we will discuss the challenges in the following problems - connectivity, reachability and network throughput. We will discuss results from connectivity in detail both from an analytical and simulation model.

2 - Expected Interference and Concurrent Transmission in Vehicular Ad Hoc Networks
Shivkumar Kalyanaraman, Professor, shivkuma@ecse.rpi.edu, Lili Du, Satish Ukkusuri

This talk will address the issue of interference caused by concurrent transmissions in a vehicular ad hoc network. Specifically, we will discuss analytical expressions of expected interference due to vehicular mobility and driver behavior. In addition an integer programming model to determine concurrent transmissions will be discussed. Finally, the implications on network throughput and open research questions in this area will be highlighted.

3 - Modeling the Information Propagation in Transportation Networks
ManWo Ng, Graduate Research Assistant, University of Texas at Austin, ECJ Hall 6.2, 1 University Station C1761, Austin, TX, 78712, United States, mwng@mail.utexas.edu, Dung-Ying Lin, S. Travis Waller

Travel information provision to road users is crucial in routing problems. Traditionally, information is collected through sensors and communicated to users by infrastructures that typically require substantial investments. Here, we consider a more cost effective alternative: vehicle-to-vehicle (V2V) communication as a means of providing online travel time information. The first step is to understand how information spreads in a V2V system. To this end, we will present a simple model.

4 - High Vehicular Mobility Improves the Performance of Information Flow in Vehicle Ad Hoc Networks
Lili Du, RPI, dul@rpi.edu, Satish Ukkusuri

High vehicular mobility distinguishes Vehicular Ad Hoc Networks (VANET) from general mobile ad hoc networks. The analytical models in this research characterize the reachability of a defined Information Flow Network (IFN) while incorporating vehicular lane-changing behavior and relative speed. The closed form expressions for the expected node degree as well as the reachability in an IFN are provided. Simulation models are developed to validate the analytical results.

■ WA34

C-Room 304

Real-time Traffic Management and Operations

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Pei-Wei Lin, Assistant Professor, Univrsity of Missouri, Kansas City, 5100 Rockhill Rd, Kansas City, MO, 64110, United States, linp@umkc.edu

1 - Reliable Real-time Travel Time Prediction with Sparsely Distributed Detectors`
Nan Zou, Research Associate, University of Maryland, 9716 Luguna Road, Middle River, MD, 21220, United States, nanzou@umd.edu, Jianwei Wang, Gang-Len Chang

This study aims to develop a reliable and cost-effective travel time prediction system that needs only a small number of traffic detectors and does not rely on the concurrent measurement of travel times to perform accurate real-time travel time predictions under recurrent traffic conditions and some scenarios with missing data.

2 - A Stochastic Approach for Throughput Maximizing Advance Warning Sign Location
Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. 2nd St., Tucson, AZ, United States, chiu@email.arizona.edu, Liang Zhou

Advance warning signs are a common type of temporary traffic control device to alert motorists of upcoming roadway disturbances. This paper discusses the possibility to improve work zone throughput through a careful selection of location of the first warning sign. A stochastic model was developed to for this purpose. Calibrated using simulated data, the model has shown to be effective in determining the placement of the first warning sign under various work zone entry traffic volumes.

3 - Information-theoretic Sensor Location Model for Traffic Condition Monitoring Applications
Xuesong Zhou, Assistant Professor, University of Utah, 122 South Central Campus Dr., Salt Lake City, UT, 84112, United States, zhou@eng.utah.edu, Xing Tao, Peter Martin

An information-theoretic model is presented to characterize network-wide traffic monitoring systems that can utilize data from detectors, AVI readers and GPS probes. This talk will discuss the marginal value of probe data and how to locate traffic detectors and AVI readers so as to maximize the expected information gain.

4 - Real-time Incident Management and Operations - Performance and Benefits Evaluation in Kansas City
Pei-Wei Lin, Assistant Professor, Univrsity of Missouri, Kansas City, 5100 Rockhill Rd, Kansas City, MO, 64110, United States, linp@umkc.edu, Jason Sims

This study is presented to evaluate the performance and assess benefits of the Scout system-Motorist Assist in Kansas City metropolitan area. The evaluation study consists of two phases: Phase 1 focuses on the reliable assess of system performance including incident detection, response, clearance and duration; and Phase 2 is performed to develop the methodology and to estimate resulting system benefits from data available in the incident operations record.

■ WA35

C-Room 305

Development and Management of Transportation Infrastructure II

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Ivan Damnjanovic, Assistant Professor, Texas A&M University, TAMU 3136, College Station, TX, 77843, United States, idamnjanovic@civil.tamu.edu

1 - A Finite-mixture Modeling Approach to the Management of Transportation Infrastructure Systems
Pablo Durango-Cohen, Assistant Professor, Northwestern University, pdc@northwestern.edu

Maintenance optimization models rely on the specification of a perfect deterioration model. This can lead to inadequate characterizations due to population heterogeneity or epistemic uncertainty, and consequently to the implementation of inefficient policies. We propose a framework where deterioration is represented by a finite-mixture model. Policies are obtained by solving a partially-observable. Numerical examples illustrate the convergence and effectiveness of the approach.

2 - A Model for Optimal Maintenance Policies of Multi-component Transportation System with Demand Response
Pattharin Sarutipand, PhD Candidate, Northwestern University, p-sarutipand@northwestern.edu, Pablo Durango-Cohen

Optimal maintenance policies for a system of functionally interdependent components are considered. The problem is formulated as a constrained quadratic programming. The proposed model captures economic interdependencies that link the components that comprise these systems while accounting for the implications of explicitly considering the interrelationship between service level and demand of components.

3 - Optimal Sampling of Infrastructure Condition
Rabi Mishalani, Ohio State University, mishalani@osu.edu, Liying Gong

This study focuses on quantifying the spatial sampling uncertainty associated with inspecting infrastructure condition, and developing a methodology that includes sample size as a decision variable in inspection and maintenance decision-making where total life-cycle cost is minimized. A numerical analysis demonstrating the value of both aspects is also presented.

■ WA36

C-Room 306

Advances in Dynamic Traffic Assignment

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Thanasis Ziliaskopoulos, Professor, University of Thessaly, Pedion Areos, Volos, Vo, 38334, Greece, ziliasko@uth.gr

1 - Enhancement of a Simulation Based Dynamic-equilibrium Assignment Method
Michael Florian, INRO Consultants Inc, Montreal, Canada, mike@crt.umontreal.ca, Michael Mahut, Nicolas Tremblay

This paper reports on the evaluation of alternative dynamic-equilibrium assignment methods for use with a simulation based dynamic traffic assignment method. Since the realism of a traffic simulation model results in an assignment map which is discontinuous and difficult to characterize analytically, the solution methods are inspired from mathematical programming methods used for variational inequalities but are applied in a heuristic way. This paper evaluates variants of the solution algorithm inspired by gradient-based methods used in static equilibrium models These methods are applied in conjunction with a dynamic step-size adjustment technique The tests are executed on several congested urban networks of significant size (up to 6500 links) from North America and Europe compare the results of these methods with the popular MSA method.

2 - Gap-driven Algorithms for the Dynamic User Equilibrium Problem on Large Networks

Hani Mahmassani, Professor, The University of Maryland at College Park, Department of Civil & Environmental Engi, College Park, MD, 20742-3021, United States, masmah@umd.edu, Chung-Cheng Lu

Computational results on large networks are presented for alternative approaches to the MSA for simulation-based DTA models. The approach is driven by minimizing a gap function, and embeds (i) a simulation-based dynamic network loading model to capture traffic dynamics and determine experienced path travel costs for a given path flow pattern; and (ii) a path swapping-based descent direction method to solve the restricted NMP defined by a subset of feasible paths.

■ WA37

C-Room 307

Military Applications II

Contributed Session

Chair: Melanie Carlson, MAJ, USMA, 47 Winhaven Ct, Highland Falls, NY, 10928, United States, melanie.carlson@usma.edu

1 - Developing a Relational Theory of Intra-state Conflict Dynamics

Marcus Louie, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States, mlouie@andrew.cmu.edu, Kathleen Carley

Non-state actors in intra-state conflicts utilize alliances with others to improve their security and to enhance their ability to operate. Using a dynamic-network multi-agent model of intra-state conflict we investigate cultural similarity-based, resource-based, and interest-based logics of alliance formation and their effects on a conflict. This work is intended to develop theory on the conditions of alliances and their roles in intra-state conflicts.

2 - Agent Based Modeling & Simulation for Command and Control

Yoon Hong, Professor, Hansung University, 389, 3-ga Samsun-dong Sungbuk-gu, Seoul, 136-792, Korea, Republic of, yhong@hansung.ac.kr, Dong-joon Lee

This study considers both logic and methodology of the command and control procedure in modeling a combat situation. We also present an architecture of the intelligent agents which substitute for troop leading procedure and military decision making. A representative planning agent is selected for investigation and the related action agent is executed for simulation. The results are analyzed.

3 - Incorporating Scalable Dynamic Decision Networks with the Army's Future Combat Systems

Todd Retchless, Unites States Military Academy, D/Mathematics, USMA, West Point, NY, 10996, United States, todd.retchless@usma.edu, Gerald Kobylski, Dennis Buede, Daniel Maxwell

We will discuss our current work with Dynamic Decision Networks (DDNs) which are based on Bayesian Networks and Influence Diagrams. We will present a short background of DDNs and how our research is being incorporated with the Army's Future Combat Systems.

4 - Using Rough Sets to Address Uncertainty in Bayesian Networks

Henry Pfister, AFRL/MN, Bldg 13, Rm 341, Eglin AFB, FL, 32542, United States, henry.pfister@eglin.af.mil, Janusz Zalewski, David Hatfield

Reasoning with Bayesian belief networks (BBNs) in the traditional form requires extensive set of prior conditional probabilities for each network node, which is difficult to achieve if information on prior system behavior is uncertain. The authors address this problem by applying the concept of rough sets introduced by Pawlak, in 1982. Rough sets have less stringent requirements on prior probability distributions and may facilitate the process of updating the BBN over time using new knowledge.

5 - PEO Soldier Budget Value Analysis

Melanie Carlson, MAJ, USMA, 47 Winhaven Ct, Highland Falls, NY, 10928, United States, melanie.carlson@usma.edu

The Army's PEO Soldier seeks to influence budget decisions with a data driven strategy that focuses on capabilities delivered to the force. A model is being developed to quantitatively demonstrate the value of programmed funding for programs that provide protection from adverse environmental conditions and thus allow Soldiers to maintain cutting edge effectiveness in a high tech, high intensity operational environment.

■ WA38

C-Room 308

Marketing III

Contributed Session

Chair: Ahmet Ozkul, Assistant Professor of Management, State University of New York - Oneonta, Economics & Business Division, Netzer Building, Oneonta, NY, 13820, United States, ozkula@oneonta.edu

1 - A Decision Support System for Modeling Market Structure in Online Auctions

Stephen France, PhD Candidate, Rutgers, The State University of New Jersey, PhD in Management Program, 180 University Avenue, Newark, NJ, 07102, United States, sfrance@andromeda.rutgers.edu

We present a decision support system for modelling the market structure in online auction data. We use association mining to select groups of brand features and we develop a method for creating a distance matrix representing market structure between brands and brand features.

2 - The Duration of Recency, Short-term and Direct Advertising Effects on Sales

Hiroshi Kumakura, Associate Professor, Senshu University, 2-1-1, Higashi-mita, Tama-ku, Kawasaki, 214-8580, Japan, kumakura@isc.senshu-u.ac.jp

It has been considered that advertisement (ad) has long-term and indirect effects on sales. Recently its short-term and direct effects are noticed. Such ad effects (recency) work directly consumers' brand buying, because ad recalls consumers to a brand's name at their category buying, if that brand's ad has reached consumers immediately before their category buying. We measure the duration of recency, short-term and direct ad effects on sales, by using single-source panel data.

3 - Segmentation Analysis for the Brand / Price Strategy Using Finite Mixture Models

Katsuo Kuji, Researcher, Kuji Senses Inc., 7-5-1-203 Akasaka, Minato-ku, Tokyo, 107-0052, Japan, k.kuji @kujisenses.com, Koji Yamashita, Kakuro Amasaka, Yoshiyuki Okuse

Some consumers might take not only price but brand into consideration when they choose products. In our research, a finite mixture model based on stated preference data was estimated to identify the heterogeneity of market segments. Applying a stepwise latent class approach, we confirmed the heterogeneity among the segments specified by two factors: perceived brand values and price sensitivity. And this method will allow companies to calculate optimum prices for practical use.

4 - Innovativeness Measure and Forecasting Adoption Time of Innovation

Masataka Yamada, Professor, Kyoto Sangyo University, Motoyama, Kamigamo, Kita-ku, Kyoto, 603-8555, Japan, myamada@cc.kyoto-su.ac.jp

This is to analyze the structure of innovativeness and to estimate an adopterÅfs adoption time of an innovation. Adopting socially independent-interdependent personality test and category-specific six item innovativeness measure, we investigate the structure of innovativeness. Then, we estimate the adoption time using the personality score and the category-specific innovative score.

5 - The Impact of Co-promotion on the Supply Chain Performance in a Rolling Horizons Environment

Ahmet Ozkul, Assistant Professor of Management, State University of New York - Oneonta, Economics & Business Division, Netzer Building, Oneonta, NY, 13820, United States, ozkula@oneonta.edu, Hurrem Yilmaz

Co-promotions are employed by companies to match the demand and supply, and widely discussed in the marketing literature. However, supply chain implications of co-promotions have received relatively less attention. We propose a co-promotion model for matching products (functional and innovative), and supply chains (efficient and responsive) under a set of environmental factors. Using a rolling horizons methodology with forecasting errors, we test our hypotheses on products and supply chains.

■ WA39

C-Room 309

Contract Design in Pharmaceuticals

Sponsor: Health Applications Section
Sponsored Session

Chair: Bert De Reyck, Associate Professor, University College London, Gower Street, London, WC1E 6BT, United Kingdom, BDeReyck@london.edu

1 - Designing Contracts with Options for Pharmaceutical R&D Alliances

Nicos Savva, Research Associate, Cambridge University, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, n.savva@jbs.cam.ac.uk, Stefan Scholtes

Designing robust long-term contracts for R&D alliances is challenging. Changes in the marketplace, the political and regulatory environment, or the strategy of the partners threaten the viability of the partnership. Flexibility is important to cope with these uncertainties. In contracts, flexibility can be operationalised through options clauses. We will show how OR models can help value such options clauses and optimise contract design.

2 - Control Rights in R&D Licensing Contracts

Pascale Crama, Assistant Professor, Singapore Management University, Singapore, Singapore, pcrama@smu.edu.sg, Bert De Reyck, Zeger Degraeve

R&D projects are fraught with uncertainties, making it difficult to consider all scenarios in licensing contracts. Control rights allow the holder to react to new information. First, we study the value of signing a contract. Then we investigate the optimal allocation of control rights to maximize the licensor's value when using a contract with upfront and milestone payments and a royalty rate. We notice an interaction between the choice of contract terms and the allocation of control rights.

3 - Quantitative Models for Vaccine Procurement

Aykagan Ak, Georgia Institute of Technology, School of Industrial and Systems Enginee, 765 Ferst Drive, Atlanta, GA, 30332, United States, aykagan@gatech.edu, Clarence Wardell III, Ozlem Ergun, Jessica Heier, Pinar Keskinocak

A United Nations Agency serves as a bulk purchasing agent for vaccines and syringes for 37 countries in Latin American and the Caribbean. Its goal and subsequent challenge is to reduce costs while improving service. We examined its current forecasting and procurement process, explored the potential benefits of using bundle bids, and identified opportunities for reducing costs and improving service.

4 - Value Transference and Brand Management in Pharmaceuticals

Israel Zang, Professor, The Tel Aviv Yafo Academic College, 29 Melchet St., Tel Aviv, Israel, israelza@mta.ac.il, James Conley, Morton Kamien

While patent protection is time limited, a trademark is indefinite, and trademarking a drug creates value transferable to new drugs. We consider the question of whether an incumbent patented and trademarked drug producer, facing generic competition, and introducing an improved drug, will choose to leave the trademark with the old drug or to transfer it to its newer version. We characterize the equilibrium solutions, their effects, and whether a sandwich pricing strategy will be employed.

■ WA40

C-Room 310

Pandemic Flu, Childhood Vaccines, and Hospital Operations

Sponsor: Health Applications Section
Sponsored Session

Chair: Pinar Keskinocak, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States, pinar@isye.gatech.edu,

Co-Chair: Julie Swann, Georgia Tech, Industrial and Systems Engineering, Atlanta, GA, United States, julie.swann@isye.gatech.edu

1 - Evaluation of Targeted Influenza Vaccination Strategies via Population Modeling

John Glasser, Mathematical Epidemiologist, Centers for Disease Control and Prevention, 1600 Clifton Road, NE, Mail Stop A-34, Atlanta, GA, 30333, United States, jglasser@cdc.gov, Denis Taneri, Jen-Hsiang Chuang, Jianhong Wu, Peet Tüll, James Alexander, William Thompson

In realistic age-structured models, we compared vaccinating infants and adults aged 65+ years, the current strategy, with vaccinating schoolchildren, an oft suggested alternative. This alternative reduces mortality among the very young and old more than vaccinating them. Insofar as anti-viral medications also prevent infection or reduce the duration or magnitude of infectiousness, early treatment of ill schoolchildren would be most efficient, mitigating the evolution of resistance.

2 - Pandemic Flu Response

Ali Ekici, PhD Student, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States, aekici@isye.gatech.edu, Pinar Keskinocak, Julie Swann, Shaudi Hosseini, Randeep Ramamurthy

Given the instances of Asian flu over the past few years, experts think that a pandemic might happen in the near future. Epidemiologists have warned that one in every three people could be infected, many of them requiring hospitalization. We constructed a model to predict the number of people infected, using data for state of Georgia. We developed optimization models to design networks to distribute food to affected populations, and analyzed the number and location of facilities to be set up.

3 - Catch-up Scheduling for Childhood Immunization

Faramroze Engineer, Georgia Institute of Technology, United States, fenginee@isye.gatech.edu, Pinar Keskinocak, Larry Pickering

We develop an Integer Programming based tool for constructing catch-up schedules for childhood immunization. The schedules ensure that all remaining doses are administered, the spacing between doses of the same vaccine adhere to the minimum gaps, and the timing of the doses do not violate the minimum age limit. Our approach is unique not only in methodology but also in the information, strategy and advice offered to the user.

4 - Capacity Management in a Cardiac Surgery Line

Carter Price, AMSC Program, Department of Mathematics, University of Maryland, College Park, MD, 20742, United States, price@math.umd.edu, Bruce Golden, Michael Harrington, Edward Wasil, Timothy Babineau, Bartley Griffith

Capacity management is a key component to operating a hospital efficiently. In this presentation, we discuss the use of simulation and machine learning in managing the throughput of a cardiac surgery line at a major urban hospital. Our models were developed in close cooperation with surgeons, nurses, and hospital management. We present results from an actual data set and discuss implementation issues.

■ WA41

C-Room 3A

Joint Session B&SB/HAS: Computational Methods for Learning and Modeling Genome-Wide Biological Control Networks

Sponsor: INFORMS Computing Society/ Bioinformations & Systems Biology, Health Applications Section
Sponsored Session

Chair: Richard Bonneau, Ast. Professor, New York University / Courant Institute, 100 Washington Sq. E, New York, NY, 10003, United States, bonneau@nyu.edu

1 - Learning Gene Regulatory Modules Through Integrated Biclustering of Systems Biology Data

David Reiss, Sr. Scientist, Institute for Systems Biology, 1441 North 34th Street, Seattle, WA, 98103-8904, United States, dreiss@systemsbiology.org, Richard Bonneau, Vesteinn Thorsson, Nitin Baliga

Learning regulatory networks from expression data is an under-constrained problem that is aided by pre-identifying groups of putatively co-regulated genes (regulons). Recently, biclustering has been shown to be appropriate for this problem. Co-regulated genes are often functionally related and contain common DNA sequence motifs. I will describe cMonkey, an algorithm which identifies regulons by integrating biclustering of mRNA data with associations and the de novo detection of DNA motifs.

2 - The Inferelator: Data Driven Regulatory Network Inference

Richard Bonneau, Ast. Professor, New York University / Courant Institute, 100 Washington Sq. E, New York, NY, 10003, United States, bonneau@nyu.edu

I will continue our introduction to systems biology and focus on our method for network inference, which learns regulatory influences for genes and/or gene clusters from mRNA and protein expression levels. The procedure can simultaneously model equilibrium and time-course expression levels, such that both kinetic and equilibrium expression levels may be predicted by the resulting models. We discuss the results from an initial application of this method to the extremeophile, Halobacterium NRC-1.

3 - Inference of Gene Regulatory Networks in Mammalian Cells
Vesteinn Thorsson, Senior Research Scientist, Institute for Systems Biology, 1441 North 34th Street, Seattle, WA, 98103-8904, United States, thorsson@systemsbiology.org

Statistical methods for variable selection show promise in revealing the complex networks that underlie gene transcription in unicellular organisms (R. Bonneau, INFORMS 2007;D. Reiss, INFORMS 2007). The resulting gene regulatory network models indicate that systemic responses to environmental changes may be predictable. We discuss challenges in generalizing these methods to mammalian cells, and evaluate predictions for macrophages, which form an essential component of the innate immune system.

■ WA42

C-Room 3B

Health Systems Analytics

Contributed Session

Chair: Matthew Dean, University of Connecticut, 2100 Hillside Road, Unit 1041, Dept. of Operations & Info Management, Storrs, CT, 06269, United States, matthew.dean@business.uconn.edu

1 - Inpatient Bed Requirements from Emergency Department: A Forecasting and Financial Perspective
Shital Shah, Assistant Professor, Rush University Medical Center, 1700 W Van Buren St 126B, Chicago, IL, 60612, United States, Shital_C_Shah@rush.edu, Julio Silva, Edward Ward

Emergency Department provides services to non-scheduled patients, a fraction of which require hospitalization. Uncertain, on-demand inpatient bed requirements cause's delays. The project goal is to determine optimal inpatient bed requirements with financial analysis. Faster transfers and higher conversion of potential opportunity into additional revenue and increased patient satisfaction is expected.

2 - Developing Medical Assignments to Schedule Attention in a Maternal and Childish Hospital
Carlos Paternina-Arboleda, Chairman, Department of Industrial Engineering, Universidad del Norte, Km 5 Via a Puerto Colombia, Barranquilla, AT, Colombia, cpaterni@uninorte.edu.co, Johanna Amaya, Luis Ramìrez-Polo, Luceny Guzmán

Organizing health care systems requires finding an acceptable balance between health care financing and the social equity (service) of the system. This work relates to the implementation of scheduling procedures to a maternal and childish hospital. The scheduling procedure directly improves the time patients spend in the hospital and the global quality care to patients through the organization of medical appointments with increased service level being the main objective.

3 - Lateral Transshipment of Slow Moving Critical Medical Items
Mingzhou Jin, Mississippi State University, PO Box 9542, Miss State, MS, 39762, United States, mjin@ise.msstate.edu, Gozde Agirbas

Healthcare providers have to keep high availability for critical medical items. However, high availability means high expiration possibility because of their low demands and limited lifetimes. Their expirations contribute a lot to the current prohibitively high cost of the healthcare system. This paper studies the decision rule based on the myopic best action for lateral transshipment in a two-hospital system. Numerical experiments demonstrate significant cost savings.

4 - Understanding Setup Costs in Healthcare Services
Sanjeev Bordoloi, Associate Professor, University of St. Thomas, Opus School of Business, 1000 LaSalle Ave, Minneapolis, MN, 55403, United States, sbordoloi@hotmail.com

Many service agencies fail to acknowledge setup or switching costs that are incurred while services are rendered. Decisions are taken purely based on operational effectiveness, operating costs and fixed costs. However, setup costs can be significantly high and could easily alter decisions when considered appropriately. We look into this matter in healthcare industry and showcase the relevance of setup costs in decision-making.

5 - Dynamic Allocation of Cardiac Diagnostic Testing Time Slots
Matthew Dean, University of Connecticut, 2100 Hillside Road, Unit 1041, Dept. of Operations & Info Management, Storrs, CT, 06269, United States, matthew.dean@business.uconn.edu

We look at the problem of dynamically allocating time slots for a cardiac diagnostic center. Specifically, we focus on recommending which type of patient should be tested when a conflict for a time slot arises during the day. We describe the innovative and holistic approach developed to solve this problem.

■ WA43

S-Grand Ball. A (Lev. 2)

Aviation Applications I

Contributed Session

Chair: Peng Cheng, Associate Professor, Tsinghua University, Main Building 614, Dept. of Automation, Beijing, BJ, 100084, China, chengp@tsinghua.edu.cn

1 - Adaptive Air Traffic Network Redesign®CModel and Algorithm
Rui Geng, Tsinghua University, Main Building 614, Beijing, China, gengrui@tsinghua.edu.cn, Peng Cheng

This paper presents a bi-level MIP model of Adaptive Air Traffic Network Redesign problem. The upper level selects a sub-network from the air-route network including additional route segments which can be opened dynamically. The lower level picks the most suitable route for each flight taking into account several new constraints, such as shortest route occupancy time constraint. This paper also proposes an algorithm combining exact method and heuristic algorithm to solve the problem.

2 - An Optimization Model for Risk and Economic Throughput Level of Runway Landing Operations
Babak G. Jeddi, PhD Candidate, George Mason University, 5235 Richardson Dr, Fairfax, 22032, United States, bghalebs@gmu.edu

Two risks associated with aircraft landing procedures on a runway are the risks of a wake vortex encounter and simultaneous runway occupancy. We develop an optimization model to maximize successful landing operations while controlling these risks by enforcing go-around procedures when separation distances are too small. The model maximizes expected total dollar benefits minus total go-around costs by adjusting the rate of landing attempts for a given type of follow–lead aircraft.

3 - The Application of Banker's Algorithm for Conflict Avoidance in Air Traffic Control
Dan Li, PhD Student, Tsinghua Unversity, Main Building 611, Beijing, 100084, China, dan.pamela@gmail.com, Peng Cheng

Conflict detection and resolution is essential for flight safety and efficiency. Banker's algorithm, originally developed for computer operating systems, is a common deadlock avoidance policy which is also used in other fields to solve resource allocation problems. We introduce the idea of BA into flight conflict avoidance and show that it is not overly conservative. Indeed, Banker's Algorithm approach can provide very good operational flexibility when properly applied to air traffic control.

4 - Taking off Online: Impact of Electronic Distribution Channels on Firm Performance
Dina Ribbink, PhD Student, University of Maryland, 3370 Van Munching Hall, College Park, MD, 20742, United States, dribbink@rhsmith.umd.edu, Animesh Animesh

The paper investigates the effect of introducing an extra distribution channel on firm's performance. Specifically, company's share of sales via its own website is expected to increase overall financial performance. Data from the airline industry is used to support our hypothesis.

5 - Optimal Scheduling on Arrival Air Traffic Flow with Flight Path Alteration
Peng Cheng, Associate Professor, Tsinghua University, Main Building 614, Dept. of Automation, Beijing, BJ, 100084, China, chengp@tsinghua.edu.cn, Xiaohong Guan, Leyuan Shi

We describe recent efforts of short-term air traffic flow management within a 1-2 hour time window for vectoring arrival air traffic to a congested airport. Bursting severe weather may cause airport capacity's to drop. We propose an Integer Program model to support the scheduling on arrival traffic flow considering the option of vectoring part of it to alternate landing airports. A Lagrangian Relaxation approach incorporating stochastic local search policy is developed to solve this model.

■ WA44

S-Grand Ball. B (Lev. 2)

Undergraduate OR Education in the Liberal Arts Environment

Sponsor: INFORM-ED

Sponsored Session

Chair: Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, TX, United States, aholder@trinity.edu

1 - How Should We Introduce OR to Undergraduate Students?
David Rader, Rose-Hulman Institute of Technology, 5500 Wabash Ave, Terre Haute, IN, 47803, United States, david.rader@rose-hulman.edu

When teaching mathematics students about OR, it is important to convey not only the fundamental problems and theory of the discipline but also what makes it such an exciting field of study. Courses successful in motivating students highlight modeling approaches, algorithm (solution) development, and how theoretical insights from the problem affect solution approaches and improvements. Examples of these approaches from various courses are given.

2 - Modeling Projects for Undergraduates
Bob Bosch, Oberlin College, bobb@cs.oberlin.edu

For the last 16 years, I've taught OR courses at Oberlin College, a top-tier liberal arts institution. I structure each course so that it culminates with a modeling project. In this talk, I will describe my experiences and present numerous examples. Several stellar projects have led to publications in refereed journals.

3 - OR & Undergraduate Research in Mathematics
Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, TX, United States, aholder@trinity.edu

Undergraduate mathematics students are often interested in applied mathematics, and we will discuss how OR is especially well suited to undergraduate research/senior projects. We will detail success with applications in medicine, marketing, and biology as well as in OR itself, of which several have ended in peer-reviewed publication.

■ WA45

S-Capitol Hill (Lev. 3)

Derivatives Pricing Models and Methods

Cluster: Financial Engineering
Invited Session

Chair: Liming Feng, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States, fenglm@uiuc.edu

1 - Exact Simulation for Option Pricing and Greek Estimation
Nan Chen, Chinese University of Hong Kong, 709A, William Mong Engineering Building, Chinese University of Hong Kong, Shatin, Hong Kong - ROC, nchen@se.cuhk.edu.hk

We investigate how to use exact simulation technique to estimate prices and Greeks of derivative securities. The idea is to consider the probability density of diffusions under Wiener measure, instead of Lebesgue measure. The availability of closed form under Wiener measure facilitates us conducting simulation to draw exact samples and meanwhile obtaining unbiased estimators with small variances for Greeks.

2 - Moment Explosions in Affine Diffusion Models
Kyoung-Kuk Kim, PhD Candidate, Columbia Business School, 311 Uris Hall, 3022 Broadway, New York, NY, 10027, United States, KKim11@gsb.columbia.edu, Paul Glasserman

We investigate the tail behavior of canonical affine term structure models through an analysis of their associated dynamical systems. We derive a necessary and sufficient condition for the model to have a Gaussian distribution, and we describe the regions of finite exponential moments for the stationary and transient distributions.

3 - Pricing Discretely Monitored Lookback Options in Levy Process Models
Liming Feng, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States, fenglm@uiuc.edu, Vadim Linetsky

In this talk, we present an efficient method for pricing discretely monitored lookback option in Levy process models. The method involves a sequential evaluation of Hilbert transforms. A discrete approximation with exponentially decaying errors is developed based on the Whittaker cardinal series for functions analytic in a strip in the complex plane.

■ WA46

S-Ballard (Lev. 3)

Environmental Modeling

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, United States, edbaker@ecs.umass.edu

1 - RGGI, Carbon Leakage, and the Influence of Border Measures
Marek Kolodziej, PhD Student, Geography and Environment, Boston University, 12 Beacon Ter. Apt. 2, Somerville, MA, 02143, United States, marek@bu.edu, Ian Sue Wing

The Regional Greenhouse Gas Initiative seeks to cap emissions of CO2 from power plants in 9 states starting in 2009. Like other sub-global initiatives, RGGI may result in carbon leakage due to the relocation of power generation and energy-intensive production to non-signatory regions. We analyze this issue by (1) illustrating the channels of leakage, (2) quantifying the leakage and macroeconomic impacts using a CGE model, and (3) evaluating the effectiveness of measures to neutralize leakage.

2 - Impact of Technological Change on the Greenhouse Gas Marginal Abatement Cost
Haewon Chon, Maryland School of Public Policy/JGCRI, 8400 Baltimore Ave, Ste 201, College Park, MD, 20740, United States, hwchon@gmail.com, Leon Clarke, Erin Baker

Marginal abatement cost (MAC) is a crucial component when choosing a greenhouse gas stabilization target and the optimal inter-temporal emission path. Using MiniCAM integrated assessment model, we have derived MAC curves for several potential technological changes. We focus on two key attributes: the reduction in emissions absent carbon tax and whether the advanced technology MAC curve converges to or diverges from the reference MAC curve.

3 - Spatially Differentiated Trade of Permits for Electric Power Supply Chains with Noncompliance
Trisha Woolley, PhD Student, University of Massachusetts Amherst, Isenberg School of Management, 121 Presidents Drive, Amherst, MA, 01003, United States, twoolley@som.umass.edu, John Stranlund, Anna Nagurney

In this paper, we develop an electric power supply chain model with alternative technologies that incorporates a multipollutant tradable permit system with (possible) noncompliance. The equilibrium prices of the electric power transactions and those of the multiple permits, along with their quantities, and penalties assessed for noncompliance are determined using variational inequality theory. A computational procedure that exploits the structure of the problem is applied to numerical examples.

4 - Data-driven Optimization for Minimizing the Environmental Impact of Airport Deicing Activities
Victoria Chen, University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Campus Box 19017, Arlington, TX, 76019-0017, United States, vchen@uta.edu, Prashant Tarun, Dan Bergman, Jay Rosenberger, Huiyuan Fan, Seoung Bum Kim

A prototype is presented for Dallas-Fort Worth International Airport (D/FW). Deicing and anti-icing fluids have a high concentration of glycol that can lead to increased bacterial growth in the receiving waters and reduced dissolved oxygen. Our prototype uses actual data for two primary tasks: (1) Construction of simulation model and (2) Development of a stochastic dynamic programming based optimization tool to dynamically assign airplanes to deicing pad locations.

■ WA47

S-Everett (Lev. 3)

Operations Planning and Technology Adoption in Commodity Markets

Cluster: Operations Management in Commodity Markets and Agribusiness
Invited Session

Chair: Ankur Goel, University of Texas-Austin, 10926 Jollyville Road, #708, Austin, TX, United States, goel@mail.utexas.edu

1 - Technology Deployment Flexibility in the Natural Gas Industry
Paul Enders, Tepper School of Business, Carnegie Mellon, 5000 Forbes Avenue, Pittsburgh, 15213, United States, penders@cmu.edu, Nicola Secomandi, Alan Scheller-Wolf

We model the deployment of production and communication technologies in natural gas production as real options. Based on real data from Equitable Resources, we quantify the incremental value of optimally managing the adoption of production and communication technologies, as well as the additional value of modeling price and flow-rate uncertainty. We also provide insight into optimal investment and divestment patterns, and discuss how these generalize to other resource extraction industries.

2 - Characterization of Adaptive Optimal Procurement Policies From the Spot Market
Ankur Goel, University of Texas-Austin, 10926 Jollyville Road, #708, Austin, TX, United States, goel@mail.utexas.edu, Genaro Gutierrez

We characterize the optimal procurement policies in presence of commodity markets. The commodity price process is modeled as a two factor model that offers no risk-free arbitrage opportunities. We empirically compare the value of a adaptive policy, where stochastic price process parameters are updated frequently, over non-adaptive policies, where parameters of the stochastic process remain constant.

3 - Optimal Exploitation of a Mineral Resource
Rene Caldentey, Prof., New York University Stern School of Business, 44 West 4th Str., New York, NY, 10012, United States, rcaldent@stern.nyu.edu, Rafael Epstein, Denis Saure

We investigate the optimal long-term operation (extraction and capacity investment strategies) of an underground copper mining project. The resource is deposited over a collection of sites with varying quality and extraction costs. Output is sold in a spot market at a stochastically evolving price independent of the level of production. We apply our methodology to a real instance of an underground copper mining project.

■ WA48

S-Fremont (Lev. 3)

Risk Management in Finance

Contributed Session

Chair: Ankit Jain, UC Berkeley, 1945 Berkeley Way Apt 327, Berkeley, CA, 94704, United States, ankit@ieor.berkeley.edu

1 - Dynamic Optimization in Active Portfolio Management
Qian Li, Xi'an Jiaotong University, Xi'an Jiaotong University, Xi'an, China, manage@mail.xjtu.edu.cn, Linyan Sun

We consider the active investment portfolio management on the assumption of stochastic volatility of risk financial assets. The problem was formulated as a dynamic tracking task with quadratic criterion. We obtain the stochastic linear quadratic optimal control task for the system with random parameters and propose an approach of defining a feedback strategy.

2 - The Rationing Credit Guarantee Model with the Increment and the Deposit Guarantee
Sun Yan, Xi'an JiaoTong University, No.28,Xianning West Road,Xi'an,P.R.China, Xi'an, China, yansun82@gmail.com

According to the meaning of the credit guarantee, the paper figures out that the rationing credit guarantee should consider both the uncertainty and the deposit guarantee. By using the quadratic programming method, it establishes the rationing model with the increment and the deposit guarantee. On the basis of the existing credit risk model, it makes use of the history data to show the scientific argument for making the reasonable decision on the rationing credit guarantee.

3 - Optimizing Fund Allocation by Considering RAROC
Jia-Ying Chen, College of Management National Taiwan University, No.1, Sec. 4, Roosevelt Rd., Taipei, Taiwan - ROC, d95741002@ntu.edu.tw, Andy Guo, David Chiang

Banks need to consider the risk, they also need to improve their profitability. One of the performance index need to consider both risk and profitability, which is frequently adopted by banks, is the risk adjusted return on capital (RAROC). Thus, based on the Markowitz's portfolio theory and the concept of RAROC, this research derives nonlinear programming formulation to achieve the overall goals for the lowest risk, determines the best allocation proportion for each customer credit group.

4 - Determination of Option Prices Using Fuzzy Neural Networks
Nagen Nagarur, Associate Professor, Binghamton Universiry, Vestal Parkway, Vestal, NY, 13902, United States, nnagarur@binghamton.edu, Domnic Ojala

A fuzzy neural network model is presented to determine option prices. The model takes into account all the variables of current price, strike price, volatility, interest rate, and time to expire. Also, the interest rate is considered as a fuzzy variable. The results are compared to traditional Black-Scholes model.

5 - An Operational Statistics Approach to Portfolio Management
Ankit Jain, UC Berkeley, 1945 Berkeley Way Apt 327, Berkeley, CA, 94704, United States, ankit@ieor.berkeley.edu, George Shanthikumar, Andrew Lim

We consider mean-variance portfolio choice problem. Classical approaches first do estimation and then solve the optimization problem. Robust approaches solve some optimization problem over a range of estimates but do not guarantee a better solution. We combine estimation and optimization steps and guarantee a better solution than classical one over a range of parameters. We convert the problem to a semidefinite program (SDP). Numerical experiments are done to show the efficacy of our approach.

■ WA49

S-Greenwood (Lev. 3)

Special Topics in Revenue Management and Pricing

Sponsor: Revenue Management & Pricing- Invited/Sponsored

Sponsored Session

Chair: Frank Bria, Sr. Vice President, Response Analytics, Inc., 7426 E Stetson Dr., Ste 120, Scottsdale, AZ, 85251, United States, frank.bria@responseanalytics.com,

Co-Chair: Roger R. Gung, Director, Research, Response Analytics, Inc., 7426 E Stetson Dr., Ste 120, Scottsdale, AZ, 85251, United States, roger.gung@responseanalytics.com

1 - Dynamic Pricing for Consumer Lending
Roger R. Gung, Director, Research, Response Analytics, Inc., 7426 E Stetson Dr., Ste 120, Scottsdale, AZ, 85251, United States, roger.gung@responseanalytics.com, Frank Bria, Tao Kang

The dynamic nature of consumer lending is prompting the shift from rate sheet pricing to dynamic pricing. Dynamic pricing, as defined in this talk, includes differential pricing based on deal and buyer attributes, and flexible-pricing for product preferences and price negotiation. We present our new solution method to dynamic pricing in the context of auto lending, including price elasticity modeling and profit optimization. We also discuss the pitfall of using rate sheet for price negotiation.

2 - Measuring Pricing Performance in Travel & Transportation
Brenda Barnes, Brenda A. Barnes, LLC, 163 Third Avenue #192, New York, NY, 10003, United States, brendaabarnes@gmail.com

Pricing practitioners use a variety of methodologies, tools and metrics to measure the outcomes and performance of their pricing decisions. An experienced airline and hospitality industry executive will discuss common techniques, challenges in measuring pricing performance, shortcomings in current tools, and oppportunities for future research and development.

3 - Perspectives on the Future of Pricing
Andrew Boyd, aboyd@prosrm.com

Every company that exists sells something, and in doing so sets a price for what it sells. This gives rise to a variety of ways to price and sell, many of which have received little research attention. We begin by taking a look at demand curves (price response functions) and their practical and theoretical limitations. We then survey some business models where the use of demand curves is inappropriate.

■ WA50

S-Issaquah A & B (Lev. 3)

Measuring Pricing Performance

Sponsor: Revenue Management & Pricing- Invited/Sponsored

Sponsored Session

Chair: Glenn Colville, Pricing Consultant, Zilliant, 866 Brookhaven Springs Drive, Atlanta, GA, 30342, United States, Glenn.Colville@zilliant.com

1 - Hotel Price Cache
Wassim Chaar, Sr. Principal, Sabre Holdings, 3150 Sabre Drive, MD 8203, Southlake, TX, 76092, United States, wassim.chaar@sabre-holdings.com

Hotel shopping uses cached rates in order to make the process efficient. The cache is charged each night by polling hotel CRSs for many combinations of future arrival and departure dates. When a property is selected, the actual rate is then retrieved from the hotel. Discrepancies between the cache and actual prices can lead to price jumps. This talk discusses the observed consumer choice behavior when a price jump occurs and measure its impact on revenue.

2 - B2B Normative Pricing Strategy: Antecedents and Profitability Impact
Tim Baker, Associate Professor, Washington State University, 2710 University Drive, CIC 125N, Richland, WA, 99354, United States, bakert@tricity.wsu.edu, Vaidy Jayaraman

We wish to determine via structural equation modeling (1) the drivers of adherence/lack-of-adherence to normative pricing strategies, and (2) the impact of adherence/lack-of-adherence to normative pricing strategies on financial measures of sales performance, relative to all other factors thought to impact such sales performance measures.

■ WA51

S-Kirkland (Lev. 3)

Probability Management

Cluster: Queueing Models
Invited Session

Chair: Sam Savage, Conbsulting Prof., Stanford University, Dept.. of MS&E, 326 Terman, Stanford, CA, 94305, United States, savage@stanford.edu

1 - Probability Management: An Overview
Sam Savage, Conbsulting Prof., Stanford University, Dept.. of MS&E, 326 Terman, Stanford, CA, 94305, United States, savage@stanford.edu

Probability Management is an approach to creating enterprise wide stochastic models that may be consolidated, audited, and most importantly trusted by management. It is defined by a managerial component, the Chief Probability Office (CPO), an informational component, Stochastic Information Systems, and a technological component, Interactive Simulation. Live Computer demonstrations will include applications from Energy, Finance and Human Resources.

2 - A Threshold Probability Approach to Risky Project Selection with Joint Resource Constraints
Alan King, IBM Thomas J Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States, kingaj@us.ibm.com, Dharmashankar Subramanian, Paul Huang

The optimal selection of portfolios of risky projects involves balancing current costs against the probable range of future returns. Projects can be ranked according to the implied expected value of project continuation. In this talk we offer a ranking model that accounts for the fact that projects may consume limited resources or there may be dependencies between projects.

3 - Probability Management Support in Risk Solver Software for Excel
Daniel Fylstra, President, Frontline Systems Inc., P.O. Box 4288, Incline Village, NV, 89450, United States, dfylstra@frontsys.com

This talk will describe and demonstrate support for Probability Management in Risk Solver software for Excel. We'll show how Stochastic Libraries can be generated via Monte Carlo simulation and stored, and how they are used in models as uncertain variables; how to create and publish Certified Distributions, based on either analytic probability distributions or Stochastic Libraries, that are easy for end user modelers to use; and how models can be tested for Certified' and Coherent' properties.

■ WA52

S-Leschi (Lev. 3)

Policy Decisions in Technology Management

Sponsor: Technology Management
Sponsored Session

Chair: Dundar Kocaoglu, Professor, Portland State University, P.O. Box 751, Eng. & Tech. Management, Portland, OR, 97207, United States, kocaoglu@etm.pdx.edu

1 - Evaluating Emerging Technologies for National Technology Policy
Pisek Gerdsri, Doctoral Student, Portland State University, P.O. Box 751, Eng. & Tech Mgmt., Portland, OR, 97207, United States, Pisek@pdx.edu, Dundar Kocaoglu

A decision model assesses the contributions of emerging technologies and evaluates their impact on the country's objective. The relative impact value of each technology is determined by a six-level hierarchical decision model (national objective, industry's goals, industry's strategies, technological benefits, technological factors, and technologies). The model is applied to a case study of nanotechnology in agriculture.

2 - Optimizing Origin-to-destination Flow of Freight in Lake Superior
Hongyi Chen, Assistant Professor, U. of Minnesota, Duluth, MIE Department, Duluth, MN, 55812, United States, hongyi@pdx.edu

A method that combines utility theory and nonlinear network modeling is proposed to optimize the origin-to-destination flow of freight in Lake Superior. The method determines the shipping routes with the highest company value.

3 - Systemic Approach to Forecasting Emerging Technologies
Guillermo Rueda, PhD Student, Intel, Hillsboro, OR, 97124, United States, guillermo.rueda@intel.com, Dundar Kocaoglu

A combination of several methods is being used as a way to overcome for the lack of historical information when forecasting emerging technologies. A methodology has been defined as a way to handle multiple factors and their relative importance combining the use of different methods such as the Delphi method, bibliometric analysis, utility curves, scenarios and composite indicators.

4 - Trust in E-commerce
Rosine Hanna, Graduate Student, Portland State University, Eng. & Tech Management, PO Box 751, Portland, OR, 97207, United States, rosine@pdx.edu, Charles Weber

An investigation of trust in e-commerce finds trust in traditional trust mechanisms is greater than trust in Internet-based institutions among the IT-savvy and among non-IT-savvy. Residents of nations that are not completely industrialized expressed severe distrust in e-commerce, where as residents of industrialized nations trust e-commerce. Policy makers in developing nations must build trust in institutions, if e-commerce is to be used as a vehicle for economic development.

■ WA53

S-Medina (Lev. 3)

Facilities Material Handling

Contributed Session

Chair: Melih Temel, PhD Candidate, State University of New York at Buffalo, Department of Industrial and Systems Eng, University at Buffalo 416 Bell Hall, Buffalo, NY, 14260, United States, mtemel@buffalo.edu

1 - The In-process Wait-time Flow-shop
Melinda McGurer, USCG Academy, Mathematics Department, Melinda.D.Mcgurer@uscg.mil, Manbir Sodhi

The In-Process Wait-Time (IPW) Flow-shop is introduced. The goal is to minimize the time that jobs spend waiting between processing on consecutive machines. The IPW Flow-shop and its permutation variant are strongly NP-complete for three or more machines. A computational analysis on permutation variants 7|2|P|IPW and 20|20|P|IPW show that the heuristic of Rejendran and Ziegler performs better on these IPW flow-shop problems than does the heuristic of Nawaz, Enscore and Ham.

2 - Analysis of Order Picking on Sorting Wave Structure
Melih Temel, PhD Candidate, State University of New York at Buffalo, Department of Industrial and Systems Eng, University at Buffalo 416 Bell Hall, Buffalo, NY, 14260, United States, mtemel@buffalo.edu, Rajan Batta, Rakesh Nagi

We consider an order-picking system feeding an automated sorting system in a warehouse setting. We examine the effect of batch- and zone-picking policies on the distribution of the wave arriving at the sorting system. In doing so, we seek to explore the impact of order-picking policies on the sorting system's performance, as measured by the likelihood of encountering deadlock and the system throughput.

■ WA54

S-Queen Anne (Lev. 3)

Sequential Change Detection Problems

Sponsor: Applied Probability
Sponsored Session

Chair: Savas Dayanik, Assistant Professor, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, sdayanik@Princeton.EDU

1 - Poisson Disorder Problem with Phase-type Change Distributions
Semih Sezer, Assistant Professor, University of Michigan, sezer@umich.edu, Erhan Bayraktar

We consider the Poisson disorder problem where the arrival rate of a Poisson process changes suddenly at some unknown and unobservable time. The objective is to detect the change-time as quickly as possible. In this talk, we assume that the change-time has a phase-type distribution. We find an optimal stopping rule for this general case, and we give a numerical algorithm that approximates the value function of the problem with negligible error levels.

2 - An Adaptive Methodology for the Quick Identification of Space-time Anomalies
Michael Porter, North Carolina State University, Box 8203, Raleigh, NC, 27695, United States, porter@stat.ncsu.edu

This talk discusses an approach to anomaly detection (a specific type of change where the change occurs in a local region of space) for space-time point processes. Besides estimating the rate of change and change point, we also estimate the anomalous spatial region. This added complication leads us to adaptively estimate the unknown pre and post change parameters, thus expanding the common GLR, CUSUM, and Shiryaev-Roberts change detection methodologies.

3 - Bayesian Sequential Change Detection and Identification
Savas Dayanik, Assistant Professor, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, sdayanik@Princeton.EDU, Christian Goulding

The problem of detection and identification of an unobservable change in the distribution of a random sequence is formulated via a hidden Markov model approach. The formulation is Bayesian, on-line, discrete-time, allowing multiple disorders with dependent observations, statistical dependencies between the change-time and change-type, and general discrete-time disorder distributions. Optimality results and numerical examples will be given.

■ WA55

S-Ravenna (Lev. 3)

Weather or Not: Coping with Weather Uncertainty in Aviation Operations

Sponsor: Aviation Applications
Sponsored Session

Chair: Mark Hansen, NEXTOR, UC Berkeley, 114 McLaughlin Hall, University of California, Berkeley, Berkeley, CA, 94706, United States, mhansen@ce.berkeley.edu

1 - A Fast Response Mechanism for Airspace Capacity Windfalls
Andrew Churchill, Graduate Research Assistant, University of Maryland, 3117 AV Williams, College Park, MD, 20742, United States, churchil@umd.edu, David Lovell, Michael Ball

We propose a dynamic fast-response mechanism to help airspace users take advantage of unanticipated capacity opportunities in strategic en-route congestion management initiatives. These types of programs would typically be triggered by the presence of severe weather in the en-route airspace. User preference regarding alternate and preferred routings is incorporated, as are various realistic airspace constraints.

2 - Using Weather Forecast Information to Model Stochastic Evolution of Terminal Capacity
Yoonjin Yoon, UC Berkeley, 107D McLaughlin Hall, UC Berkeley, Berkeley, CA, 94720, United States, yoonjin@berkeley.edu

Stochastic forecasts of airport terminal capacities utilize a set of capacity scenarios. In previous research, capacity scenarios are generated solely from the historical capacity profiles, such as historical AAR. In this talk, we consider how to incorporate the weather forecast information, to tailor capacity scenarios to a specific day-of operation. Data mining is used to generate the capacity scenarios and update the probabilistic scenarios.

3 - Delay Modeling Using Center and National Weather Impacted Traffic Indices
Dr. Banavar Sridhar, NASA Ames Research Center, Banavar.Sridhar@nasa.gov

The total aggregate delay experienced by aircraft in the United States is a measure of performance of the air traffic management system. Weather is a major factor causing delay. This paper describes a classification methodology and a three-step regression model to provide a comprehensive approach to estimate delay. The methodology is verified using national traffic, weather and delay data for the years 2004, 2005 and 2006.

■ WA56

S-Wallingford (Lev. 3)

Energy Industry Issues

Contributed Session

Chair: Greg Daneke, Professor & Senior Fellow, University of Calgary, 1248 Social Sciences Tower, 2500 Univ. Dr. NW, Calgary, AB, T2N1N4, Canada, gdaneke@ucalgary.ca

1 - Energy Management in the Plastics Industry
Farouq Alhourani, Assistant Professor, University of Tampa, 401 W. Kennedy Blvd, Box O, Tampa, 33606, United States, falhourani@ut.edu, Umesh Saxena

A self assessment tool for energy management in the Plastics industry (SIC code 3089) is developed. Using data from 28 companies, a model for calculating a reference point for electricity use is obtained. The actual electricity use for a company can be compared with this reference point and if energy conservation is beneficial, a set of energy conservation opportunities should be explored. The effectiveness of this tool is demonstrated by application to five companies in this group.

2 - Component Replacement Analysis for Sets of Heterogeneous Asset
Jose Espiritu, PhD Candidate, Rutgers University, 709 Bevier Road, Piscataway, NJ, 08854, United States, jespirit@eden.rutgers.edu, David Coit

A component replacement methodology was developed to solve equipment replacement problems for systems composed of sets of heterogeneous assets subject to annual budgetary constraints over a finite planning horizon. The proposed methodology is based on an integrated dynamic and integer programming approach. The objective is to obtain the minimum cost policy such that the Net Present Value of maintenance, purchase and opportunity costs is minimized.

3 - Clearing Quantity and a Unique Price in Markets with Non-convexities
Gabriella Muratore, Dr., University of Catania- Dip. Mat e Inf., V.le A. Doria 6, Catania, 95125, Italy, gabriellamuratore@yahoo.com

We present a market mechanism for finding a clearing quantity and a unique clearing price in a market with non convexities under slightly modified assumptions of a perfectly competitive market. Beside its theoretical importance, the market mechanism could be helpful in energy markets which work under the assumptions of perfect competition. A number of market imperfections keeps energy price too low to support investment in new generating capacity. Our market models addresses this issue.

4 - Modeling Unit Commitment Problem with Uncertainty
Pablo Ruiz, Areva T&D Inc., 10865 Willow Road NE, Redmond, WA, 98052, United States, paruiz@ieee.org, C. Russ Philbrick, Kwok Cheung, Eugene Zak

Uncertainty in the unit commitment problem stems from power demand and physical conditions of the generators and transmission lines. A financial market inseparable duet - risk vs. return – has its counterpart in the power market: cost vs. reliability. Though traditional approaches such as regulating reserves and contingency analysis have been effectively used to establish an appropriate balance between risk and reliability, stochastic methods offer the potential for superior solutions.

5 - Cooperative Agents, Culture, and Sustainable Energy Choices
Greg Daneke, Professor & Senior Fellow, University of Calgary, 1248 Social Sciences Tower, 2500 Univ. Dr. NW, Calgary, AB, T2N1N4, Canada, gdaneke@ucalgary.ca

As we experience the cataclysmic consequences of our failed institutions (particularly those which promote dependency on carbon fuels), our understanding of the actual cultural forces at work in energy choices remains miniscule. This research addresses these conceptual deficiencies and explains how insights from cultural evolution studies and computational economics can be applied to the redesign of institutions which promote a more sustainable set of energy choices.

■ WA57

S-Columbia (Lev. 4)

Sports & Entertainment

Contributed Session

Chair: C. Christopher Lee, Professor, Pacific Lutheran University, School of Business, 1010 122nd Street S., Tacoma, WA, 98447, United States, leec1234@hotmail.com

1 - Team Selection Strategies in Youth Sports
Stephanie Garman, Graduate Research Assistant, Department of Industrial Engineering, University of Arkansas, Fayetteville, AR, 72701, United States, sngarman@gmail.com, Ed Pohl

Have you or your child ever been on a team that failed to win a game in a single season? In many youth sports programs, team selection strategies often promote the creation of stacked teams. These unfair selection strategies create unbalanced leagues which often have one or two teams who win all their games and one or two teams that win no games. This study investigates the impact of team formation strategies on the distribution of wins and losses for a youth baseball league.

2 - College Football Ranking: A Fresh Look at an Old Subject
Branford McAllister, Director, Developmental Test Support Department, Jacobs Engineering, 339 Oaklake Lane, Niceville, FL, 32578, United States, branford.mcallister@eglin.af.mil

Much is at stake in college football: money, prestige, recruiting, and regional pride. This paper reviews the challenges of ranking systems, playoffs, and bowls in crowning national champions. I make a case for my own open, simple, and fair ranking system that predicts winners as effectively as other methods.

3 - Using Dynamic Programming to Determine Strategy in a Contract Bridge Tournament

Nicholas Beaumont, Faculty of Business and Economics, Monash University, P.O. Box 197 Caulfield East, Vic 3145, Australia, Nicholas.beaumont@buseco.monash.edu.au

A contract bridge tournament typically comprises seven rounds of matches. Pairs of players receive rewards (masterpoints) for each match they win and for being highly placed at the end of the tournament. In rounds 2 onwards, a pair plays against a pair that has been about as successful so far. We use dynamic programming to demonstrate that, instead of playing to win, it may be advantageous (albeit unethical) to deliberately throw a match so as to draw easier opponents in the next round.

4 - Web 2.0 Business Model: A Case of Facebook.com

C. Christopher Lee, Professor, Pacific Lutheran University, School of Business, 1010 122nd Street S., Tacoma, WA, 98447, United States, leec1234@hotmail.com, Chung-Shing Lee, Hee-Boong Kwon, Min-Rak Choi

This paper attempts to develop a business model for web 2.0 applications. From the literature review, this research formulates hypotheses on nine attributes that enable customer engagement, and customer satisfaction. Wagner and Majchrzak (2007) serves as a framework for this research. Using a questionnaire, survey data are collected from the users of www.facebook.com. Statistical analysis establishes relationships among the variables, and helps develop the business model.

■ WA58

S-Pike (Lev. 4)

Groups in NPD: Dynamics, Biases, and Control

Cluster: New Product Development
Invited Session

Chair: Sanjiv Erat, Assistant Professor, Rady School of Management, University of California at San Diego, La Jolla, CA, United States, serat@ucsd.edu

1 - Budget Creation and Control for Effective NPD Portfolio Management

Stylianos Kavadias, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, NW, Atlanta, GA, 30308-0520, United States, Stylianos.Kavadias@mgt.gatech.edu, Raul Chao, Cheryl Gaimon

In this paper we explore how a manager allocates resources between NPD programs under various organization design mechanisms that determine how the NPD budget is created and controlled. We consider the allocation of resources between existing product improvement (incremental projects) and new product development (radical projects). Our results indicate that autonomy, in terms of how the NPD budget is determined, does not always favor radical innovation. Managerial implications are discussed.

2 - A Model of Fair Process and its Limits

Yaozhong Wu, Assistant Professor, NUS Business School, BIZ2 #03-08, 1 Business Link, National University of Singapore, Singapore, 117592, Singapore, bizwyz@nus.edu.sg, Christoph Loch, Ludo Van der Heyden

Organizational justice research has shown that fair process, or employee engagement and transparency, enhances both employee motivation and performance. However, work to date has not addressed why fair process is so often violated in practice and why in these instances the hoped for benefits not pursued. We develop a principal-agent model that links fair process to social preferences, and we show that indeed fair process will not always be used.

3 - Economic Models of Team Decision-making: Are Two Heads Better Than One?

Sanjiv Erat, Assistant Professor, Rady School of Management, University of California at San Diego, La Jolla, CA, United States, serat@ucsd.edu

Firms tend to rely on teams to make many decisions during product development. This article examines this phenomenon to understand the drivers of effective team decision-making. First, we consider a normative model of group decisions, and we characterize the structure of optimal group decision outcome. Subsequently, we consider the process of group discussion and consensus-building, and we explore how the process of deliberation may introduce biases into the group decisions.

4 - Process Investment Decisions of an Entrepreneur Firm Under Competition

Fehmi Tanrisever, The University of Texas at Austin, IROM Dept., McCombs School of Business, 1 University Station, B6500, Austin, TX, 78712-0212, Fehmi.Tanrisever@PhDmccombs.utexas.edu, Sinan Erzurumlu, Nitin Joglekar

When to invest in process improvement that can induce revenue growth, instead of conserving cash and reducing the potential for bankruptcy, is a dilemma faced by many entrepreneurial firms early in their lifecycle. We examine production quantity and cost-reducing R&D investment decisions in a two period model. Results show that uncertainty and anticipated growth rates affect process investment decisions crucially. We relate our findings with observations from case studies in startup companies.

■ WA59

S-Seneca (Lev. 4)

Technology and Capacity Choice

Cluster: Capacity and Technology Management
Invited Session

Chair: Ebru Bish, Associate Professor, Virginia Tech, 250 Durham Hall, Dept.. of ISE, Blacksburg, VA, 24061, United States, ebru@vt.edu,

Co-Chair: Weiping Chen, United States, wpchen@vt.edu

1 - Fostering New Technology Adoption

Feryal Erhun, Assistant Professor, Stanford University, MS&E, Stanford, CA, 94305, United States, ferhun@stanford.edu, Ozgen Karaer, Hau L. Lee

Faced with a new technology introduced in a market, a firm has to account for uncertainties regarding the future of the technology, network effects, and steep starting costs while making the adoption decision. RFID adoption has been going through this process and suffering from this individual perspective of each firm. We study this adoption problem by finding the gap due to lack of coordination and analyze the impact of intervention methods like external funds, mandates, and quantity discounts.

2 - Inventory Sharing and Preventive Transshipments with Local Decision Making

Ying Rong, PhD Student, Department of Industrial and Systems Engineering, Lehigh University, 200 West Packer Avenue, Mohler Lab, Room 371, Bethlehem, PA, 18015, United States, ying.rong@lehigh.edu, Yang Sun, Lawrence Snyder

In order to cope with demand uncertainty in the supply chain via the risk-pooling effect, retailers can share their inventory between replenishments from their suppliers. In this study, we analyze the optimal behavior of two decentralized retailers in a two-period setting with preventive transshipments allowed at the beginning of the second period. We discuss the impact of the transshipment price and compare the systems with and without transshipments.

3 - Capacity Investment in Imperfect Capital Markets

Onur Boyabatli, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, Singapore, onur.boyabatli@insead.edu, Beril Toktay

This paper analyzes the effect of capital market imperfections on firm's operational decisions in a capacity investment setting. We focus on the interaction between a single firm that decides on its technology choice (flexible vs dedicated), capacity level, production quantities and a single creditor that provides funds to the firm to finance its operational investments. We demonstrate that some of the common operational insights do not continue to hold in imperfect markets.

4 - Firm's Optimal Resource Portfolio Under Consumer Choice, and Supply and Demand Uncertainties

Weiping Chen, Virginia Tech, United States, wpchen@vt.edu

We study the firm's optimal resource investment portfolio when facing both supply and demand risks under a consumer choice model. The firm produces two substitutable products, and can invest in product-dedicated resources as well as a more expensive, flexible resource. We investigate how the firm can utilize resource diversification and product differentiation strategies to hedge against supply and demand risks.

■ WA60

S-University (Lev. 4)

Economic Experiments: Applying a New Method to Questions in Innovation and Entrepreneurship

Sponsor: Technology Management
Sponsored Session

Chair: Christian Schade, Professor, Humboldt-Universitaet zu Berlin, Spandauer Str. 1, Berlin, DE, 10178, Germany, schade@wiwi.hu-berlin.de

1 - Coordination with R&D Investments
Christian Schade, Professor, Humboldt-Universitaet zu Berlin, Spandauer Str. 1, Berlin, DE, 10178, Germany, schade@wiwi.hu-berlin.de, Sabrina Boewe, Anna Kostanovskaya

The effects of technological spillovers, success probability, and investment cost on R&D investment decisions and coordination of individuals are investigated within the framework of the Interdependent Security Model (Kunreuther and Heal, 2005). We find that free-riding as well as investment risk explain more in variance of investment decisions than normative equilibrium predictions.

2 - Panel Econometrics for Experimental Data: Implications for Innovation and Entrepreneurship Research
Anna Kostanovskaya, PhD Student, Humboldt-Universitaet zu Berlin, Spandauer Str. 1, Berlin, DE, 10178, Germany, kostanovskaya@wiwi.hu-berlin.de

The paper develops the idea why one may want to use panel econometrics for the analysis of experiments in behavioural economics: randomisation problems due to the potential influence of unobserved variables and the subjects' heterogeneity can be handled. Two econometric analyses based on laboratory experiments dealing with R&D decisions are presented.

3 - Experimental Evidence on Time-money-tradeoffs
Katrin Burmeister, PhD Student, Humboldt-Universitaet zu Berlin, Spandauer Str. 1, Berlin, DE, 10178, Germany, burmeister@wiwi.hu-berlin.de, Christian Schade

We measure time-money-tradeoffs in the laboratory as well as in the field. Relevance for entrepreneurship research is discussed.

4 - Measuring Fairness Considerations with the Ultimatum Game: An Experimental Investigation
Claudia Rangnow, PhD Student, Humboldt-University Berlin, Spandauer Str. 1, Berlin, DE, 10178, Germany, rangnowc@wiwi.hu-berlin.de, Christian Schade

We present results of an experiment on ultimatum bargaining and discuss the relevance of these findings for entrepreneurship research.

Wednesday, 10:00am - 11:30am

■ WB01

C-Room 602

Supply Chain Competition and Coordination I

Contributed Session

Chair: Sammi Tang, Washington University in St Louis, 1 Brookings Drive, St Louis, MO, 63130, United States, ytang@wustl.edu

1 - Controlling Power Retailer's Gray Activities with Contract Design
Xuemei Su, College of Business Administration, California State University, Long Beach, Long Beach, CA, 90840, United States, xuemeisu@uwm.edu, Samar Mukhopadhyay

We investigate a distribution system where a manufacturer sells through a number of retailers one of whom is dominant. The dominant retailer is the price leader and provides demand-stimulating services. We study two contract types namely, quantity discount and revenue sharing to examine which coordinates the channel and prevents the dominant retailer' reselling activities.

2 - Beer Game Studies: A Critique
Vijay Aggarwal, Professor, Management Development Institute, Mehrauli Road, Sukhrali, Gurgaon, 122001, India, vijay@mdi.ac.in, T T Niranjan

Lacunae in the beer game studies of the Bullwhip are identified and discussed at the levels of the overall experimental design, external validity and construct validity. These go far beyond the well recognized limitations of experiments within academic setting. Our preliminary experimental results substantiate our claims. In this paper we raise concerns about the efficacy of the beer game as used in behavioral operations literature. We propose modifications and direct future research.

3 - An Optimal Joint Supply Policy Between Two Manufacturers
Atipol Kanchanapiboon, PhD Student, New Jersey Institute of Technology, Department of Industrial Engineering, University Heights, Newark, NJ, 07102, United States, ak248@njit.edu, Sanchoy Das

The joint production-inventory model is a robust representation of the supply relationship existing in many supply chains. The model considers a pair of manufacturers where the production rates and the batch sizes are known and both maintain inventory on outgoing and incoming sides respectively. This paper derives an optimal joint supply policy that minimizes the total cost between the pairs. A modified Golden section search is used to derive the optimal supply solution.

4 - Competition and Dual Sourcing in the Presence of Supply Uncertainty
Sammi Tang, Washington University in St Louis, 1 Brookings Drive, St Louis, MO, 63130, United States, ytang@wustl.edu, Panos Kouvelis

We consider manufacturers adopting supplier diversification strategy to deal with supply yield uncertainty. We study monopoly and Cournot duopoly model to investigate how manufacturer competition affects firms' sourcing decisions and expected profit. We also study supplier competition effect and how supplier correlation impacts the value of diversification. Both substitutable and complementary competition are studied.

■ WB02

C-Room 603

Effects of Take-back Legislation on Supply Chain Design and Operations

Cluster: Closed-Loop Supply Chains and Sustainable Operations
Invited Session

Chair: Eda Kemahlioglu-Ziya, UNC- Chapel Hill, CB# 3490, Chapel Hill, NC, 27514, United States, Eda_KemahliogluZiya@unc.edu

1 - Effects on E-waste Regulation on New Product Introduction
Qiong Wang, Bell Labs, Alcatel-Lucent, 600 Mountain Avenue, Murray Hill, NJ, United States, qwang@research.bell-labs.com, Erica Plambeck

In our infinite-horizon model of new product introduction, firms set the development time and expenditure for each new version of a durable electronic product. Consumers' willingness to pay depends upon the time until the next new-and-improved product is introduced. E-waste regulations increase the equilibrium development time, R&D spending and hence product quality. The increase in development time reduces E-waste and also increases consumers' willingness to pay, which increases firms' profits.

2 - An Analysis of Monopolistic and Competitive Collection Schemes for Recycling
Tamer Boyaci, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, tamer.boyaci@mcgill.ca, Fuminori Toyasaki, Vedat Verter

We model two recyclers who set competitive treatment fees, taking into account their costs and manufacturer actions. The manufacturers compete (via prices) in the product market. Under the monopolistic scheme, the manufacturers belong to a NPO that allocates the collected EOL returns to recyclers and reflects the costs on manufacturers. Under the competitive scheme, the manufacturers directly contract with the recyclers. We identify conditions that give preference to each collection scheme.

3 - Efficient Take-back Legislation
Atalay Atasu, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, IF, 77300, France, atalay.atasu@insead.edu, Miklos Sarvary, Luk Van Wassenhove

In this paper, the economic and environmental impacts of environmental take-back directives are investigated under a general setting that applies in leading economies of the world. The conditions for optimally regulating such systems are identified and a number of possibilities for improving the existing legislation are provided.

4 - Remanufacturing Under Take-back Legislation: Cost Benefits or Potential Competition?
Gokce Esenduran, Kenan-Flagler Business School, UNC at Chapel Hill, CB# 3490, McColl Bldg., Chapel Hill, NC, 27599, United States, gokce_esenduran@unc.edu, Eda Kemahlioglu-Ziya, Jayashankar Swaminathan

We consider an OEM with and without in-house remanufacturing capabilities under multiple take-back legislative scenarios. When the OEM cannot remanufacture, we allow a third-party remanufacturer in the market. Questions we raise include:When should an OEM with in-house remanufacturing capability remanufacture under different legislations?If the OEM cannot remanufacture, when should he sell cores to a remanufacturer?Does imposing remanufacturing targets always increase the remanufacturing level?

■ WB03

C-Room 604

Sustainable Operations

Cluster: Supply Chain
Invited Session

Chair: Beril Toktay, Georgia Institute of Technology, 800 West Peachtree St., Atlanta, GA, 30308, United States, beril.toktay@mgt.gatech.edu

1 - Vertical Integration Versus Contracting Under Yield Uncertainty and Proprietary Technologies
Ozge Islegen, oislegen@stanford.edu, Erica Plambeck

In solar PV and organic cotton industries, suppliers of the main input are reluctant to increase their capacity due to the uncertain yield of the output. However, it is not evident for manufacturers whether vertical integration or contracting is the optimal stimulus to increase efficient suppliers' capacities especially if some manufacturers also have proprietary technologies. We establish conditions which lead to distinct optimal market structures in a 2-level vertical supply chain.

2 - Component Commonality Under Product Remanufacturing
Ravi Subramanian, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, United States, ravi.subramanian@mgt.gatech.edu, Beril Toktay, Mark Ferguson

Using the classical approach in the market segmentation literature, we investigate incentives for component commonality when products return for remanufacture. Interestingly, there are scenarios where commonality would be preferred in the traditional forward chain but not when the forward and reverse chains are treated in conjunction, and vice-versa.

3 - Relicensing Fees as a Secondary Market Strategy
Nektarios Oraiopoulos, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States, nektarios@gatech.edu, Mark Ferguson, Beril Toktay

Recent articles have criticized some OEMs who are perceived to be trying to eliminate the secondary market for their products. The tradeoff that needs to be examined is whether the benefit from maintaining a secondary market can outweigh the effect of cannibalization. We develop a model where the OEM can affect the resale value through a relicensing fee charged to the buyer of the used equipment. We derive the conditions that favor stimulating or deterring the secondary market.

4 - Adoption of Voluntary Environmental Standards: Empirical Analysis of LEED Green Building Standards
Suresh Muthulingan, PhD Student, UCLA Anderson School of Management, Leon & Toby Gold Hall, Suite B512, 110 Westwood Plaza, Los Angeles, CA, 90095, United States, suresh.muthulingam.2010@anderson.ucla.edu, Charles Corbett

Organizations adopt voluntary standards as they may have an underlying desire to signal their intent or they may derive intrinsic benefits from the standards. We study which of these factors plays the primary role in the adoption of the voluntary LEED standards for Green Buildings. We find evidence neither factor independently explains the observed adoption patterns, however a combination of the two factors does. We also find tentative evidence that the adoption decision is made sequentially.

■ WB04

C-Room 606

Tutorial: Trends in OR and MS Education at the Introductory Level

Cluster: Tutorials
Invited Session

1 - Trends in OR and MS Education at the Introductory Level
Frederick S. Hillier, Department of Management Science & Engineering, Stanford University, fhillier@stanford.edu, Mark S. Hillier

The last 40 years have seen major changes in OR and MS education at the introductory level. This tutorial traces the changes that have occurred, describes what subjects are currently being taught, and assesses the changes that can be expected in the near future.

■ WB05

C-Room 607

Panel Discussion: Dual Careers - Challenges and Creative Solutions

Sponsor: Women in OR/MS
Sponsored Session

Chair: Ana Muriel, Associate Professor, University of Massachusetts Amherst, 160 Governors Drive, Amherst, MA, 01003, United States, muriel@ecs.umass.edu

1 - Dual Careers - Challenges and Creative Solutions
Moderator: Ana Muriel, Associate Professor, University of Massachusetts Amherst, 160 Governors Drive, Amherst, MA, 01003, United States, muriel@ecs.umass.edu, Panelist: Rosemary Berger, Pinar Keskinocak, Anna Nagurney, Lawrence Snyder, Grace Lin

The panelists will share their experience and advice on the hard task of optimizing the dual careers of spouses while balancing work and family. A lively discussion should follow.

■ WB06

C-Room 608

Game Theory Applications in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Haresh Gurnani, Professor, University of Miami, 417B Jenkins Building, Department of Management, Coral Gables, FL, 33124, United States, haresh@miami.edu

Co-Chair: Jun Ru, PhD Candidate, University of Texas at Dallas, School of Management, Richardson, TX, 75083, United States, jxr052000@utdallas.edu

1 - Contracting Consignment Sales
Jun Ru, PhD Candidate, University of Texas at Dallas, School of Management, Richardson, TX, 75083, United States, jxr052000@utdallas.edu, Yunzeng Wang

Motivated by Amazon.com's online retailing, we study a consignment contract where retailer changes a supplier a pre-specified percentage of the list price' of the product sold to the market, where the supplier is allowed to choose the list price for its product. We build a game-theoretic model to demonstrate that managed under such a contract, the channel incurs a minimum loss of 26.4% in efficiency. We then propose an alternative contract to improve the channel performance.

2 - Effectiveness of Transfer Pricing Strategies in Multinational Supply Chains with Random Demands
Srinagesh Gavirneni, Assistant Professor, Cornell University, Johnson Graduate School of Management, Ithaca, NY, 14853, United States, sg337@johnson.cornell.edu, Masha Shunko, Xiaohang Yue

For companies that have supply chains spanning many countries with differing tax rates, transfer pricing is a popular strategy to reduce their tax burden. There has been limited research on this topic for supply chains with random components. We analyze supply chains from an operations management standpoint (considering random demands, capacity issues, and multiple products), determine optimal transfer pricing strategies and analyze their effect for a wide variety of parameter settings.

3 - The Impact of Wholesale Price Commitment and Retail Competition on the Introduction of Store Brands
Ana Groznik, Indiana University, 1309 E 10th St, Bloomington, IN, 47405, United States, agroznik@indiana.edu, Seb Heese

Store brands present direct competition to national brands, thus often causing supply chain conflict. We consider the tradeoffs governing store brand introduction decisions of competing retailers, and we investigate how the resulting dynamics are affected by the national brand manufacturer's (in)ability to credibly commit to a wholesale price.

4 - Decentralized Inventory Sharing with Asymmetric Information
Xinghao Yan, Purdue University, Krannert School of Management, West Lafayette, IN, 47906, United States, yan1@purdue.edu, Hui Zhao

We study two retailers who privately hold demand information, non-cooperatively determine their order quantities, but cooperatively share inventory with each other. We characterize retailers' Bayesian Nash equilibrium order quantities. We find although sharing information does not always benefit retailers, coordination scheme can be developed if the retailers truthfully share information. When incorporating truth-inducing mechanism with the coordination scheme, an all-win situation is ensured.

■ WB07

C-Room 609

Partially Observed Inventory Models

Cluster: Inventory
Invited Session

Chair: Metin Cakanyildirim, School of Management, The University of Texas at Dallas, 2200 N Floyd Rd, Richardson, TX, United States, metin@utdallas.edu

1 - Inventory Control with Observation Costs
Vidyadhar Kulkarni, Professor, Dept. of Stat and OR, University of North Carolina, Chapel Hill, NC, 27599-3260, United States, vkulkarn@email.unc.edu, Nan Liu

We consider an inventory system where there is a fixed cost to observe the inventory level. After observing the level one needs to decide how much to order and when to observe the inventory level next. We present results about the structure of the optimal policy.

2 - Successive Demand Updating and Inventory Ordering after Observations of Sales and Lost Sales
Annabelle Feng, Asssitant Professor, McCombs School of Business, The University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States, annabelle.feng@mccombs.utexas.edu, Alain Bensoussan, Metin Cakanyildirim, Suresh Sethi

Customer demands are often partially observed due to the lack of tracking lost sales. A two-stage multi-period inventory model is studied to understand the policy impact of the lost sales observation. We demonstrate two different roles of inventory here: satisfying the demand and deducing the demand information. To explain the counterintuitive policy behaviors, we show that additional information of the demand may lead to an increased cost evaluation when the demand observation is censored.

3 - Computation of Optimal Order Quantities in an Inventory System with Censored Demand Data
Arnab Bisi, Assistant Professor, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States, abisi@krannert.purdue.edu, Surya Tokdar

We study the problem of computing the optimal order quantities in a newsvendor model with censored demand. The demand distribution is updated over time based on historical sales data. We develop a computation method which can compute approximate optimal policies and costs for any demand distribution. We show how the method can be implemented for various demand models. Comparison with the exact solutions confirms high accuracy of our computing scheme.

4 - Mean and Variance Based Policies for a Partially Observed Zero-balance Walk Inventory Model
Metin Cakanyildirim, School of Management, The University of Texas at Dallas, 2200 N Floyd Rd, Richardson, TX, United States, metin@utdallas.edu, Alain Bensoussan, Suresh Sethi

We study a partially observed inventory system in which the demand is not observed, the inventory level is noticed when it reaches zero, the unmet demand is lost. To minimize the total discounted costs, we provide approximations based on the mean/variance of the inventory level. The approximation has a novel DP equation that resembles a mixture of equations of the fully and partially observed problems. The mean/variance policy generalizes the policy of the fully observed problem.

■ WB08

C-Room 611

Inventory Management in Supply Chain

Contributed Session

Chair: Suman Niranjan, Research Assistant, Biomedical, Industrial & Human Factors Engineering, Russ Center, Wright State University, 3640 Colonel Glenn Hwy, Dayton, OH, 45435, niranjan.2@wright.edu

1 - Inventory Policy Selection in Supply Chains with Bi-level Stochastic Demand: A Simulation Study
Parag Dhumal, The University of Toledo, The College of Business Administration, 2801 W. Bancroft road, Toledo, OH, 430606, United States, pdhumal@utnet.utoledo.edu, Udayan Nanadkeolyar, P Sundararaghavan

We develop and analyze several inventory policies for retail supply chains where product demand follows a bi-level pattern (cyclically high & low triggered by sales promotions or other market forces). Considering a three-member supply chain model (Retailer, Distributor & Manufacturer), polices are developed from Total Independence to Complete Cooperation mode. Simulation experiments are performed to capture the impact of these policies for several problem parameters and to report our findings.

2 - Entry Timing In a Secondary Market: When to Trade?
Tingting Yan, PhD Student, Arizona State University, 1205 East Apache Blvd. Apt.155, Tempe, AZ, 85281, United States, tingting.yan@asu.edu, Rui Yin, Kevin Dooley

In volatile, long-lead time markets, a secondary market enables retailers to update their inventory. When to update involves a trade-off between value of accurate information and value of holding the products. We use stochastic modeling to identify the optimal trading time. We find that the optimal time is sensitive to the spot price function and retail price, and trading in a secondary market almost always yields benefit.

3 - Optimal Ordering Policies Under a Fixed Penalty for Shortages
Wen Chen, PhD Student, Rutgers Business School, 617 Central Ave, 2nd floor, Harrison, NJ, 07029, United States, echodrawing@yahoo.com, Katehakis Michael N

In this research we investigate an inventory system with a fixed penalty cost that is incurred whenever there is a shortage. Explicit solutions are derived for some interesting demand distributions.

4 - Efficient N-supplier Coordination
Andrew Manikas, Professor, Georgia Tech, 800 West Peachtree Street, College of Management, 4th, Atlanta, GA, 30308, United States, andrew.manikas@mgt.gatech.edu, Srinagesh Gavirneni, Yih-Long Chang

In a decentralized supply chain with an assembler/retailer and n-suppliers, total expected profits will be sub-optimized due to the disconnect between marginal benefits and marginal costs of each firm. We propose a coordinating mechanism, called salvage manipulators, to increases overall total expected profit while keeping the supply chain decentralized.

5 - A Simulation-optimization Approach for Multi-echelon Inventory Systems with Intermediary Product Demand
Suman Niranjan, Research Assistant, Biomedical, Industrial & Human Factors Engineering, Russ Center, Wright State University, 3640 Colonel Glenn Hwy, Dayton, OH, 45435, niranjan.2@wright.edu, Frank W. Ciarallo

A capacitated three-echelon assembly system with an intermediate, external product demand in one of the upper echelons is used in a simulation based inventory optimization approach to determine the optimal base stock levels. The gradient estimation technique of perturbation analysis is used to derive sample path estimators. The optimal base-stock level that satisfies the required service level is found by a modified Zoutendijk's feasible direction method.

■ WB09

C-Room 612

Supply Chain Design for Large Scale Mass Customization

Cluster: Mass Customization
Invited Session

Chair: Ashok Kumar, Grand Valley State University, kumara@gvsu.edu

1 - The Medco Story: A Modern Marvel of Large Scale Mass Customization
Art Onge, St. Onge Company, 1400 Williams Road, York, PA, 17402, astonge@stonge.com

Medco prepares and delivers over two million distinct prescriptions each week from its two facilities. How did St. Onge Company – a consulting/engineering firm known for its creative and innovative business solutions – employed mass customization principles to design an automated, error-free prescription delivery system with virtually no human involvement is discussed.

2 - Challenges and Solutions in Designing Mass Customization Strategies for Large Scale Supply Chains: The Medco Story
Art Onge, St. Onge Company, 1400 Williams Road, York, PA, 17402, astonge@stonge.com

Medco delivers over two million distinct prescriptions each week through a supply chain that extends thousands of miles. The challenges, including inventory distortions, encountered in developing an automated, error-free prescription preparation and delivery system for MEDCO are identified. Creative solutions deploying mass customization strategies are presented for this remarkable example.

3 - Mass Customization: An Enterprise-wide Business Strategy
David J. Gardner, Management Consultant, Mass Customization Expert, 18603 Wedge Parkway #L170, Reno, NV, 89511, United States, djg@mass-customization-expert.com

Mass Customization (also known as build-to-order, assemble-to-order and engineer-to-order) is a different business paradigm from Mass Production. This presentation addresses why mass customization for manufactured products must

be viewed holistically across the enterprise to ensure operational success. It also discusses the notion of the extended enterprise where dealers and/or customers play a key role in configuring order configurations and how they must be connected to the enterprise.

4 - A Meta-analysis of the Trends and Directions of Research in Mass Customization

Ashok Kumar, Grand Valley State University, kumara@gvsu.edu, Kathryn Stecke, Frank T. Piller

Over 1,500 publications have appeared since Davis (1987) coined the term mass customization in Future Perfect. We select approximately 100 publications based on their impact on the field and partition the concepts and decisions addressed in these papers into logical taxonomies and structures and set forth directions for future research.

■ WB10

C-Room 613

Coordination and Collaboration in Inventory Control Problems

Cluster: Inventory
Invited Session

Chair: Osman Alp, Bilkent University, Industrial Engineering Department, EA421, Ankara, TR, 06800, Turkey, osmanalp@bilkent.edu.tr

1 - Joint Replenishment Problem with Transportation Capacity

Ulku Gurler, Professor, Bilkent University, Department of Industrial Engineering, Ankara, Turkey, ulku@bilkent.edu.tr, Cagdas Buyukkaramikli, Osman Alp

In this study, we examine a coordinated replenishment problem in the presence of transportation capacity. We discuss a multi-retailer, single-echelon setting under the quantity based joint replenishment policy (Q,s) with positive leadtimes and full backorders and consider extensions.

2 - A Two-echelon Inventory System when Retailers are Jointly Replenished: Analysis and Insights

Banu Yuksel Ozkaya, Hacettepe University, Department of Industrial Engineering, Ankara, 06800, Turkey, byuksel@hacettepe.edu.tr, Emre Berk, Ulku Gurler

We study a single-item, two-echelon inventory system with one warehouse and multi- retailers in the presence of replenishment economies at the lower echelon. We analyze the system when the retailers are jointly replenished under policies within the Inventory Position Regenerative Ordering Policy class. We address a number of questions such as impact of warehouse function as a cross-dock, impact of policy choice on intra-chain dynamics, impact of policies on distribution of costs across echelons.

3 - Analysis of Supplier's Benefits under Vendor Managed Inventory

Secil Savasaneril, Assistant Professor, Middle East Technical University, Industrial Engineering Department, Ankara, Turkey, secil@ie.metu.edu.tr, Nesim Erkip

The benefits of Vendor Managed Inventory (VMI) are often attributed to information sharing between the supplier and the retailer, however, there is more to VMI than just the information availability; there are benefits hidden in the increased flexibility of the supplier's manufacturing operations. We analyze how the supplier can translate this flexibility into benefit, and determine the conditions that make VMI a viable strategy for the supplier.

4 - Joint Optimization Models for Assemble-to-order System Replenishment and Allocation

Kai Huang, Assistant Professor in Operations Management, Technology University of Eindhoven, Pav. E.01, P.O.Box 513, Department of Technology Management, Eindhoven, 5600MB, Netherlands, k.huang@tue.nl, Ton de Kok

We consider a periodic-review Assemble-To-Order system assuming base stock replenishment policy. We establish stochastic programming models for the classical criteria of minimizing expected overall holding cost and backlogging cost. Numerical experiment results are compared with previous results under criteria of maximizing overall reward within a time window. We also propose a series of non-FCFS allocation rules.

■ WB11

C-Room 614

Production & Scheduling I

Contributed Session

Chair: Rob Leachman, Professor, UC Berkeley, Dept. of Indus Eng & Oper Res, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, leachman@ieor.berkeley.edu

1 - Simulation of Order Scheduling Under Hybrid Order Fulfillment Strategy

Ling Zhou, Vsl, Dortmund, Dortmund, Germany, zhou@vsl.mb.uni-dortmund.de

Manufacturing industries are trying to implement innovative strategies compare to traditional Build-To-Forecast to cut large order fulfillment time. The work focuses on the discrete-event-simulation of order scheduling process and explores the possibilities of innovative strategies for optimization of order scheduling and hence lead-times. It analyses order fulfillment process through practical studies and introduces new hybrid strategy which is supported by results obtained in simulation model.

2 - Workforce Cross-training Decision with Minimizing the Number of Workers

Sungsu Kim, Pennslyvania State University, Industrial and Manufacturing Engineering, University Park, PA, 16802, United States, sungsukim2@hotmail.com, David A. Nembhard

We study workforce cross-training decision with the objective of minimizing the number of workers satisfying given production requirements under various factors in parallel system. We considered several factors such as the number of workers, number of tasks, the length of time horizon/unit time period, upper-bound of cross-training level, workforce selection rule, and production requirement level, and explored their effects on cross-training decisions.

3 - Semiconductor Lot Allocation Using Robust Optimization

Adam Ng, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, isentsa@nus.edu.sg, Yang Sun, John Fowler

We consider the problem of allocating a set of wafer lots to customer demands to minimize total demand un-fulfillment and over-fulfillment penalties when lot-sizes are uncertain. The application of the robust optimization approach for this problem is proposed. We present the quadratic-constrained mixed-integer program of the formulation, and develop a branch-and-price algorithm to solve the program. Finally we present some computational results of our implementation.

4 - Improved Heuristics to Minimize Total Tardiness in a Single Machine Scheduling Problem

Jose Humberto Ablanedo Rosas, Engineering Department, ITESM en Hidalgo, Pachuca, Hidalgo CP, 42080, Mexico, hablaned@itesm.mx, Antonio Alejand, Arriaga Martinez

The single machine scheduling problem is an NP-hard combinatorial problem. Hence, many heuristics have been proposed to solve it. We discuss improvements in some heuristics to minimize the total tardiness in a single machine scheduling problem with n independent jobs, considering its processing time and due date. Comparison of the solutions, obtained through computational experiments, shows that the proposed modifications provide significant improvements to quality solution without affecting computational times.

5 - An Automated Planning Engine for Biopharmaceutical Production

Rob Leachman, Professor, UC Berkeley, Dept. of Indus Eng & Oper Res, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States, leachman@ieor.berkeley.edu, Lenrick Johnston

This optimization-based production planning tool generates capacity-feasible batch processing schedules for the facilities in a biomanufacturing supply chain and an availability schedule for finished product against given demands. It precisely reflects constraints imposed by regulatory approvals, outcomes of quality testing and processing options. Problems with 27,000 binary variables, 130,000 linear variables and 80,000 constraints are automatically formulated and solved within a few hours.

■ WB12

C-Room 615

Scheduling III

Contributed Session

Chair: Gilles Mouzon, Wichita State University, 4000 E 17th Str N Apt 374, Wichita, KS, 67208, United States, gilles_mouzon@yahoo.fr

1 - Minimizing the Weighted Number of Late Jobs with Late Batch Deliveries on a Single Machine

Rui Zhang, Mr., McMaster University, DSB/A210, McMaster University, 1280 Main Street Weat, Hamilton, On, L8S4M4, Canada, zhangr6@mcmaster.ca, George Steiner

We study the single machine scheduling problem of minimizing the weighted number of late jobs with batch setup times and delivery costs when late jobs are also delivered. We propose a pseudopolynomial dynamic programming algorithm (DP), which runs in polynomial time for the special cases of equal processing times or equal weights. We convert the DP into an FPTAS for the general case. (by George Steiner and Rui Zhang)

2 - Near Optimal Appointment Overbooking to Improve Client Access and Server Productivity

Stephen Lawrence, Associate Professor, University of Colorado, Leeds School of Business, 419 UCB, Boulder, CO, 80305, United States, Stephen.Lawrence@colorado.edu, Linda LaGanga

Appointment overbooking can mitigate productivity lost to no-shows, but at the cost of increasing both patient wait times and provider overtime. In this paper, we formulate an analytic model of appointment overbooking from which we derive optimal and near-optimal appointment schedules. Our results compare favorably with other previously proposed scheduling methods, and indicate that appointment overbooking can be an effective means to increase both client access and server productivity.

3 - Scheduling Problem with Sequence-dependent Setup Times and Setup Workforce Constraint

Simin Huang, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, huangsimin@tsinghua.edu.cn, Linning Cai

We present a problem of scheduling a given set of jobs to m parallel machines under the situation that the machines require sequence-dependent setup time between jobs and also that the workers to perform setup operations are constrained by a limited number. The objective is to minimize total completion time. The problem is formulated as an integer programming model. Heuristic approaches are developed to solve the problem.

4 - Optimal Crane Scheduling

John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States, john@hooker.tepper.cmu.edu, Samid Hoda, Ben Peterson, Iiro Harjunkoski, Latife Genc Kaya

We present an algorithm for scheduling cranes in a factory or mill. The cranes operate on a single track and cannot bypass each other. Each job to be scheduled consists of a sequence of pickup and delivery stops at predetermined locations and a time window. We combine a local search heuristic for assigning jobs to cranes and sequencing them with a dynamic programming algorithm that finds an optimal space-time trajectory for each crane.

5 - Multiobjective Scheduling Optimization to Minimize Energy Consumption on a Single Machine

Gilles Mouzon, Wichita State University, 4000 E 17th Str N Apt 374, Wichita, KS, 67208, United States, gilles_mouzon@yahoo.fr, Mehmet Yildirim, Janet Twomey

A great amount of energy is wasted in industry by machines which stay idle due to underutilization. A metaheuristic methodology is proposed to solve a multiobjective optimization problem to minimize the wasted energy and some scheduling criteria to provide a set of non-dominated solutions to the decision maker.

■ WB13

C-Room 616

Polyhedral Aspects and Strong Formulations for Integer Programming

Sponsor: Optimization/ Integer Programming

Sponsored Session

Chair: Yongpei Guan, School of Industrial Engineering, University of Oklahoma, 202 West Boyd Street, Norman, OK, United States, yguan@ou.edu

1 - Using Integer Programming for Solving Problems in Information Theory

Ahmet Keha, Assistant Professor, Arizona State University, P.O. Box 875906, Tempe, AZ, 85287, United States, Ahmet.Keha@asu.edu

In this talk we introduce integer programming formulations for several problems in Information Theory. We study the polyhedral structure of the modular sum problem which is related with the single constraint relaxations of these problems. We finally present some computational experiments that shows the effectiveness of our models and cuts.

2 - Polyhedral Results for 1-restricted Simple 2-matchings

Yanjun Li, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States, li14@purdue.edu, David Hartvigsen

A simple 2-matching in a graph is a subgraph whose connected components are paths and cycles. A 1-restricted simple 2-matching is a simple 2-matching with no isolated edges. Such matchings are related to the TSP. We study a family of graphs on which the convex hull of 1-restricted simple 2-matchings has a simple description, introduce a new class of valid blossom-type inequalities, and show that the general polytope could be complex.

3 - Extended Formulations for Stochastic Lot-sizing Problems

Andrew Miller, University of Wisconsin-Madison, 3156 Engineering Centers Building, 1550 Engineering Drive, Madison, WI, United States, amiller@engr.wisc.edu, Yves Pochet

We discuss strong MIP formulations of stochastic lot-sizing models obtained by integrating additional variables into the base formulation. Our results generalize the work of Krarup and Bilde, Eppen and Martin, and others, to the stochastic case. They also extend the work of the current authors and others on extended formulations for mixing sets. To the best of our knowledge, they provide the only known convex hull descriptions of stochastic lot-sizing problems having more than two periods.

■ WB14

C-Room 617

Networks & Graphs

Contributed Session

Chair: Chien-Yu Chen, George Mason University, 4400 University Dr, Fairfax, VA, 22030, United States, cchen8@gmu.edu

1 - Using Centrality Measures to Interdict Evasion Paths

Feng Pan, Los Alamos National Laboratory, MS F603, Los Alamos, NM, 87545, United States, fpan@lanl.gov, Aric Hagberg, David Izraelevitz

A guided random walk is used to model evasion paths in a transportation network and to compute the expect cost of the evasion paths. We use centrality measures to identify the key nodes to intercept the evader. We will discuss some computational results and insights of this approach to network interdiction applications.

2 - A Guided Iterative Local Tour Improvement for the Traveling Salesman Problem

Mohammad S. Sabbagh, Isfahan University of Technology, Dept.. of Industrial and Systems Eng., Isfahan, 84156-8311, Iran, sabbagh@cc.iut.ac.ir

Tour construction algorithms stop when a solution is found and never tries to improve it. The best tour construction algorithm usually gets within 10-15% of optimality. Once a tour has been generated by some tour construction heuristic, we might wish to improve that solution. There are several ways to do this, but the most common ones are the 2-opt and 3-opt local searches. We propose a new technique, called guided-search, which uses some necessary conditions of tour optimality to search for an improvement in a much smaller neighborhood.

3 - Building A Dynamic Knowledge Network Display and Diagnostic Support System

Steven Harper, Assistant Professor, James Madision University, Zane Showker Hall, Harrisonburg, VA, 22807, United States, srharper@uiuc.edu, Noshir Contractor

We conceptualize knowledge networks as intrinsically multi-dimensional, created from the interactions and interconnections among people, documents, and organizations. We describe the process of combining the NSF projects database with the ISI bibliometric database to build a Network Display and Diagnostic Support System called CI-KNOW, Cyberinfrastructure Knowledge Networks On the Web. We discuss the implications of using the system for managing portfolios in research and other business networks.

4 - Evaluating Random Solutions to Network Design Problems with Demand Uncertainty

Steven Cosares, Hofstra University, Dept.. of QM, Hempstead, NY, 11549, United States, acsstc@hofstra.edu, Fred Rispoli

The solution to the (single-source) network design problem is a spanning tree that provides a compromise between the fixed costs of establishing links and the variable costs of satisfying the demand. When the intensity of the demand is uncertain, a spectrum of trees is optimal. We investigate the effectiveness of considering randomly generated (cost-ignorant) trees in the process of obtaining an approximation to the optimal spectrum that uses a reasonable amount of computational effort.

5 - Monte Carlo Sampling Within a Benders Decomposition for a Stochastic Programming ATP Model

Chien-Yu Chen, George Mason University, 4400 University Dr, Fairfax, VA, 22030, United States, cchen8@gmu.edu

A stochastic programming model is developed to pre-allocate available-to-promise (ATP) into distinct buckets. With pre-allocated ATP quantities, a firm can promise customer orders from different demand channels and time periods in real time. To quickly obtain a close-optimal solution over a huge number of stochastic demand scenarios, the solution approach uses a Monte Carlo sampling within a Benders decomposition. We examine solution quality by investigating the statistical optimality gap.

■ WB15

C-Room 618

Stochastic Programming II

Cluster: Stochastic Optimization/Large Scale Optimization
Invited Session

Chair: Gautam Mitra, Distinguished Professor and Director, CARISMA-Brunel University/ Optirisk Systems, John Crank Building, Uxbridge, UB8 3PH, United Kingdom, gautam.mitra@brunel.ac.uk

1 - Software Tool for Decision Making Under Uncertainty: A Combined Paradigm of SP and Simulation

Christian Valente, Doctoral Candidate, CARISMA, Brunel University/ Optirisk Systems, John Crank Building, Uxbridge U B8 3PH, United Kingdom, Christian.Valente@brunel.ac.uk, Gautam Mitra

We report on the work in progress in the design and the enhancement of our Stochastic Programming Integrated Environment: SPInE. We describe the following design features and usage scenarios of SPInE: (a) the connection of Stochastic AMPL to a scenario generator library; (b) the use of SPInE as an ex-ante decision tool; (c) how SP solvers are adopted and embedded to compute the distribution of the objective function value; (d) how back testing, simulation and stress testing are organised.

2 - HMM Based Scenario Generation for an Investment Optimization Problem

Christina Erlwein, Doctoral Candidate, CARISMA, Brunel University, John Crank Building, Uxbridge UB8 3PH, United Kingdom, Christina.Erlwein@brunel.ac.uk, Gautam Mitra, Diana Roman

We formulate an investment decision problem within a CVaR framework. Based on a hidden Markov model filtering approach we develop a scenario generator for modeling asset price dynamics. Historical data sets for gold spots and the FTSE 100 are filtered to calculate optimal parameter estimates within the hidden Markov model, scenarios for the time series are generated based on these optimal parameter estimates. The HMM parameter filtering method generates scenarios which lead to stable in-sample solutions for various investment optimization problems.

3 - Information Relaxations and Duality in Stochastic Dynamic Programs

David Brown, Assistant Professor, Duke University: Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States, James Smith, Peng Sun

We describe a dual approach to stochastic dynamic programming: we relax the constraint that the chosen policy must be temporally feasible and impose a penalty that punishes violations of temporal feasibility. We describe the theory underlying this dual approach and demonstrate its use in inventory models and option pricing models.

4 - Network Design Under Threat

Suvrajeet Sen, Professor, The Ohio State University, Industrial and Systems Engineering, Columbus, OH, United States, sen.22@osu.edu

This presentation discusses a network design model in the presence of threats. By using stochastic mixed-integer programming, we are able to accommodate cases in which design decisions affect the probability of attack. We study the differences between deterministic design models, and these stochastic MIP models.

■ WB16

C-Room 619

Nonconvex MINLP Applications

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Kevin Furman, ExxonMobil, 1545 Route 22 East, Annandale, NJ, 08801, United States, kevin.c.furman@exxonmobil.com

1 - Lagrangian Branch and Cut for Optimization of Nonconvex MINLP Hierarchical Systems

Jeremy Michalek, Assistant Professor, Carnegie Mellon University, Scaife Hall 323, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States, jmichalek@cmu.edu

We address a class of nonconvex MINLP problems for the design of systems composed of a hierarchy of subsystems by applying a Lagrangian branch and cut algorithm. We demonstrate the approach using two examples: product family optimization and hierarchical layout optimization, and we compare efficiency and optimality.

2 - Decomposition Method for Mixed Integer Linear Bi-level

George Saharidis, Research Associate, Rutgers University, 98 Brett Road, Piscataway, NJ, 08540, United States, saharidis@gmail.com, Marianthi Ierapetritou

The majority of scientific results in bi-level optimization has focused in the linear version of the problem. The mixed integer linear bi-level problem (MILBP) continues to be a difficult task. We present a new approach in order to solve MILBP based on decomposition methodology.

3 - Short-term Operational Planning in Upstream Natural Gas Production Networks

Ajay Selot, Chemical Engineering, Massachusetts Institute of Technology, 66-365, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States, selot@mit.edu, Paul Barton

We present an operational planning framework for upstream natural gas networks whose features are inspired by the Sarawak Gas Production System in Malaysia. It incorporates models of the production infrastructure and the contractual framework. Customized heuristics that exploit problem structure are required for global solution of the resulting nonconvex MINLP in a branch-and-bound framework. A strategy for efficient solutions of hierarchical multiobjective instances is also discussed.

4 - A Mixed Integer Nonlinear Program with Complementarity Constraints for Reinforced Concrete Design

Andres Guerra, PhD Candidate, Colorado School of Mines, 1500 Ilinois St, Golden, 80401, United States, aguerra@mines.edu, Alexandra Newman

A novel formulation aiming to achieve optimal design of reinforced concrete (RC) structures is presented here. The explicit optimization formulation incorporates, inter alia, stiffness correlation among all structural members via finite element analysis and complementarity constraints to model nonlinear material response. Optimal sizing and reinforcing for beam and column members in multi-bay and multi-story RC structures result in cost savings over typical-practice design solutions.

■ WB17

C-Room 620

Information Systems

Contributed Session

Chair: Sridhar Narasimhan, Professor, Georgia Tech, 800 W Peachtree St., Atlanta, GA, 30308, United States, sri@mgt.gatech.edu

1 - Global E-trade Framework and its Case Study

Hag-Min Kim, Professor, Scjool of International Trade and Business, Kyung Hee University, Hoeggi-dong #1, Dongdaemun-Gu, Seoul, Korea, Republic of, edoctor@khu.ac.kr

This paper discusses global e-trade framework and in particular foucses on the Korea e-trade initiatives. The e-trade promotions in Korea has been largely made both at government and corporation levels. It has been found that the e-trade study should be managed in systematic way and for this reason this paper suggests an international e-trade framework. The validation comes from many information system literatures and some case study results will also be presented.

2 - Antecedents of Mobile Data Service Success
Byoungsoo Kim, Korea Advanced Institute of Science and Technology, 207-43, Chongryangri-dong, Dongdaemun-gu, Seoul, Korea, Republic of, tree9901@kgsm.kaist.ac.kr, Minnseok Choi, Ingoo Han

This study enhances our understanding of key factors affecting M-satisfaction toward MDS by posing the following research question: How does MDS information and system characteristics affect M-satisfaction, continued usage intention, and M-loyalty behaviors? Based on motivation theory and satisfaction model, this study developed a model for explaining how MDS information and system characteristics may affect M-satisfaction.

3 - The Impact of Trust on Intention to Use in Virtual Communities According to Customer Type
Hyoung-Yong Lee, Assistant Professor, School of Business Administration, Hansung University School of Business Administration, 389 Samseon-dong 3-ga, Seongbuk-gu, Seoul, 136-792, Korea, Republic of, leemit@hansung.ac.kr, Hyunchul Ahn, Kyong Joo Oh

Utilization of established virtual communities as a source of profit has also become crucial for the virtual community service providers. Thus, the service providers should try to find out the type of users: i.e., whether it is utilitarian or hedonic. They would then be able to ascertain what type of trust should be facilitated. When they understand which kind of trust they need to develop to induce members to use the site more, they can manage virtual communities more efficiently.

4 - Computational Experiments for Sequential Grid Computing
Sridhar Narasimhan, Professor, Georgia Tech, 800 W Peachtree St., Atlanta, GA, 30308, United States, sri@mgt.gatech.edu, Sam Ransbotham, Saby Mitra, Ishwar Murthy

We present new models for determining the optimal sequence of computers to use for handling big computing jobs in an uncertain environment. We present static and dynamic models for this problem. Extensive computational results are also presented.

■ WB18

C-Room 201

Panel: Meeting the Challenges of Solver Independence

Sponsor: INFORMS Computing Society
Sponsored Session

Chair: Lou Hafer, Simon Fraser University, Computing Science, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, lou@cs.sfu.ca

1 - Panel: Meeting the Challenges of Solver Independence
Moderator: Lou Hafer, Simon Fraser University, Computing Science, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, lou@cs.sfu.ca, Panelist: Kipp Martin, Steven Dirkse, Ted Ralphs

The panelists will draw on their 80 years of collective experience using and implementing optimisation software to provide an informative and spirited discussion of the right way to do it, the wrong way to do it, the small pleasures, and the petty annoyances of writing solver-independent software. From efficient creation of call-back functions for Hessian calculation to suppressing unwanted output, we have opinions, and we're not afraid to use them!

■ WB19

C-Room 203

Workforce Flexibility in Service Systems

Cluster: Workforce Engineering
Invited Session

Chair: Eylem Tekin, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, eylem@tamu.edu

1 - Benefits of Cross-training in a Skill-based Routing Contact Center
Baris Balcioglu, Assistant Professor, University of Toronto, baris@mie.utoronto.ca, Mahvareh Ahghari

We study customer contact centers providing different types of services to impatient customers. Our goal is to assess the performance improvement via cross-training the agents. We also compare the performance of the contact centers operating under different strategies. Our simulation study shows that limited cross-training, with 2 skills per agent, results in considerable performance improvements.

2 - On Comparing Flexibility Structures in Parallel Queueing Systems
Douglas G. Down, Associate Professor, McMaster University, downd@univmail.cis.mcmaster.ca, Sigrun Andradottir, Hayriye Ayhan

We discuss two issues in the problem of comparing flexibility structures in systems of parallel servers. The first is the role of the server's scheduling policy. The second is how one may incorporate the variability of underlying distributions when making comparisons.

3 - Design Issues in Service Systems with a Mix of Dedicated and Cross-trained Servers
Eylem Tekin, Assistant Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, eylem@tamu.edu, Sam Merriweather

We consider pools of dedicated and cross-trained servers working in parallel. We first discuss the policies for customer routing. Then, we investigate how various system parameters such as the number of servers, arrival rates, and service times affect the decisions related to cross-training.

■ WB20

C-Room 204

Distributed Decision Making

Sponsor: Decision Analysis
Sponsored Session

Chair: Christian Wernz, University of Massachusetts Amherst, 160 Governors Drive, Amherst, MA, 01003, United States, cwernz@ecs.umass.edu

Co-Chair: Abhijit Deshmukh, University of Massachusetts Amherst, 160 Governors Drive, Amherst, MA, 01003, United States, deshmukh@ecs.umass.edu

1 - Multilevel Distributed Optimization in Dynamic Supply Chain Management
Laura Di Giacomo, Doctoral Student, Universita' degli Studi di Roma, Piazza Aldo Moro 5, Rome, 00185, Italy, l.digiacomo@caspur.it, Giacomo Patrizi

A distributed multilevel dynamic optimization problem is solved in the space of the control variables and in the parameter estimation space, through a general variational inequalities formulation, so that uncertainties can be handled and 'certainty equivalents' of the optimal policies can be derived. Convergence and experimental results will be presented from Supply Chain implementations.

2 - Technology Investment and Capacity Decisions of a Telecommunications Operator
Taner Bilgiçe, Bogazici University, Department of Industrial Engineering, Bebek, Istanbul, 34342, Turkey, taner@boun.edu.tr

We investigate technology investment and capacity decisions of a telecom operator under different scenarios. In all scenarios, uncertain demand is positively affected by successful technology adoption. This, in turn, has an effect on peak capacity design decision. We formulate the problem in a decentralized setting under vertical and horizontal competition and show that variants of profit sharing contracts coordinate such systems.

3 - Bridging Organizational Scales with a Multiscale Decision-Making Model
Christian Wernz, University of Massachusetts Amherst, 160 Governors Drive, Amherst, MA, 01003, United States, cwernz@ecs.umass.edu, Abhijit Deshmukh

An agent's decision influences other agents and their decisions across all levels in an organization. Our model captures and analyzes multiscale effects that occur in hierarchical organizations. The agents' interaction is represented with dependency graphs and analyzed using phase diagrams and Nash equilibria. Results show how to improve the decision-making capabilities of agents, how to reduce information exchange needs, and determine organizational design that motivates cooperative behavior.

■ WB21

C-Room 205

Axiomatic Foundations of Risk Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Michael Zabarankin, Assistant Professor, Stevens Instiute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Michael.Zabarankin@stevens.edu

1 - Risk Tuning with Generalized Linear Regression
R. Tyrrell Rockafellar, Professor Emeritus, University of Washington, Department of Mathematics, Box 354350, Seattle, WA, 98195-4350, United States, rtr@math.washington.edu, Michael Zabarankin, Stan Uryasev

Linear regression, as a way of approximating a random variable by other random variables, is usually approached through least squares, but it can also be carried out in other ways. This possible through the coordination of axiomatic concepts of error measure, deviation measure and risk measure with certain statistics. The choice of approach can be tuned to the needs of a particular model in finance or OR more generally.

2 - Deviation Measures: Theory and Applications
Michael Zabarankin, Assistant Professor, Stevens Instiute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States, Michael.Zabarankin@stevens.edu

During the last several years, significant progress has been made in the development of the theory and application of general deviation measures, introduced by Rockafellar, Uryasev and Zabarankin. The talk will discuss the framework of general deviation measures in the context of portfolio analysis, capital asset pricing model, market equilibrium, generalized linear regression, the theory of choice, maximum entropy principle, and probability inequalities.

3 - Higher Moment Coherent Risk Measures
Paul Krokhmal, Assistant Professor, University of Iowa, 2403 Seamans Center, Iowa City, IA, 52242, United States, krokhmal@engineering.uiowa.edu

We discuss modeling of risk-averse preferences in stochastic programming problems using risk measures. By developing simple representations that express risk measures via specially constructed stochastic programming problems, we introduce a new family of higher-moment coherent risk measures (HMCR). It is demonstrated that the HMCR measures are SSD-compatible, can be efficiently implemented in stochastic optimization models, and perform well in portfolio optimization case studies.

4 - Mean-deviation Analysis in the Theory of Choice
Anton Molyboha, PhD Student, Stevens Institute of Technology, Hoboken, NJ, United States, amolyboh@stevens.edu, Bogdan Grechuk, Michael Zabarankin

Mean-deviation analysis, along with the existing theories of coherent risk measures and dual utility, has been examined in the context of the theory of choice, which studies individual preferences in terms of ordering relationships. Axiomatic foundation of the theory of coherent risk measures has been obtained as a relaxation of the axioms of the dual utility theory, and a further relaxation of the axioms has been shown to lead to the mean-deviation analysis.

5 - Maximum Entropy Principle with General Deviation Measures
Bogdan Grechuk, PhD Student, Stevens Institute of Technology, bgrechuk@stevens.edu, Michael Zabarankin, Anton Molyboha

A random variable maximizing Shannon differential entropy with constraints on the mean and quantile-based deviation measure has been shown to have a log-concave distribution. In the case of comonotonic deviation measure, an optimal distribution has been obtained in explicit form. Conversely, through maximum entropy principle, a log-concave distribution has been shown to correspond to a comonotonic quantile-based deviation measure.

■ WB22

C-Room 206

Decision Analysis Applications II

Contributed Session

Chair: Seth Guikema, Assistant Professor, Texas A&M University, 3136 TAMU, College Station, TX, 77843-3136, United States, sguikema@civil.tamu.edu

1 - Project Prioritisation Across Multiple Areas in Decision Conferencing
Alec Morton, Dr, London School of Economics and Political Science, Operational Research Group, London, WC2A 2AE, United Kingdom, A.Morton@lse.ac.uk

A distinctive feature of many Decision Conferencing interventions is that often the structure of the client organisation is explicitly represented as areas in the structure of the model. Drawing on experience in prioritising science projects in government and the private sector, this talk discusses how the area structure is used in the value model, and presents some new ideas about sensitivity analysis for balance across areas.

2 - Methodology for Selecting the Best Strategy for Transporting Heavy Oil from a Field of Ecopetrol S.A
Mario Castillo, Titular Professor, University of Los Andes, Calle 19A No. 1-37 Este, Bogota, DC, 11111, Colombia, mcastill@uniandes.edu.co, Alvaro Mendoza, Sergio Cabrales

Because of the decrease of oil reserves in Colombia, the heavy oil exploitation has become a new business opportunity for the petroleum companies. The Colombian Petroleum Company, ECOPETROL, has considerable heavy oil reserves in one of its fields and must select the best alternative to transport it among the near stations. This paper presents a decision analysis methodology that considers the economic performance and the synergy with other projects of the company to select the best alternative.

3 - Modeling of Business Systems Dynamic Development
Igor Muradyan, PhD Student, Institute of Control Sciences, Profsoyuznaya 65, Moscow, 117997, Russia, muradyan_igor@mail.ru, Semen Yuditskiy, Ludmila Zheltova

We suggest a model that evaluates firm's performance and realization of objectives under various economical and non-economical environmental changes. Our model enables a firm to make a right decision in development of its survival strategy under different economical and social circumstances. Model is based on Petri nets that could be effectively used to generate scenarios that approximate firm's development after a particular decision is made.

4 - Construction Risk Analysis Using the Advanced Programmatic Risk Analysis and Management Model
Seth Guikema, Assistant Professor, Texas A&M University, 3136 TAMU, College Station, TX, 77843-3136, United States, sguikema@civil.tamu.edu, William Imbeah

Construction managers face many risks, making it difficult to meet project objectives of cost, schedule and quality. Decision support tools based on Risk and Decision Analysis can help manage risk in construction projects. This talk demonstrates the usefulness of the Advanced Programmatic Risk Analysis and Management Model, originally developed for the aerospace industry, for the construction industry and discusses the changes in APRAM needed to ease its use in the construction industry.

■ WB23

C-Room 208

Queueing Models I

Contributed Session

Chair: Zhe George Zhang, Professor, Western Washington University, Department of Decision Sciences, Western Washington University, Bellingham, WA, 98225, United States, George.Zhang@wwu.edu

1 - Real-Time Scheduling Policies for Multiclass Call Centers with Impatient Customers
Oualid Jouini, Ecole Centrale Paris, Grande Voie des Vignes, Châtenay-Malabry, Ce, France, walid.jouini@ecp.fr, Auke Pot, Ger Koole, Yves Dallery

We consider a call center model with two classes of impatient customers, VIP and less important ones. We focus on developing queue joining and call selection heuristics. The policies satisfying performance constraints related to the ratio of the loss probabilities, as well as the variance of waiting times in queue. We propose and compare several real-time scheduling policies in order to reach our objective. The policies are characterized by simplicity and ease of implementation.

2 - Queues with Lévy Input and Hysteretic Control
Rene Bekker, Vrije Universiteit Amsterdam, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, rbekker@few.vu.nl

We consider a (doubly) reflected Lévy process where the Lévy exponent is controlled by a hysteretic policy consisting of two stages. In each stage there is typically a different service speed or arrival rate. We determine the steady-state performance, both for systems with finite and infinite capacity. Thereby, we unify and extend many existing results in the literature focusing on the special cases of M/G/1 queues and Brownian motions.

3 - Transient Analysis Using Diffusion Approximation for Build-up Period of Peer-to-peer Networks
Young Myoung Ko, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States, ymko@tamu.edu, Natarajan Gautam

In this research, we consider a multi-server queueing system applicable to multimedia service with peer-to-peer networks where customers upon receiving service could become servers and servers could depart from the system. We model growth and decay of both users as well as servers using a diffusion approximation to determine an optimal initial service capacity.

4 - Modeling Production and Inventory Systems with a Multi-server Vacation Model

Zhe George Zhang, Professor, Western Washington University, Department of Decision Sciences, Western Washington University, Bellingham, WA, 98225, United States, George.Zhang@wwu.edu

In this research, we investigate a production system with random demand and production times by utilizing a multi-server queueing model with server vacations. With such a model, the issue of joint capacity and inventory decision is addressed. Using some approximations and bounds, we develop some closed form solutions to the optimal policy parameters. Numerical examples are also presented to show the accuracy of these formulas.

■ WB25

C-Room 210

Statistics/Quality Control I

Contributed Session

Chair: Jamison Kovach, Assistant Professor, University of Houston, 312 Technology Building, University of Houston, Houston, TX, 77204, United States, jvkovach@uh.edu

1 - A New Multivariate Control Scheme Using P-values

Sang-Ho Lee, POSTECH, San31 Hyoja-dong, Pohang, Korea, Republic of, samo35@postech.ac.kr, Eung-Gu Kim, Han-Min You, Chi-Hyuck Jun

A new multivariate control scheme using the p-values associated with Hotelling's T2 statistic is proposed. The problem is viewed as a multiple significance testing, where the null hypothesis is the process mean unchanged at a new subgroup. The proposed scheme utilizes the Benjamini-Hochberg procedure for controlling the false positive rate. Some simulations were carried out to demonstrate and compare the performance of the proposed scheme with Shewhart scheme in terms of the average run length.

2 - Semiconductor Yield Modeling Using Generalized Linear Models

Dana Krueger, Arizona State University, P.O. Box 875906, Tempe, AZ, 85287-5906, United States, danak@asu.edu, Douglas Montgomery

Semiconductor yield modeling is essential to identifying processing issues, improving quality, and meeting customer demand. Historically, yield models have been developed at the wafer level. Our work uses generalized linear models to model yield at both the die and wafer levels for a real industrial dataset using defect counts from each layer of the wafer and die location parameters. We examine pass/fail responses as well as building models for specific failure bins.

3 - Change Diagnosis of the Time-to-failure Data with the Cox Proportional Hazard Model

Zhiguo Li, University of Wisconsin, Madison, 1513 University Avenue, Madison, United States, zhiguoli@wisc.edu, Shiyu Zhou

The changes or trends of the hazard rates for specific events are of high importance in both healthcare, such as public health surveillance, and engineering fields. Since the Cox PH Model is widely used for time-to-failure (survival) data, the method is developed to differentiate the changes in the baseline hazard and those in the effects of covariates for diagnosis purpose. The performance is investigated in terms of type-II error and case studies are presented to illustrate its effectiveness.

4 - A Robust Design Approach for Experiments with Restricted Design Points

Jamison Kovach, Assistant Professor, University of Houston, 312 Technology Building, University of Houston, Houston, TX, 77204, United States, jvkovach@uh.edu

Within the context of robust design investigations, we examine the use of D-optimal experimental designs, which provide an efficient method for experimentation when standard approaches are not suitable for the problem at hand. The performance of our proposed methodology is then compared with traditional approaches in which restricted design points are disregarded.

■ WB26

C-Room 211

Joint Session DM/QSR/ ICS/Computational Methods for Data Mining : Data Mining in Manufacturing and Web

Sponsor: Data Mining (Sponsored), Quality, Statistics and Reliability, INFORMS Computing Society

Sponsored Session

Chair: Myong K. (MK) Jeong, Assistant Professor, University of Tennessee, 311 ESH, Knoxville, TN, 37996, United States, mjeong@utk.edu

1 - A New Support Vector Based Wavelength Selection Method for NIR Spectra of Wood Products

Seung H. Baek, The University of Tennessee, Knoxville, TN, United States, sbaek4@utk.edu, Myong K. (MK) Jeong, Hyun W. Cho, Eun S. Youn

To ensure safe and long-lasting protection of wood products, some chemicals have been used for wood protection. Wood companies have tried to discriminate between woods treated and non-treated by a specific chemical. We propose a new support vector-based wavelength selection algorithm for near infrared spectra data of wood products. Experimental results show that the proposed method improves computation time as well as classification accuracy.

2 - A Personalized Recommendation Model Based on Hybrid Method

Sang Hyun Choi, chois@gsnu.ac.kr, Myong K. (MK) Jeong

In the recent trend of digital economy, firms are facing the challenges of providing differentiated products and services to each customer based on the purchasing information from the customers. This research suggests a new hybrid method for personalized recommendation that combines the collaborative filtering and content-based algorithm.

3 - Patient Rule Induction Method for Optimizing Multistage Manufacturing Processes

Doh-Soon Kwak, Doctoral Student, Pohang University of Science and Technology, San 31, Hyoja-dong, Nam-gu, Pohang, Ky, 790-784, Korea, Republic of, poskit@postech.ac.kr, Kwang-Jae Kim, Myeong-Soo Lee

Most of work in multistage manufacturing process optimization assume that data have been collected and suitable models have been built. However, a good model is not easy to obtain from operational data. This paper proposes an extension of the patient rule induction method as an alternative approach to optimizing multistage manufacturing processes. The performance and properties of the proposed method are discussed using a simulation study.

■ WB27

C-Room 212

Modeling Applications using Spreadsheets (and More)

Sponsor: Spreadsheet Productivity Research

Sponsored Session

Chair: Mukul Madahar, Assistant MBA Program Director, University of Wales Institute Cardiff, Cardiff School of Management, Colchester Avenue, Cardiff CF23 9XR, United Kingdom, MMadahar@uwic.ac.uk

1 - Application of Game Theory Under Repeated Market Play

Gerald Sheble, Maseeh Professor, Portland State University, 1900 SW 4th Ave, Ste 160, Portland, OR, 97201, United States, gbsheble@pdx.edu

Auction Markets simulation is standard to successful application of Game Theory to repeated auction market strategies. Repeated auction plays in the energy industry are based on the expected value of future plays. The linking of expected future outcomes to the daily bid/offer is investigated by this paper. Spreadsheet analysis is extendable to markets when there is constant movement of commodities through the supply chain and the equipment life cycle is expressed in decades instead of years.

2 - VolRight - A Tool for Distribution Volume Growth for Future Planning

Jessica Myers, OR Analyst, UPS, 1400 N. Hurstbourne Pkwy, Louisville, KY, 40223, United States, jemyers@ups.com, Keith Ware, Duane Hooper

The Long Range Planning function base their plans off a projected volume growth rate for the entire country. The VolRight tool was developed to help them distribute the projected volume growth across locations in accordance with historical trends while maintaining the national growth level. The spreadsheet calls Perl scripts to accesss and summarize the historical data, and then produces a center to center volume file to be used for planning purposes.

3 - A Categorization Model for Spreadsheet Use in Organizations

Mukul Madahar, Assistant MBA Program Director, University of Wales Institute Cardiff, Cardiff School of Management, Colchester Avenue, Cardiff CF23 9XR, United Kingdom, MMadahar@uwic.ac.uk, Pat Cleary

In this paper we expand upon a previous INFORMS paper which presented an analysis of proposed categorization models developed for spreadsheet use in organizations. We have now completed a further phase of research whose purpose was to refine the model and define specific model dimensions. We report on this further phase and outline a plan to fully validate the model.

4 - A Template for Planning and Optimizing Small Package Loads
Keith Ware, OR Manager, UPS, 1400 N. Hurstbourne Pkwy, Louisville, KY, United States, kware@ups.com, Jonathan Youngblood, Jim Murphy, Doug Mohr

UPS hub managers make weekly and daily adjustments to their sort load plans in order to adapt to different volume levels and/or planned changes in truck traffic. The load planning template is a spreadsheet based tool that gathers all the pertinent planning information, and enables a load planner to make and visualize the impact of changes to the plan. The tool also serves as a quasi-interface for an optimization model for developing a plan that minimizes handling and transportation costs.

■ WB28

C-Room 213

Operations Management III

Contributed Session

Chair: Baris Yalabik, Assistant Professor, University of Tampa, 401 W Kennedy Blvd Box O, Tampa, FL, 33606, United States, byalabik@ut.edu

1 - Aligning ERP with Process and Positioning Strategies
Arun Madapusi, Teaching Fellow, University of North Texas, Department of Management, PO Box 305429, Denton, TX, 76203, United States, madapusi@unt.edu, Pamela Rogers

A firm's sustained competitive advantage depends on how its processes, positioning strategies, and enterprise resource planning (ERP) systems fit and reinforce one another. However, mis-alignments between these three elements can adversely affect business performance. This study presents a systematic logic that firms can use to address such mis-alignment challenges.

2 - An Operational Ecology Model for Viability in a Complex Business Ecosystem
Namkyu Park, Asscociate Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States, namkyu@wayne.edu, Olusola Oduntan, Olugbenga Mejabi

Increased uncertainty in the business context of many companies is affecting their ability to remain viable. Maintaining the status quo is no longer a viable option, but adaptation and sensitivity to the needs of the marketplace are now a requirement for viability. An Operational Ecology Model is presented as a management framework for integrating the conflicting objectives of the operational ecosystem into a cohesive strategy that supports the improvement of the viability of the enterprise.

3 - Competitive Environment, Strategy, and Performance in the Supply Chain Network
Joungho Lee, PhD Candidate, Hong-ik University Dept.. of Business Administration, 72-1 Sangsoo-dong Mapo-gu, Seoul, 121-791, Korea, Republic of, leejoungho@hanmail.net, Choonho Ryu

This paper aims to identify the exploitative activities and exploratory activities in supply chain networks using adaptive system theory and analyzes them with empirical approach. The research investigates the direct or indirect influence of these activities of adaptive system on competitive capability and business performance in manufacturing firms, and empirically demonstrates successful ways to manage supply chain networks as adaptive system.

4 - Negotiating Change during the Adoption of a New Management Practice: The Case of Lean Manufacturing
Katherine Heynoski, PhD Candidate, University of Michigan, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, kheynosk@umich.edu

While many companies are eager to adopt the latest management fads, few are able to achieve the expected benefits from their implementation. This research examines what happens when a large, bureaucratic organization tries to imitate a popular work system. It is hypothesized that managers' deeply held values will influence the way change implementation is approached and how the management system is recontextualized. Specifically, organizations adopting lean manufacturing will be studied.

5 - Environmental Life Cycle Assessment: A Review
Baris Yalabik, Assistant Professor, University of Tampa, 401 W Kennedy Blvd Box O, Tampa, FL, 33606, United States, byalabik@ut.edu

We provide a review of Environmental Life Cycle Assessment (ELCA) as a strategic and operational tool. Specifically, we consider the implications of using ELCA for the operations function and discuss the effects on the overall strategy of a firm. Our objective is not only to describe the results obtained by previous literature but also to develop a prescriptive model synthesizing and extending those results.

■ WB29

C-Room 214

Joint Session OS/ICS: Recent Development in Software for Linear and Convex Optimization Problems

Cluster: Optimization /Computational Optimization and Software, INFORMS Computing Society

Invited Session

Chair: Erling Andersen, CEO, MOSEK ApS, Fruebjergvej 3 Box 16, Copenhagen, 2100, Denmark, e.d.andersen@mosek.com

1 - CVX: Software for Disciplined Convex Programming
Michael Grant, 100 Dovetail Lane, Georgetown, TX, 78628, United States, mcg@algorithmguy.com, Stephen Boyd

In this talk we present an overview of CVX, a software framework developed in MATLAB for constructing and solving disciplined convex programs. Constraints and objectives are specified in standard MATLAB syntax. In this talk we will demonstrate the software and discuss some of its more novel features, such as the automated conversion of geometric programs to semidefinite programs.

2 - On Popular Demand: A Python Interface to MOSEK
Ulf Worsoe, Senior Developer, Mosek ApS, Fruebjergvej 3, Box 16, Copenhagen, 2100, Denmark, ulf.worsoe@mosek.com

Python is a scripting language which is becoming increasingly popular. It is generally considered easy to learn and use, and it is distributed with a large standard library. MOSEK version 5.0 includes a complete Python interface to the MOSEK optimizers, implemented to induce a minimum overhead. We demonstrate some of the interface features that makes the Python interface a powerful prototyping and inspection tool.

3 - Solving Linear Optimization Problems with MOSEK
Bo Jensen, MOSEK ApS, C/O Symbion Science Park Fruebjergvej 3, Copenhagen, 2100, Denmark, bo.jensen@mosek.com

The software package MOSEK is capable of solving large-scale sparse linear optimization problems using either an interior-point, a primal simplex or a dual simplex algorithm. The aim of this talk is to present the simplex optimizers and the recent advances in their implementation. Moreover, we will present numerical results demonstrating the optimizers performance.

4 - On the Recent Advances in the Mosek Interior-point Optimizer
Erling Andersen, CEO, MOSEK ApS, Fruebjergvej 3 Box 16, Copenhagen, 2100, Denmark, e.d.andersen@mosek.com

The interior-point optimizer implemented in MOSEK is intended for solution of large scale sparse linear, conic, and convex problems. In this talk we will present the recent advantages in the implementation of interior point optimizer for linear problems. These advances includes an improved stopping criteria, better numerical stability and enhanced efficiency. Finally, we will present computational results.

■ WB30

C-Room 2A

Quality Control and Improvements for Multistage Systems II

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, james.kong@okstate.edu

1 - Multi-step Control in Semiconductor Manufacturing
Joe Qin, University of Texas, 1 University Station C0400, Austin, TX, United States, qin@che.utexas.edu, Erhan Kutanoglu, Clare Schoene

Semiconductor manufacturing processes consist of hundreds of discrete steps, and upon completion measurements are made to ensure electrical specifications are met. Current manufacturing technology controls individual processing steps but does directly control electrical parameter values. A multi-step algorithm that coordinates lower level controllers while addressing the optimality of the entire process is proposed. The algorithm uses a partial least squares model and available data to predict outputs and determine optimal set points for the subsequent processing steps.

2 - Enhanced Piecewise Least Squares Approach for Diagnosis of Ill-Conditioned Multi-station Assembly with Compliant Parts

Darek Ceglarek, Professor, 3Dept.. of Industrial and Systems Engineering, University of Wisconsin-Madison, Madison, WI, 53706, United States, darek@engr.wisc.edu, Z henyu (James) Kong, Atul Tripathi, Prakash

Assembly process-induced dimensional variation has a significant impact on product quality and functionality. Furthermore, part compliance/flexibility frequently results in ill-conditioned assembly systems posing enormous challenges to process control and fault failure diagnosis. We propose an Enhanced PLS-based diagnostic methodology which searches for a set of latent vectors with the search constrained by assembly response function–the Stream-of-Variation (SOVA) model of assembly system–and which performs decomposition of response based on the end-of-line-measurements.

3 - Stream of Variation Analysis in Assembly Systems: Modeling and Its Applications

Wenzhen Huang, Assistant Professor, Mechanical Engineering Department, University of Massachusetts Dartmouth, North Dartmouth, MA, 02747, United States, whuang@umassd.edu, Zhenyu (James) Kong, Darek Ceglarek

A 3D rigid assembly modeling technique is developed for stream of variation analysis (SOVA) in multi-station processes. An assembly process is modeled as a spatial indexed state transition dynamic system. The model takes into account product and process factors such as: part-to-fixture, part-to-part and inter-station interactions, which represent the influences coming from both tooling errors and part errors. The incorporation of the virtual fixture concept and inter-station interaction leads to the generic, unified SOVA model formulation. An automatic model generation technique is also developed for surmounting difficulties in modeling based on first principles. It enhances the applicability in modeling complex assemblies. The model is validated using industrial case studies and series of simulations conducted using standardized industrial software (3DCS Analyst). The recent advances of SOVA model in application is also presented, which is composed of (1) multivariate process capability for system robustness evaluation; (2) tolerance design allocation; and (3) diagnosis. Sensitivity and multivariate process capability analysis using Yield Surrogate Model are introduced for system synthesis, which is formulated as a probabilistic optimization problem. Strategies and algorithms are developed for optimization in synthesis. The sensitivity and Orthogonal Diagonalization Analysis are developed for dimensional fault diagnosis. Comprehensive case studies, including either software simulation cases and industrial cases, were conducted for validation purposes.

4 - Incorporation of Some Gd&T Aspects into Stream of Variation Analysis for Multistage Assembly Processes

Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States, james.kong@okstate.edu

A large body of research has been conducted in variation propagation for multistage assembly processes. Most of them were mainly focused on the process modeling, i.e., how the obtain the coefficient matrix which represents the linear relationship between input variable (error sources such as tooling variation) tolerance and output variable (measurement points) variation. For modeling of the input variable tolerance, the assumptions of linear and independent tolerances are made. However, these assumptions may bring some conflicts when applying the model for real applications. This paper discusses some GD&T aspects, such as composite tolerances, circular tolerances, bonus tolerances and clearance tolerance which are widely used in real industrial applications. The mathematical modeling of these tolerances is developed and incorporated into the developed 3D stream of variation analysis (SOVA) model. A few case studies are provided which use the commercial Monte Carlo simulation software as bench mark to validate the results from SOVA. The reasonably consistent comparison results demonstrate the validity of the proposed method.

■ WB31

C-Room 2B

Reliability II

Contributed Session

Chair: Hsiao-Hui Lee, PhD Candidate, University of Rochester, Simon School, Rochester, NY, United States, hsiao-hui.lee@simon.rochester.edu

1 - Warranty Cost Analysis Under Imperfect Repair

Gulay Samatli, Drexel University, Drexel University, Department of Decision, Science 204 Academic Building, Philadelphia, PA, 19104, United States, samatli@bilkent.edu.tr, Mehmet Rustu Taner

This study proposes alternative repair strategies for one- and two-dimensional warranties with the objective of minimizing manufacturer's expected warranty cost. Numerical experimentation with a model based on quasi renewal processes indicates that performance of the repair strategy depends on various factors such as product reliability, cost characteristics, and warranty structure.

2 - Optimal Highway Inspection and Maintenance Policies Under Uncertainty

Thomas Yeung, Assistant Professor, Ecole des Mines de Nantes, 4, Rue Alfred Kastler, BP 20722, Nantes, 44307, France, thomas.yeung@emn.fr, Bruno Castanier

Every year billions of dollars are spent on highway maintenance. We propose to develop an accurate model of road degradation by decomposing the cracking process into two phases: 1) crack initiation modeled as a Poisson process and 2) crack propagation modeled as a Gamma process. We formulate an optimal policy for highway inspection in conjunction with maintenance and rehabilitation actions by minimizing cost subject to a specified level of road safety.

3 - Software FMEA

Fran Zenzen, Program Manager, General Dynamics, 8201 E. McDowell Rd, MS H8260, Scottsdale, AZ, 85257, United States, fran.zenzen@gdc4s.com, Greg Twaites

Today's companies need to produce defect-free software that meets customer requirements. Critical customer requirements must operate prior to delivery. One way to ensure customer satisfaction is to use Failure Modes and Effects Analysis (FMEA) to identify critical requirements and implementation strategies during project planning. A cost-effective software implementation strategy is provided. The strategy integrates FMEA into the software development process.

4 - Clinical Laboratory Operation: Trade-offs Between Capacity, Redundancy, and Service Contract

Hsiao-Hui Lee, PhD Candidate, University of Rochester, Simon School, Rochester, NY, United States, hsiao-hui.lee@simon.rochester.edu, Gregory Dobson, Vera Tilson

We study the trade-offs between capacity, number of machines, and service contract when purchasing machines for a clinical blood lab in the hospital. The objective is to minimize mean wait time for jobs under a budget constraint. We then demonstrated how the machine failure, total capacity, redundancy, and increasing arrival rate, affect the optimal solution.

■ WB32

C-Room 302

Planning

Contributed Session

Chair: Sanyogita Lakhera, Graduate Student, University of Illinois at Urbana-Champaign, 117 Transportation Bldg, 104 s Mathews, Urbana, IL, 61801, United States, lakhera2@uiuc.edu

1 - Impacts of Innovation Intensity on Revenue Performance and Export Performance

Xiaolin Li, PhD Candidate, Kent State University, Department of M&IS, Kent, OH, 44242, United States, xli8@kent.edu

This paper investigates the effect of a firm's innovation intensity on its overall competitiveness and global competitiveness through examining the impact of percentage of R&D workforce on revenue performance and export performance. The study reveals that innovation intensity positively impacts revenue performance but has little effect on a firm's export performance.

2 - J-Curve Effects on CEO Succession: Expectations vs. Performance as a Determinant of CEO Dismissal

William S. Hesterly,University of Utah, David Eccles School of Business,, 1645 E. Campus Center Drive #106, Salt Lake City UT 84112, bill.hesterly@business.utah.edu, Harris Sondak, Jonathon H. Westover

We apply and extend James Davies, "Towards a Theory of Revolution" (ASR, 1962), framework for understanding political revolutions to understanding a revolutionary event in business organizations—forced CEO departures. When do firms decide to pursue a new direction by making a change at the top level of management? Up to this point, the research on CEO succession has primarily used overall firm performance as the primary predictor of such succession events (poor performing firms are much more likely to replace CEOs than other firms), while controlling for such variable categories as industry/organizational factors and various CEO characteristics. However, Davies (1962) states that, "Revolutions are most likely to occur when a prolonged period of objective economic development is followed by a short period of sharp reversal.

3 - Decision Support Tools for Approximating Utility Distribution Networks in the Urban Environment

Sanyogita Lakhera, Graduate Student, University of Illinois at Urbana-Champaign, 117 transportation bldg, 104 s mathews, Urbana, IL, 61801, United States, lakhera2@uiuc.edu, Uday Shanbhag, Kevin Waicekaus

We consider the problem of estimating the distribution system design from GIS data. By transforming the image data into an electrical load distribution over a prescribed grid, we consider a related question; how to determine the optimal flows on such a grid, given a set of substations. The unknown substations are determined by approximately solving the related mixed-integer nonlinear program through smoothing approaches. Finally, we solve the load flow equations to obtain required flows.

■ WB33

C-Room 303

Adaptive Route Choice Models

Sponsor: Transportation Science & Logistics
Sponsored Session
Chair: R. (Jay) Jayakrishnan, UCI, rjayakri@uci.edu

1 - Adaptive Route Choice Models

Song Gao, Assistant Professor, University of Massachusetts Amherst, 16B Marston Hall, 130 Natural Resources Road, Amherst, MA, 01003, United States, songgao@ecs.umass.edu, Emma Frejinger, Moshe Ben-Akiva

We specify and estimate adaptive route choice models that explicitly capture travelers route choice adjustments according to real-time information in a stochastic time-dependent network. Two types of adaptive route choice models are studied: a sequence of path choice models at every intermediate decision node; and a routing policy choice model where the alternatives correspond to decision rules at the origin rather than simple paths. The models are estimated based on a Swedish GPS data set.

2 - Online Routing with Nonlinear Utility Functions: Extensions and Examples

Stephen Boyles, The University of Texas at Austin, 1 University Station C1761, Austin, TX, 78705, United States, sboyles@mail.utexas.edu, S. Travis Waller

Extensions are made to an earlier online non-additive routing algorithm to account for additional dependency structures among stochastic arcs in the network. Additionally, the solution sensitivity is explored by considering different types of disutility function, representing a variety of risk preferences and functional forms.

3 - Using Vehicles as Probes in the System-optimum Network Assignment Under Uncertainty

Natalia Ruiz Juri, University of Texas at Austin, Earnest Cockrell Jr. Hall, 6.2, Austin, TX, United States, natiruizjuri@gmail.com, S. Travis Waller

The advances in wireless information technologies facilitate the collection and distribution of real-time data about the state of stochastic networks. This work studies the impacts of such information on the system optimum assignment of wireless-equipped assets. Mathematical formulations are provided for different probe routing strategies and network characteristics. Optimal solution algorithms and efficient heuristics procedures are discussed and compared.

4 - Almost Sure Asymptotic Optimality in Online Routing Problems

Michael R. Wagner, Assistant Professor, Department of Management, Cal State East Bay, 25800 Carlos Bee Blvd, Hayward, CA, 94542, United States, michael.wagner@csueastbay.edu, Patrick Jaillet

We consider online routing problems such as the online TSP. The problems are online since the problem instance is revealed incrementally. We introduce probabilistic assumptions as a tool to study online algorithms that do not utilize the probabilistic information. Under very mild assumptions we show that many online algorithms are asymptotically optimal, with probability one.

■ WB34

C-Room 304

Transportation Network Calibration, Consistency and Flexibility

Sponsor: Transportation Science & Logistics
Sponsored Session
Chair: Srinivas Peeta, Professor, Purdue University, Civil Engineering, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States, peeta@purdue.edu

1 - Consistency-seeking for Behavior-based Traffic Routing Strategies

Alexander Paz, Senior Professional, Cambridge Systematics, 218-15 Nimitz Drive, West Lafayette, IN, 47906, United States, apaz@purdue.edu, Srinivas Peeta

A fuzzy control framework is used to enhance, based on real-time data measurements, the consistency of a controller-estimated driver behavior model which is a key component in the determination of information-based traffic routing strategies. Enhancing the consistency of the controller-estimated driver behavior model results in more consistent/reliable information-based traffic routing strategies.

2 - Flexible Network Design with Demand Elasticity and Income Effect

Gopal Patil, PhD Candidate, Rensselaer Polytechnic Institute, JEC-4002, Dept. of Civil Engineering, Troy, NY, 12180, United States, patilg@rpi.edu, Satish Ukkusuri

Flexible network design problem (FNDP) is a multi-stage network improvements problem where the decision makers get options of changing, delaying, or canceling the future improvements under network uncertainty. Improvements reduce travel costs which will have impact on network demand and travelers income. In this study we incorporate demand elasticity and income effect of network improvements.

3 - Calibration of Dynamic Traffic Assignment with Linear Programming Techniques

Varunraj Valsaraj, Graduate Research Assistant, The University of Texas at Austin, 1 University Station C1761, ECJ Hall Suite 6.2, Austin, TX, 78712, United States, varunrajv@yahoo.co.in, Dung-Ying Lin, S. Travis Waller

Calibration of dynamic traffic assignment (DTA) to match the observed flows has been one of the key challenges in the deployment of DTA on real world networks. The input parameters can be calibrated within bounds to match the flows. We investigate the linear programming techniques to determine the optimal combination of input parameters that minimizes the error between DTA and observed flows. Numerical experiments are presented and discussed.

■ WB35

C-Room 305

Simulation-based Emergency Response Planning

Sponsor: Transportation Science & Logistics
Sponsored Session
Chair: Shengnan Wu, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, SHW14@PITT.EDU

1 - Emergency Response Planning

Eva K. Lee, Associate Professor & Director, Georgia Institute of Technology, Center for OR in Medicine & HealthCare, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States, evakylee@isye.gatech.edu, Ferdinand Pietz, Bernard Benecke, Chien-Hung Chen

City readiness and emergency response for biodense and infectious disease outbreaks involves multi-level strategic and operational planning of the public health infrastructure. We provide an overview of infrastructure networks and highlight some challenges in emergency preparedness and response. Strategic stockpile, medical supply distribution, routing of the population, and various issues in logistics and transportation will be discussed and analyzed.

2 - Modeling to Improve Incident Response

William Wallace, Professor, Department of Decision Sciences and Engineering Systems, Rensselaer Polytechnic Institute, CII 5117 110 Eighth St, Troy, NY, 12180, United States, wallaw@rpi.edu, Paul Salasznyk, Jing Gong, Earl Rusty Lee

Incident response must be faster, more integrated, and more intelligent in responding to events in order to reduce the human, economic and environmental losses. Ongoing research to improve incident response time is being conducted in the Capital District Region of NY, USA. The focus of the work is on improving data sharing among first responders by using data mining and simulation to determine data needs and timing requirements.

3 - Evaluating Epidemic Control Strategies Using BioWar, a City-scale Multi-agent Simulation

Virginia Bedford, Carnegie Mellon University, School of Computer Science, 5000 Forbes Avenue, Pittsburgh, PA, 15213-3891, United States, vbedford@cmu.edu, Bruce Lee, Kathleen Carley

Many strategies have been proposed to prevent and/or control a potential mass infectious disease epidemic/pandemic such as influenza. These include mass vaccination, anti-viral distribution, and social distancing policies such as school and work closures, quarantine, and isolation. Using BioWar, a multi-agent, city-scale model that incorporates social networks, we designed an influenza epidemic simulation and virtual experiments to test the efficacy and impact of these potential strategies.

4 - Simulation-based Real-time Decision Making for Disaster Responses

Shengnan Wu, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States, SHW14@PITT.EDU, Oleg Prokopyev, Larry Shuman, Bopaya Bidanda, Carey Balaban, Matthew Kelley, Ken Sochats, Bryan Lawson, Ming Cheng

Recently, disaster planning has drawn great attention due to the increasing exposure of society to both terrorist attacks and natural events. With substantial detail, we built an agent-based discrete event simulator to assess the performance of the disaster responses. This very large model requires a considerable amount of computer time to execute. We are developing a heuristic to quickly locate very good solutions so that the system can be used for real time decision making during the disaster.

■ WB36

C-Room 306

Intermodal Transportation Network Modeling

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Thanasis Ziliaskopoulos, Professor, University of Thessaly, Pedion Areos, Volos, Vo, 38334, Greece, ziliasko@uth.gr

1 - Intermodal Freight DTA Platform: Application to Evaluation of New Services in European Corridor

Hani Mahmassani, Professor, The University of Maryland at College Park, Department of Civil & Environmental Engi, College Park, MD, 20742-3021, United States, masmah@umd.edu, April Kuo, Chung-Cheng Lu, Rahul Nair, Jing Dong, Kuilin Zhang, Elise Miller-Hooks, Vishnu Arcot

New rail and intermodal services in a European corridor are evaluated using a dynamic simulation-based freight network assignment model, that incorporates mode and intermodal service choice along with path assignment. The simulation captures terminal delays which feed back to the shipper decisions to compute an equilibrium solution where appropriate.

2 - System Optimal Assignment Under User Specific Time Constraints

Deepak Kumar, PhD Candidate, University of Texas at Austin, 1 University Station C1761, ECJ Hall 6.202, Austin, TX, 78712, United States, dkumar@mail.utexas.edu, S. Travis Waller

In this paper we study the system optimal assignment problem where a fraction of the demand has specific travel time constraint. We analyze the feasibility of the problem and discuss the properties of the problem. As the problem is NP-complete we also propose a simple heuristic to obtain the bounds on the solution.

■ WB37

C-Room 307

Military Applications III

Contributed Session

Chair: Adedeji Badiru, Professor & Department Head, Air Force Institute of Technology, Systems & Engineering Management Dept., Wright-Patterson Air Force Base, Dayton, OH, 45433, United States, adedeji.badiru@afit.edu

1 - Architecture Alternatives for Ballistic Missile Defense (BMD) with Distributed Fire Control

George Mayernik, Raytheon Integrated Defense Systems - Systems, Architecture, Design & Integration Directorate, George_E_Mayernik@raytheon.com, John R. Krasnakevich, David B. Hamlin

BMD sensor netting using external Early Warning Sensors and X-Band radars in operation with interceptor fire units under C2BMC control is analyzed. Evaluation of alternate operation concepts is developed to demonstrate the importance of deploying a balanced system with sensors matched to interceptors in a distributed fire unit configuration. Included is a summary of architectural insights and description of defense effectiveness as a function of capability/basing of a netted radar network.

2 - A Decision Support Tool to Optimally Allocate Mine Rollers in the Al Anbar Province of Iraq

Joseph Mlakar, US Marine Corps, 3300 Russell Road, Quantico, VA, 22134, United States, joseph.mlakar@usmc.mil

The insurgency in Iraq is using Victim Operated Improvised Explosive Devices (VOIEDs) as a primary weapon against coalition forces. Mine rollers have been produced to counter the VOIED threat. Allocating mine rollers is a complex problem: each type of roller has a different set of vehicles on which it can be mounted and each unit operating in Al Anbar has a different level of exposure to the VOIED threat. We develop an Excel-based decision support tool capable of developing optimal allocation strategies for mine rollers in order to best counter the VOIED threat in the Al Anbar Province.

3 - A Stochastic Approach to Assess Situation Awareness in Networks of Partially Cooperating Entities

René Janssen, Netherlands Defence Academy, P.O.Box 10000, Den Helder, NH, 1780 CA, Netherlands, RHP.Janssen@nlda.nl, Herman Monsuur

Cooperating nodes in a network can obtain better situation awareness by sharing information. The process of updating information not only depends on given characteristics of the nodes and the network structure. It also depends on the uncertain willingness/possibility of individual nodes to transfer information to adjacent nodes as may be experienced in practice. Our network performance metric takes into account this stochastic behaviour of the nodes. We illustrate our results by simulation.

4 - Information Fusion Using Conceptual Spaces: Mathematical Programming Models and Methods

Michael Holender, State University of New York at Buffalo, 339 Bell Hall, Buffalo, NY, 14260, United States, holender@buffalo.edu, Moises Sudit, Rakesh Nagi

Conceptual Spaces is a representation in cognitive theory used to describe human understanding of concepts, a geometrical way to represent human thought. They relate nicely to Data Fusion Levels 1 and 2 (as defined by JDL). We focus on modeling these Conceptual Spaces as a mathematical program that solves various Level 1 fusion problems in a single, mathematically sound model. These models are then extended in the light of Level 2 Fusion, Situational Assessment.

5 - OR/MS Modeling for AFSO21 Process Improvement in US Air Force

Adedeji Badiru, Professor & Department Head, Air Force Institute of Technology, Systems & Engineering Management Dept., Wright-Patterson Air Force Base, Dayton, OH, 45433, United States, adedeji.badiru@afit.edu

OR/MS has repeatedly demonstrated its versatility to make contributions to military operations. Many techniques were developed around World War II era specifically to enhance military missions. US military remains one of the biggest users of OR/MS techniques. Another avenue for OR/MS applications has evolved in AFSO21 (Air Force Smart Operations for the 21st Century). The purpose of this paper is to introduce the quantitative modeling opportunities available within AFSO21 implementations.

■ WB38

C-Room 308

Marketing IV

Contributed Session

Chair: Hong Yuan, Assistant Professor of Marketing, University of Illinois, 350WH, 1206 South 6th St., Champaign, IL, 61820, United States, hongyuan@uiuc.edu

1 - Long-term Financial Implication of Serving Customers with Better Products

Hyun Shin, UCLA, 3241 S Sepulveda Blvd. Apt 202, Los Angeles, CA, 90034, United States, hyun.shin@anderson.ucla.edu

STOC (Securities Trading of Concepts) method, proposed by Dahan and his colleagues (2002), can be a useful tool to measure the overall attractiveness of a new product. To analyze STOC data, I construct an empirical model and propose Normalized Product Attractiveness (NPA) approach. I find NPA approach provides us with useful information regarding the future stock market performance in the long-term.

2 - Strategic Timing of Product Launches

Ying Li, Assistant Professor, Texas A&M University, 4217 TAMU, College Station, TX, 77843, United States, yli@mays.tamu.edu, Yanhong Jin

This paper investigates incentives behind a firm's launch of the next generation product in a competitive environment. A firm could launch the next generation product right after it is technologically ready. Or a firm could wait and take advantage of technology maturation. The timings also affect a firm's market share. The paper examines when and why specific launch strategies are optimal.

3 - Warranty Parameters for Two-attribute Policies Under Consumer Preferences

Jayprakash Patankar, Professor, The University of Akron, College of Business Administration, Department of Management, Akron, OH, 44325-4801, United States, jgp@uakron.edu, Amit Mitra

A warranty policy involving two attributes, for example time and usage, is considered. A model is developed that incorporates consumer preferences to exercise a warranty, even if product failure occurs within prescribed bounds. Market share is maximized subject to constraints on expected warranty costs and the warranty parameters.

4 - First Mover (Dis)advantage in Duopolistic Location/Pricing Games

Amitabh Sinha, Assistant Professor, University of Michigan, Ross School of Business, 701 Tappan Avenue, Ann Arbor, MI, 48109-1234, United States, amitabh@umich.edu, Uday Rajan

We study location/pricing games with sequential location followed by simultaneous pricing in a duopoly setting. Consumer utilities are a function of price and distance, and also include a random utility term. Firm profits and strategies are evaluated as a function of the variance of the random utility (elasticity of demand), and first-mover advantages and disadvantages are identified.

5 - Why Prices Rise Faster Than They Fall? Understanding the Rockets and Feathers Phenomenon

Hong Yuan, Assistant Professor of Marketing, University of Illinois, 350WH, 1206 South 6th St., Champaign, IL, 61820, United States, hongyuan@uiuc.edu, Song Han

The Rockets and Feathers problem occurs when retail prices rise faster than they fall in response to cost shocks. Economic theory suggests no reasons for asymmetric price adjustment. We develop a dynamic game theoretic model and derive Perfect Bayesian Equilibrium to show that consumers search less when prices decrease. As a result, retailers have incentives to lower prices just enough to prevent search when costs fall which causes the prices to be stickier downwards.

■ WB39

C-Room 309

Optimization Techniques

Contributed Session

Chair: Christine Taylor, Postdoctoral Associate, Massachusetts Institute of Technology, 77 Massachusetts Ave., Rm 31-261E, Cambridge, MA, 02139, United States, c_taylor@mit.edu

1 - Optimization of Sum-of-ratios Problem and its Applications

Jianming Shi, Muroran Institute of Technology, 27-1, Mizumoto Chou, Muroran, 0508585, Japan, shi@mmm.muroran-it.ac.jp

The sum-of-ratios problem is one of the most difficult fractional programs in mathematical programming. Indeed, this problem is essentially NP-hard in spite of its special structure under the usual assumptions on numerators and denominators. In this talk we ((i) provide a recent survey of applications, theoretical results and various algorithmic approaches for this challenging problem. (ii) propose a fast algorithm to solve the problem.(iii) discuss its applications on bioimformatics

2 - Discrete Bilevel Programming with Binary Variables

Xiangrong Liu, Student, Drexel University, Academic Building, 101 North 33rd Street, 2nd floor, Philadelphia, PA, 19104-2875, United States, xl35@drexel.edu, Hande Y. Benson

Bilevel optimization consists of an upper level optimization whose set of feasible solutions depend on the set of optimal solutions of a lower level problem. Our focus is on bilevel optimization problems where the lower and/or the upper level problems have binary variables. We will express the discrete problem as a continuous nonlinear programming problem and solve it using a global optimization approach. Numerical results will be presented.

3 - Solving Rich VRPs by Column Generation

Johan Oppen,PhD Student, Molde University College, P O Box 2110, 6402 Molde, Norway, Johan.Oppen@hiMolde.no, Arne Lokketangen

Real- world optimization problems are often too complex, and problem instances are often too large, to be solved to optimality. We present a column generation algorithm for a rich Vehicle Routing Problem with inventory constraints that finds optimal solutions for small instances. The standard models, both for the master problem and the subproblems, are extended to mirror important details from the real world. Computational results and comparisons to heuristic methods are presented.

4 - An ILP Approach to Spanning Tree Problems on Incomplete Graphs with Heterogeneous Degree Constraints

Thomas Vitolo, PhD Candidate, Boston University, Systems Engineering, 15 Saint Marys Street, Brookline MA 02446, tjvitolo@bu.edu, Jian-Qiang Hu

Degree constrained spanning tree requirements commonly appear in network architecture problems. We propose a integer linear programming based approach for spanning tree problems on incomplete graphs with heterogeneous degree constraints that will always find a feasible solution or terminate should the problem be infeasible. Numerical results are presented to demonstrate the effectiveness of our method in comparison with GA methods proposed by other researchers.

5 - Embedded Optimization

Christine Taylor, Postdoctoral Associate, Massachusetts Institute of Technology, 77 Massachusetts Ave., Rm 31-261E, Cambridge, MA, 02139, United States, c_taylor@mit.edu, Olivier de Weck

This paper demonstrates an effective method for solving MINLPs, where a few non-linear constraints couple a larger set of linear constraints. Using a coupled transportation system design and routing problem as an example, an embedded LP within Simulated Annealing (SA) is utilized to obtain good solutions to the coupled design problem. A computational experiment comparing SA with and without the embedded LP shows a statistically significant improvement in computational performance.

■ WB40

C-Room 310

OR and Infectious Disease I

Sponsor: Health Applications Section

Sponsored Session

Chair: Shane Hall, Assistant Professor of Operations Research, Air Force Institute of Technology, AFIT/ENS, Bldg 641, 2950 Hobson Way, WPAFB, OH, 45433, United States, SHANE.HALL@afit.edu

1 - An Analysis of the Pediatric Vaccine Supply Shortage Problem

Ruben Proano, PhD Candidate, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champaign, Siebel Center, 201 N. Goodwin Ave, Urbana, IL, 61801, United States, rproano@uiuc.edu, Edward Sewell, Sheldon H. Jacobson

A stochastic model that captures the vaccine supply during production interruptions is used to assess the impact of vaccine stockpile levels on the probability that all children can be immunized according to the childhood immunization schedule. The model evaluates the recommended vaccines stockpile levels in the US. Results suggest that a moderate investment in higher vaccine stockpile levels would reduce the risk of vaccine shortages for production interruptions lasting more than six months.

2 - The Economics of Nosocomial Infection Controls in Hospitals

Reidar Hagtvedt, hagtvedt@gatech.edu, Paul Griffin, Pinar Keskinocak

We examine the economics of strategies to control nosocomial (hospital acquired) infections. Data from one hospital, combined with results from the literature, provide the basis for a simulation of the incidence of nosocomial infections. This model allows costs and benefits of different approaches of infection control to be assessed.

3 - Influenza Vaccine Supply Chain with Multiple Agencies

Hamed Mamani, Massachusetts Institute of Technology, 77 Massachusetts Ave, Bldg E40-130, Cambridge, MA, United States, hamed@mit.edu, David Simchi-Levi

Billions of dollars are being allocated for influenza pandemic preparedness and vaccination is a primary weapon for fighting influenza outbreaks. We analyze a model with a single manufacturer and multiple agencies purchasing and distributing the vaccination. We show that production risks, taken by the manufacturer, lead to an insufficient supply of vaccine and design contractual agreements between the agencies and the manufacturer that can coordinate the supply chain.

4 - Responding to Pandemic Influenza in San Antonio, Texas

George Miller, Altarum Institute, P.O. Box 134001, Ann Arbor, MI, 48113-4001, United States, george.miller@altarum.org, Steve Randolph, Jan E. Patterson

We used discrete event simulation to model the spread of pandemic influenza in San Antonio under varying public health mitigation strategies to assess the adequacy of the surge capacity of the health care delivery system. A mix of strategies – social distancing, use of antiviral medications, and vaccination – could limit the demand for care to levels that could be satisfied by existing capacity, as could timely and aggressive use of social distancing alone, if other strategies are unavailable.

■ WB41

C-Room 3A

Joint Session B&SB/HAS: Network Biology: Metabolism and Gene-Regulation

Sponsor: INFORMS Computing Society/ Bioinformations & Systems Biology, Health Applications Section
Sponsored Session

Chair: Eivind Almaas, Microbial Systems Biology Group, Lawrence Livermore Nat'l Lab, 7000 East Ave, L-452, Livermore, CA, 94550, United States, almaas2@llnl.gov

1 - System-level Study of Metabolism in Yersinia Pestis Using a Genome-scale Mathematical Model

Ali Navid, Microbial Systems Biology Group, Lawrence Livermore Nat'l Lab, 7000 East Ave, L-452, Livermore, CA, 94550, United States, navid1@llnl.gov, Eivind Almaas

Mathematical methods such as network optimization are critical tools for analysis and use of the ever-growing deluge of biological data. Here we report the successful coupling of linear optimization and genomic data with the aim of developing a system-level model of metabolism in the aetiological agent of the bubonic plague, Yersinia pestis. The model predictions were compared with experimental observations to ensure the accuracy of the model and completeness of our metabolic network.

2 - Modeling Metabolism: Optimal Flux Patterns and Epistatic Interactions

Eivind Almaas, Microbial Systems Biology Group, Lawrence Livermore Nat'l Lab, 7000 East Ave, L-452, Livermore, CA, 94550, United States, almaas2@llnl.gov

Using the linear and quadratic programming framework of constraint-based flux analysis, we investigate the interplay between metabolic network structure and optimal flux patterns. Recently, we determined a novel type of epistatic gene-gene interaction, as mediated by the metabolic network: Counter to intuition, an organism's fitness can improve through gene knockouts, i.e. inflicting damage on the metabolic network. The origin of this effect, as well as several examples, will be discussed.

3 - Optimal Topology for Synthetic Gene Circuits

Cheol-Min Ghim, Microbial Systems Biology Group, Lawrence Livermore Nat'l Lab, 7000 East Ave, L-452, Livermore, CA, 94550, United States, ghim1@llnl.gov, Eivind Almaas

Functional capabilities of cells can be attributed to the molecular network of interactions. Despite inherent complexity, cellular networks across the organisms share functional modules with conserved interaction patterns, reminiscent of convergent evolution. Here we comparatively assay natural circuit modules for optimal control in cells, such as chemotaxis and circadian/cell cycle clocks, and discuss the implications on the reconstruction of synthetic circuits for engineering purposes.

■ WB42

C-Room 3B

Operations Research in Medicine and Health Care I

Contributed Session

Chair: Yuriy Zinchenko, PhD, McMaster University, Department of Computing and Software, ITB 221 1280 Main Street W, Hamilton, ON, L8S 4K1, Canada, yzinchen@optserv.cas.mcmaster.ca

1 - Health Care Cost Containment Strategies for Patients with Diabetes

Maria Mayorga, Assistant Professor, Clemson University, Freeman Hall Box 34020, Clemson, SC, United States, mayorga@CLEMSON.EDU, Odette Saleeby

We consider the impact of cost containment initiatives that prevent the development of serious health complications in diabetic patients. We compare alternate reimbursement policies while considering the patients' welfare, the provider's profitability, and social impact. We formulate the decision process under uncertainty using dynamic programming and simulation.

2 - Scheduling Elective Surgeries Using a Revenue Management Approach

Alia Stanciu, Doctoral Candidate, University of Pittsburgh, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, alstanciu@katz.pitt.edu, Luis Vargas

The long term financial viability of hospital surgical units can be enhanced through better scheduling models. We present implementations of revenue management techniques and models for the advance scheduling of requests for elective surgeries. Our stochastic scheduling algorithm takes into account the variability in arrivals and surgery times, as well as various patients' reimbursement categories. We present preliminary computational results that show the efficiency of our approach.

3 - An Optimization Model to Minimize the Cost of a Tablet Composition

Ankur Jain, Student, Purdue University, 480 Stadium Mall Drive, Purdue University, West Lafayette, IN, 47907, United States, ankur.jain.2007@alumni.purdue.edu, Venkat Venkatasubramanian, Gintaras Reklaitis, Kenneth Morris

This presentation describes an optimization model which is developed to identify the best combination of excipients (inactive ingredients) in a tablet. It also discusses the integration of optimization model with a Java-based decision support system using ILOG Concert Technology.

4 - Identifying Classifiers for Head and Neck Cancer and HPV Using Machine Learning Algorithms

Hao Zhang, University of Wisconsin-Madison, Industrial and Systems Engineering Dept., 1513 University Avenue, Madison, WI, 53706, United States, haoz@cae.wisc.edu, Leyuan Shi, Gypsyamber D'Souza, Robert Meyer, Maura Gillison, Warren D'Souza

Tobacco, alcohol and HPV are established risk factors for squamous cell head and neck cancer. In this research, we apply different machine learning algorithms including support vector regression, boosted decision stump, logistic model trees and simple decision table to predict cancer and HPV status. Cancer status was predicted with an average accuracy of 90% or better. HPV16 status was predicted with an accuracy of 81% when defined by L1 antibodies and 86% when defined by in-situ hybridization.

5 - Specifying Dose Distribution Requirements for the Robust IMRT Treatment Planning

Yuriy Zinchenko, PhD, McMaster University, Department of Computing and Software, ITB 221 1280 Main Street W, Hamilton, ON, L8S 4K1, Canada, yzinchen@optserv.cas.mcmaster.ca

Radiation therapy is a dominant modality in treating various cancers. IMRT, its high-precision counterpart, is a state-of-the-art tool for this type of treatment. We investigate the possibility of including the dose distribution prescription (specified by the so-called dose-volume histograms) within the robust IMRT treatment planning framework -the approach that allows to minimize the negative impact of the inherent uncertainties- and relate this question to the classical problem of moments.

■ WB43

S-Grand Ball. A (Lev. 2)

Transforming the ATC System: A Look into the Future

Sponsor: Aviation Applications
Sponsored Session

Chair: Thomas Vossen, Leeds School of Business, University of Colorado, Boulder, CO, 80309-0419, United States, vossen@colorado.edu

1 - JPDO Systems Engineering and Analysis Division Update

Shahab Hasan, Program Manager, LMI, 2000 Corporate Ridge, McLean, VA, 22102, United States, shasan@lmi.org, Sherry Borener, Gregory Carr, Fred Wieland, George Hunter, Dan Goldner, Monica Alcabin, Michael Graham, Jeremiah Creedon, Michael Marcolini

The Joint Planning and Development Office's (JPDO) Systems Engineering and Analysis Division (SEAD) uses a breadth of modeling and simulation tools to assess the benefits of the NextGen air transportation system. SEAD analysts will discuss how our initial parametric benefits estimates have evolved into more detailed and specific analyses of operational improvements in the areas of capacity, efficiency, environmental performance, and safety.

2 - The Business Case for NextGen Aircraft Equipage

Rich Golaszewski, Executive Director, GRA, Inc, 115 West Av., Suite 201, Jenkintown, PA, 19046, United States, richg@gra-inc.com

NextGen will require complementary investments by the FAA's ATO and airspace users. This paper will use data from latest surveys of GA aircraft on the annual utilization levels, aircraft age, and types of installed equipment of various segments to examine the case for investment. Data on equipage costs in conjunction with data on aircraft values and operating costs will be used to examine the business case for various levels of investment in new avionics.

3 - Airline Performance Over Time

Dipasis Bhadra, MITRE/CAASD, 7515 Colshire Avenue, McLean, VA, 22102, United States, dbhadra@mitre.org

We present airline performance using a quantitative benchmarking method. The Data Envelopment Analysis allows us to benchmark the best performing airline and determine the relative efficiencies of individual members (called decision making unit) within a group consisting of both legacy carriers and LCCs. This non-parametric approach compares each DMU airline with only the best DMU airline. This method brings the performance comparison closer to reality than traditional parametric methods.

4 - A Framework to Determine Out-of-service Costs for Avionics Upgrades

Jonathan Drexler, Multi-Disciplinary System Engineer, CAASD/MITRE, 7515 Colshire Avenue, McLean, VA, 22102, United States, jdrexler@mitre.org

Plans are in place to build a NextGen performance-based air traffic system. This presentation will cover a methodology that estimates the out-of-service cost per day for Part-121, On-Demand, and General Aviation operators. For each operator a list of potential aircraft strategies will be identified and their resulting costs will be identified.

■ WB44

S-Grand Ball. B (Lev. 2)

Classroom Innovations for Teaching OR/MS

Sponsor: INFORM-ED

Sponsored Session

Chair: Matt Drake, Assistant Professor, Duquesne University, School of Business, Pittsburgh, PA, United States, drake987@duq.edu

1 - An OR/Problem-Solving Approach to Business Calculus

Bruce Pollack-Johnson, Associate Professor of Mathematical Sciences, Villanova University, Department of Mathematical Sciences, 800 Lancaster Avenue, Villanova, PA, 19085, United States, bruce.pollack-johnson@villanova.edu

We describe a federally-funded re-engineering of a business calculus course organized around the process of solving real-world problems using math models, calculus, and technology. Students learn OR-style post-optimality analysis, including verification, validation, and sensitivity analysis, in doing student-generated projects on topics from their own lives. Excel templates have been developed for 3-D graphing, fitting logistic models, and testing solutions for local and global optimality.

2 - Connections Between OR/MS and Analytics for Undergraduate Business Students

Susan Palocsay, Professor, James Madison University, Computer Info Sys & Mgt Science Dept., Harrisonburg, VA, 22807, United States, palocssw@jmu.edu, Rick Mathieu, Ina Markham

The role of business analytics continues to evolve and expand as companies seek higher levels of performance and enhanced competitiveness. We identify skill sets needed for business undergraduates to pursue a career path in this field, based on recent industry reports and a sample of posted job positions. Our focus is on potential opportunities to raise the visibility and appeal of OR/MS courses in business school curricula.

3 - OR in the Classroom: Helping the Homeless

Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W Main Street, Richmond, VA, 23284, United States, lamclay@vcu.edu

This presentation summarizes the results and lessons learned from managing a real-world community service class project. The project partnered with a local agency that provides services for the homeless in Richmond, Virginia. It engaged graduate students studying multiobjective decision analysis in applying value focused thinking to the agency's case management services.

4 - Adding Practical Experience to the OR/MS Classroom

Matt Drake, Assistant Professor, Duquesne University, School of Business, Pittsburgh, PA, United States, drake987@duq.edu, John Mawhinney

In this presentation we will discuss various ways in which we have incorporated practical experience into our Supply Chain Management curriculum at Duquesne University.

■ WB45

S-Capitol Hill (Lev. 3)

Financial Indices

Contributed Session

Chair: Luke Miller, Professor, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States, miller_l@fortlewis.edu

1 - A Stochastic Integer Programming Approach to the Index Tracking Problem

Stephen Stoyan, Mr., University of Toronto, 6 Danbury Court, Unionville, ON, L3R 7S1, Canada, stoyan@mie.utoronto.ca, Roy Kwon

We consider the problem of tracking a target portfolio or index subject to uncertainty. We formulate a index tracking portfolio model that involves a comprehensive set of real world portfolio elements. The model is defined in a Stochastic Mixed-Integer Programming (SMIP) framework. Due to the size and complexity of the problem, an algorithm is implemented that decomposes the large SMIP into solvable sub-problems. A two-stage SMIP is solved and the results are compared with actual index values.

2 - Dynamic Asset-liability Management for Defined-benefit Pension Plans

Jerome Detemple, Professor of Finance and Economics, Boston University School of Management, 595 Commonwealth Avenue, Boston, MA, 02215, detemple@bu.edu, Marcel Rindisbacher, Jing Zhou

A dynamic asset-liability management model for defined-benefit pension plans is developed. The plan sponsor exhibits features of loss aversion and tolerance for limited shortfalls in assets under management relative to the liability due. The optimal contribution policy, the optimal dividend policy and the associated asset allocation rule are derived and analyzed. Sound Asset-Liability Management is shown to entail future withdrawals from as well as future contributions to the pension fund, even if the current funding shortfall is large.

3 - The Inverse Movements of U.S. Stock Indices and Implied Correlations

Woo Chang Kim, PhD Candidate, ORFE, Princeton University, E312, ORFE, E-Quad, Princeton University, Princeton, NJ, 08544, United States, wookim@princeton.edu, John M. Mulvey

This paper shows that the log-prices of DJIA and S&P 100 indices and their implied correlations are strongly negatively correlated (-0.8) during 1997 to 2005. To explain this observation, we develop a mathematical model employing geometric Brownian motion for stock and stock index prices. We show that implied correlation can improve investment performance.

4 - The Valuation of Callable Currency Linked Bonds

Kyoko Yagi, Dr., The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-0033, Japan, yagi@e.u-tokyo.ac.jp, Katsushige Sawaki

This paper presents a valuation model of callable currency linked bonds with multiple coupon payments in a setting of the optimal stopping problem. We explore the analytical properties of optimal call boundary by the issuer. Furthermore, we investigate how the multiple coupon payments affect the value of the bond and the optimal call policy for the issuer. Also, the value of the bond and the optimal critical prices are examined numerically.

5 - Real Options Applied to Safety & Ergonomics Projects

Luke Miller, Professor, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States, miller_l@fortlewis.edu

This paper considers the application of real options analysis techniques as a method for estimating the value of flexibility in investment decision making as it applies to a safety and ergonomics intervention project. The perpetual call option is introduced as a method to justify immediate investment rather than delayed investment when appropriate.

■ WB46

S-Ballard (Lev. 3)

Energy Under the CO2-constrained World

Sponsor: Energy, Natural Res & the Environment/ Energy

Sponsored Session

Chair: Yihsu Chen, Assistant Professor, University of California, Merced, 5200 N. Lake Rd, School of Engineering, R262, Merced, CA, 95343, United States, yihsu.chen@ucmerced.edu

1 - A Partial Plus General Equilibrium Approach to the Simulation of the Impact of EU ETS

Pedro Linares, Universidad Pontificia Comillas, Alberto Aguilera 23, Madrid, 28015, Spain, pedro.linares@upcomillas.es, Xavier Labandeira, Miguel Rodrìguez

There are mainly two different approaches to analyze the effects of carbon emissions trading on the economy: partial equilibrium analysis and general equilibrium analysis. However, the use of both approaches separately may result in biased conclusions. The objective of this research is to simulate the effects of the European carbon market in Spain with a new approach integrating a partial equilibrium model for the electricity sector and a general equilibrium model for the whole economy.

2 - Optimal Energy R&D Portfolio Investments Under Carbon Tax Uncertainty

Ekundayo Shittu, Research Assistant, University of Massacusetts, Amherst, MA, 01003, United States, eshittu@ecs.umass.edu, Erin Baker

We explore the reaction of a firm's optimal investment in an energy R&D portfolio comprised of four different technologies to uncertainty in a future carbon tax. We find that investment allocation depends on the elasticity of substitution between carbon and non-carbon energy inputs as well as the relative costs of the technologies; and that overall investment decreases in risk.

3 - Analyzing the Long-run Impact of the Regional Greenhouse Gas Initiative

Yihsu Chen, Assistant Professor, University of California, Merced, 5200 N. Lake Rd, School of Engineering, R262, Merced, CA, 95343, United States, yihsu.chen@ucmerced.edu, Karen Palmer, Benjamin Hobbs, Dallas Burtraw, Soora Kim, Anthony Paul, Steve Gabriel

The Regional Greenhouse Gas Initiative (RGGI) is a joint effort by several Northeast States to control for regional CO2 emissions. The objective is to reduce CO2 emissions from the power sector 10% below the current level by 2019 using a cap-and-trade program. This analysis sought to evaluate the competitiveness of the state power sector and any increases in electricity costs for consumers in Maryland.

4 - Modelling the Value of Windpower in an Ontario-like Electricity System: A MPEC Approach

Scott Rogers, Dept. of Mechanical and Industrial Engineering, University of Toronto, Toronto, M5S 3G8, Canada, rogers@mie.utoronto.ca, Paul Dabrowski

This paper describes an intermediate term planning model for valuing wind power generation in a well-balanced hydro-thermal system with a Poolco kind of market. Traditional approaches have used displacement cost or market price. Using the market models we describe alternative approaches based on the properties of the market and illustrate their usefulness through an MPEC model of an Ontario-like system.

■ WB47

S-Everett (Lev. 3)

Commodity Trading and Financial Hedging

Cluster: Operations Management in Commodity Markets and Agribusiness
Invited Session

Chair: Onur Boyabatli, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, Singapore, onur.boyabatli@insead.edu

1 - Shipper Valuation and Hedging of Network Contracts for Natural Gas Pipeline Transport Capacity

Mulan X. Wang, Carnegie Mellon University, 5000 Forbes Ave Posner Hall A27, Tepper School of Business, Pittsburgh, PA, 15213, United States, mulan@cmu.edu, Nicola Secomandi

In the U.S., natural gas shippers buy the commodity at supply market hubs and contract with pipeline companies to transport it to demand market hubs where they sell it. This talk illustrates optimization-based models to value and hedge pipeline network contracts, consisting of multiple receipt points connected to multiple delivery points, as real options on natural gas futures prices.

2 - A Capacitated Commodity Trading Model with Market Power

Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Josep Maria Vendrell Simò

We consider the operational problem of a trader between two markets of the same commodity, each one of which quotes a different price. We are interested in finding the optimal trading policy across the markets so as to obtain the maximum profit in the long-term, assuming that the trading volumes influence the price processes. We assume a finite trading capacity (fixed inventory level) and proportional costs. We determine the optimal trading strategy and the optimal capacity to be installed.

3 - Integrating Long-term and Short-term Contracting in Fed-cattle Supply Chains

Onur Boyabatli, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, Singapore, onur.boyabatli@insead.edu, Paul Kleindorfer, Stephen Koontz

This paper analyzes the optimal contracting portfolio choice of a meatpacker in the fed-cattle supply chain. The meatpacker can source cattle from options-like marketing agreements and forward contracts in advance, and from the spot market on the day. We incorporate several particularities of fed-cattle supply chains (e.g., quality and cost differences between different types of contracted cattle and substitutability between beef end products).

■ WB48

S-Fremont (Lev. 3)

Financial Applications

Contributed Session

Chair: Lei Zhang, Assistant Professor, Oregon State University, School of Civil & Construction Eng., 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

1 - Revisiting Market Evaluation of Research and Development

Krishnan Ramaya, Assistant Professor, Pacific University, Department of Business, 2043 College Way, Forest Grove, OR, 97116, United States, kramaya@pacificu.edu, Kevin Bracker

This paper extends the R&D performance literature by examining the impact of R&D Intensity (R&D/Sales) on Tobin's q (Market Value of Firm/Replacement Value of Assets). We found a strong curvilinear relationship with diminishing marginal benefits to higher levels of R&D intensity. This is consistent with the concept of diminishing marginal returns to R&D expenditures. Controlling for industry significantly improves the relationship fit. Research and managerial implications are discussed.

2 - An Experimental Study of Market-Based Asynchronous Optimization for Distributed Systems

Zhiling Guo, Assistant Professor, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD, 21250, United States, zguo@umbc.edu, Gary Koehler, Andrew Whinston

We propose a decentralized optimization algorithm for distributed systems under an asynchronous market trading environment in which a dealer interacts with a number of distributed agents in a double auction e-marketplace. We evaluate the dealer's role in providing market liquidity. We also study the effects of asynchronous decision making and asymmetric market information on the market performance.

3 - Coexistence of Selling and Leasing to Retail and Corporate Consumers

Wei Yang, Assistant Professor, Long Island University at C.W. Post, School of Business, Brookville, NY, 11548, United States, wei.yang@liu.edu

We investigate the coexistence of selling and leasing of finitely durable goods when the manufacturer is a monopolist facing both corporate and individual consumers. We study the manufacturer's pricing decisions, consumer behavior and social welfare in the retail market when off-lease goods from the corporate market possess different quality and when the corporate competes in the second-hand market.

4 - Real Options Impact on Capital Budgeting

Gerald Sheblé, Professor, University of Iowa, gbsheble@ece.pdx.edu, Chin-Chuen Teoh

The proposed method of integrating profit at risk (PaR) into real options analysis achieves three critical goals: timing, simplicity, and reliability. PaR measures the minimum expected profit of portfolio over a holding time horizon. It sets the benchmark for future operation and solves the curse of lattice dimensionality. Strategic planning committees designate a certain percentage of portfolio profit requirements above the benchmark. This leads to achieving the target of performing company's operations over a comfort zone.

5 - Profit-maximizing and Socially Optimal Pricing of Advanced Traveler Information Services

Lei Zhang, Assistant Professor, Oregon State University, School of Civil & Construction Eng., 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

This paper theorizes users' willingness to pay for advanced traveler information services (ATIS). For each user, information provided by ATIS is valuable if its price is lower than the subjective gain from the information, and lower than the perceived cost of other information-acquisition means. The profit-maximizing and socially optimal prices of ATIS, which correspond to different levels of ATIS market penetration, are analyzed and computed for a real-world transportation system.

■ WB49

S-Greenwood (Lev. 3)

Revenue Management in Service and Retailing

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Hyun-Soo Ahn, Assistant Professor, University of Michigan, Stephen M. Ross School of Business, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109-1234, United States, hsahn@bus.umich.edu

Co-Chair: Ozge Sahin, Assistant Professor, Stephen M. Ross School of Business, University of Michigan, Ann Arbor, MI, 48109, United States, ozge@umich.edu

1 - A Fluid Analysis for Service Capacity Decisions
Haiyan Wang, Olin School of Business, Washington University in St. Louis, Saint Louis, MO, United States, wangha@olin.wustl.edu, Tava Olsen

We study capacity decisions in a service environment where arrival rates are highly seasonal and customers are time sensitive. We begin by studying a monopolist's capacity decision where the trade off is between the cost of extra capacity for low demand periods or loss of revenue for high demand periods. We then study a duopoly model where lost demand for one firm may become increased demand for the opponent. In both models we use a fluid model for the analysis.

2 - A Combined Auction-bargaining Model in Procurement
Kun Soo Park, PhD Student, IEOR Department, Columbia University, 305 S.W.Mudd Building, 500 West 120th Street, New York, NY, 10027, United States, kp2143@columbia.edu, Woonghee Tim Huh

We consider a two-phase procurement system where a risk-neutral buyer procures one unit of an indivisible good from one of many competing sellers. In the auction phase, the buyer selects the seller with the most competitive bid; in the subsequent bargaining phase, the buyer enters into the bargaining process with the selected seller after discovering his true cost.

3 - The Effect of Periodic Discounts on Stochastic Inventory Control
Mehmet Gumus, Assistant Professor, McGill, Canada, mehmet@ieor.berkeley.edu, Hyun-Soo Ahn, Phil Kaminsky

We consider the joint pricing and inventory control problem for a single product whose demand distribution in each period is determined by both current and past prices. We characterize the structure of the optimal policy and conduct a computational study to illustrate the effect of various parameters on the optimal policy.

4 - Optimal Capacity, Product Substitution, and Demand Models
Juqi Liu, PhD Student, Virginia Tech, liujq@vt.edu, Rawee Suwandechochai, Ebru Bish

We consider a firm that produces two substitutable products. We consider linear demand models with cross-price effects under both additive and multiplicative shocks. The firm needs to make capacity, production, and pricing decisions. While the capacity decision has to be made ex-ante, price and quantity decisions are ex-post. We study the relationship between different aggregate linear demand models and the optimal capacity as product substitution changes.

■ WB50

S-Issaquah A & B (Lev. 3)

Applications in Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Montgomery Blair, Asst Vice President, Archstone-Smith, 9200 East Panorama Cir, Englewood, CO, 80112, United States, MBlair@archstonesmith.com

1 - Demand Unconstraining in Price-based Revenue Management System
Jian Wang, Vice President of Research and Development, RainMaker Group, 5755 North Point Parkway, Suite 77, Alpharetta, GA, 30022, United States, jwang@letitrain.com

In traditional quantity-based revenue management system (RMS), unconstraining takes into account the constraints of capacity limitation and stay control. A list of methods has been published. In price-based RMS, on the other hand, demand is mainly censored in the presence of capacity limitation and market rates. No unconstraining publications can be found in the literature yet. In an attempt to draw attention to this area, we describe the definition of the unconstrained demand, and illustrate an unconstraining example in multi-family RMS.

2 - Unconstrained Demand – Back to the Drawing Board?
Montgomery Blair, Asst Vice President, Archstone-Smith, 9200 East Panorama Cir, Englewood, CO, 80112, United States, MBlair@archstonesmith.com

A key component to most modern revenue management systems is the forecast of unconstrained demand. The premier RM system in the apartment rental industry, LRO (Lease Rent Options), is no exception. This session will share some ideas, perspectives, testing initiatives, models, and thoughts on this important component from an application perspective. What is unconstrained demand – really? What new data may become available to better model it and why is it so important?

■ WB51

S-Kirkland (Lev. 3)

Topics in Service Management

Cluster: Queueing Models
Invited Session

Chair: Gad Allon, Assistant Professor, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States, g-allon@kellogg.northwestern.edu

1 - Optimal Control in a Netflix-like Closed Rental System
Achal Bassamboo, Northwestern University, a-bassamboo@northwestern.edu, Ramandeep Randhawa

We consider the introduction of a new product in a closed rental system, such as Netflix, with two types of customers who differ on their mean rental time. All customers desire this new product. We assume that if the customer's request for this product is denied, she receives a substitue product and requests for the new product upon return. We study the control problem of minimizing the mean delay encountered before obtaining the new product.

2 - A Routing Policy for a Two-class Call-center Model Designed to Respond to Unexpected Overloads
Ohad Perry, Columbia University, S.W. Mudd Building, 500 West 120th St., New York, NY, 10027, United States, op2105@columbia.edu, Ward Whitt

We consider a stochastic call center model with two customer classes and two server pools. We propose a parametric routing policy aimed to respond to unexpected overloads. A deterministic fluid model is developed, intended to be appropriate in the overloaded or efficiency-driven heavy traffic limiting regime. Analysis involves a heavy-traffic averaging principle.

3 - Fluid Models for Overloaded Multi-class Many-server Queuing Systems with FCFS Routing
Rishi Talreja, Columbia University, Dept.. of IEOR, Rm. 313, 500 West 120th St., New York, NY, 10025, United States, rt2146@columbia.edu, Ward Whitt

We study deterministic fluid models for overloaded queueing systems having multiple customer classes and multiple service pools, each with many servers. Customer abandonment acts to keep the system stable, yielding a proper steady-state description. We assume that customers are selected for service by newly available servers on a first-come first-serve basis among all eligible classes. We identify flow rates from customer classes to service pools in a large class of models.

■ WB53

S-Medina (Lev. 3)

Industry Focused Research on the Medical Device and Equipment Industry

Cluster: Technology Evaluation and Assessment
Invited Session

Chair: Kingsley Reeves, University of South Florida, 4202 E. Fowler Ave, Tampa, FL, 33620, United States, reeves@eng.usf.edu

1 - Comparison of Procurement Options in the Healthcare Industry and Determining the Degree of Innovations
Arka Bhattacharya, apbhatta@mail.usf.edu, Kingsley Reeves

We compare various purchasing models used within the medical device and equipment supply chain based on their impact on patient cost and patient access to technological innovations. The various models analyzed include self-sourcing, exclusive use of a large national group purchasing organization (GPO), exclusive use of a regional GPO, and a hybrid structure employing both a regional and national GPO.

2 - Product Recalls in the Medical Device Industry: Exploration of the Sources and Financial Consequences
Kingshuk Sinha, University of Minnesota, 321-19th Ave SE, Minneapolis, MN, United States, ksinha@csom.umn.edu, Sriram Thirumalai

This study addresses three key issues regarding product recalls in the medical device industry: first, it empirically assesses the financial consequences of recalls; second it examines the moderating effects of firm characteristics on the financial consequences; lastly, it explores the sources of recalls in this industry. The analyses are based on data from medical device firms over a four-year period (2002-2005).

3 - Defining Service Quality in an Outpatient Clinic with Complex Constituency
Swati Verma, University of South Florida, sverma@mail.usf.edu, Kingsley Reeves

It presents foundational work paving the way for further research in assessing the usefulness of RFID in an ambulatory healthcare setting to capture real-time data and promote continuous improvement.Factor analysis is used to determine if distinct patient classes exist that perceive service quality in a distinctive manner.The objective is to use the results of this work along with real-time data collection via RFID to permit service quality maximization.

4 - The Development of an Industry-focused Research Center Focused on Medical Devices
Ozan Ozcan, University of South Florida, Fairway Oaks Apts., 14231 Les Palms Circle Apt No:202, Tampa, FL, 33613, United States, oozcan@mail.usf.edu

The role of the university in promoting local innovation and economic growth is oftentimes limited to technology transfer via patenting and licensing intellectual property to local firms. We will focus on the current development of the Center for Applied Research in Medical Devices (CareMed) at the Univ. of South Florida, the structure of the center and how the university interacts with local industry to benefit the local economy and contrast this with other regionally located research centers.

■ WB54

S-Queen Anne (Lev. 3)

Heavy Traffic Limit Theorems for Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Josh Reed, New York University, Stern School of Business, 44 West 4th Street, New York, NY, United States, jreed@stern.nyu.edu

1 - Slow-server Problem in Many-server Heavy Traffic with Non-exponential Service Times
Tolga Tezcan, University of Illinois, Department of Industrial and Systems Engineering, 117 Transportation Building, 104 South Mathews Avenue, Urbana, IL, 61801, ttezcan@uiuc.edu

We consider the slow server problem. We assume that service times have a certain phase-type distribution. Specifically, service time of a server is assumed to have an exponential distribution with rate mu_i with probability p_i. Specific values of the parameters depend on the server pool the server belongs to. We show that a static priority policy is asymptotically optimal in many-server heavy-traffic.

2 - The G/GI/N Queue in the Halfin-Whitt Regime: Idle Time System Equations
Josh Reed, New York University, Stern School of Business, 44 West 4th Street, New York, NY, United States, jreed@stern.nyu.edu

We study the G/GI/N queue in the Halfin-Whitt regime. Although the main results presented in this talk are not new, the methodology by which they are obtained is. In particular, we model the queue length process as the difference between arrivals and departures. This approach requires an unconventional centering of the departure process from the system. The main results presented provide both fluid and diffusion limits for the queue length process of the G/GI/N queue in the Halfin-Whitt regime.

3 - Validity of Heavy-traffic Steady-state Approximations in Open Queueing Networks
Itai Gurvich, Doctoral Student, Columbia Business School, Uris Hall, 3022 Broadway, New York, NY, 10027, United States, ig2126@columbia.edu, Assaf Zeevi

Semi-Martingale Reflected Brownian Motions (SRBMs) are often used to approximate the dynamics of multi-class queueing networks in heavy-traffic. Process level convergence has been established under fairly general conditions. A separate question concerns the rigorous justification of approximating the steady-state of the underlying queueing network using its SRBM analogue. In this talk we give a broad set of sufficient conditions under which the above question can be answered in the affirmative.

4 - Modeling and Managing Congested Systems with Customers Sensitive to Past Delays
Andrey Torzhkov, New York University, Stern School of Business, 44 West 4th Street, New York, NY, 10012, United States, atorzhko@stern.nyu.edu, Rene Caldentey

We consider a firm serving a finite population of clients responsive to observed delays. They react by adjusting their ordering frequencies. We model this system as a closed network including a service station and virtual latency stations. Routing is state-dependent as implied by the customer behavior rule. We consider fluid and diffusion large-scale approximations which suggest that all customers tend to steer with time towards a single quality state (or a pair of neighboring ones).

■ WB55

S-Ravenna (Lev. 3)

Advances in Airline Optimization - I

Sponsor: Aviation Applications
Sponsored Session

Chair: Diego Klabjan, University of Illinois at Urbana-Champaign, 205 North Mathews Avenue, Urbana, IL, 61801, United States, klabjan@uiuc.edu

1 - Airlines Strategic Competition: A Network Equilibrium Approach
Ahmed Hassan, Research Assistant, Southern Methodist University, P.O. Box 750340, Dallas, tx, 75275-0340, United States, aehassan@engr.smu.edu, Khaled Abdelghany, Ahmed Abdelghany

We present a network equilibrium approach for modeling airlines competition at the strategic level. The model replicates air carrier decisions regarding network configuration and service frequency considering resources availability and system capacity limitations. Problem formulation, solution algorithm and Texas preliminary results are presented.

2 - Airline Charter Service for Conference Sports Travel
Anne Goodchild, Assistant Professor, University of Washington, 121E More Hall, Box 352700, Seattle, WA, 98195, United States, annegood@u.washington.edu

We model the operations of an air charter service for conference sports in competition with existing scheduled travel options. The identification of the relevant demand subset and the routing and scheduling of aircraft is done in the same framework. Through this modeling we develop an innovative method for formulating and accommodating continuous time windows and competitive market dynamics.

■ WB56

S-Wallingford (Lev. 3)

Natural Resource Issues

Contributed Session

Chair: Steven Mills, Forest Planning Analyst, FORSight Resources, LLC, 8761 Dorchester Road, Suite 101, North Charleston, SC, 29420, United States, Steven.Mills@FORSightResources.com

1 - The Innovative use of OR/MS in the Log Marketing Process of a Forestry Company
Gys Wessels, GE Strategy, Planning & Risk, Komatiland Forests (Pty) Ltd, P.O. Box 1771, Silverton, 0127, South Africa, gys@safcol.co.za, Francois de Villiers, Dawie Steenkamp

Using an LP model, we optimised the allocation of logs to customers for the annual log marketing process of a South African forestry company, Komatiland Forests (Pty) Ltd. We developed, implemented and refined the model over a period of three years. The model enabled the process to consider a large number of quotes for more than 20 products over 18 geographically dispersed plantations in an objective and fair manner. It has lead to a significant increase in planned revenue.

2 - Assessing the Impact of a Citrus Virus on Tree Production Value
Donald Stengel, Professor, California State University, Fresno, 5245 N. Backer Ave, MS PB07, Fresno, CA, 93740-8001, United States, dons@csufresno.edu, Priscilla Chaffe-Stengel

In California, orange trees that test positive for Citrus Tristeza Virus are typically subject to mandatory removal. In 1996, one district in Tulare County, California decided to suspend eradication and study the impact of the virus in a group of seven orchards. We discuss a model for (1) isolating the effect of the virus on crop production value from other causal variables like climate, prices, and orchard location and (2) tracking the impact of the virus relative to stage of infection.

3 - Effectiveness of Land-use Policies - An Evaluation Using Intelligent Search and Agent-based Modeling
Mario Gellrich, Dr., ETH Zurich, Universitaetstrasse 22, Zurich, ZH, 8092, Switzerland, mario.gellrich@env.ethz.ch, Hans Rudolf Heinimann

A challenging task of land-use research is to investigate (i) what land-use patterns society should aspire for, and (ii) how to control land-use agents to move the system towards the target state. Our study aimed to identify near-optimal land-use patterns and evaluate the effectiveness of alternative land-use policies. Therefore, we used intelligent search techniques and agent-based modeling. Results improve the understanding of the interaction of the biophysical and the social land-use system.

4 - An Adjacency Formulation Overcoming Modeling Limitations Imposed by Shelterwood Treatments

Steven Mills, Forest Planning Analyst, FORSight Resources, LLC, 8761 Dorchester Road, Suite 101, North Charleston, SC, 29420, United States, Steven.Mills@FORSightResources.com, Marc McDill

Policy guidelines limiting the size of forest openings reinforce the need for spatially explicit forest planning. These policies are modeled with adjacency constraints. The two basic types of exact adjacency constraint formulations fail to provide a framework for accurately modeling shelterwood silvicultural treatments. A new adjacency formulation overcoming the limitations of current models is presented. Extensions to other areas of harvest schedule modeling are discussed.

■ WB57

S-Columbia (Lev. 4)

Innovation/Entrepreneurship

Contributed Session

Chair: Yutaka Hamaoka, Keio University, 2-15-45 Minato-ku, Mita, Tokyo, 108-8345, Japan, hamaoka@fbc.keio.ac.jp

1 - Innovation Models and Implementations at Firm Level in Manufacturing Industry

Gurhan Gunday, M.Sc., Sabanci University, Muhendislik ve Doga Bilimleri Fakultesi, Orhanly Tuzla, Istanbul, TR, 34956, Turkey, ggunday@su.sabanciuniv.edu, Lutfihak Alpkan, Kemal Kilic, Gunduz Ulusoy

In this presentation, modelling and analysis of innovation at the firm level will be discussed based on an empirical study covering 169 manufacturing firms. An integrated model of innovativeness revealing the determinants of innovation will be suggested. An analysis on how innovativeness of firms influences their competitiveness and performance will also be presented.

2 - Harnessing Open Innovation to Commercial Business Models

Risto Rajala, Helsinki School of Economics, P.O.Box 1210, FIN-00101, Helsinki, Finland, risto.rajala@hse.fi, Mika Westerlund

Open source software (OSS) development is transforming towards more commercial orientation. How to merge the innovation capacity of OSS communities with viable business models based on OSS? Our study shows that cognitive models, product characteristics, supervisory activities related to network relationships and copyright issues are the key antecedents for developing viable future business models in the field of OSS. However, they embody potential dilemmas in the management of OSS businesses.

3 - Incentives and Unbundling in Decentralized Information Goods Industries

Moutaz Khouja, Chair, UNC Charlotte, 9201 University City Blvd, Dept.. of BIS&OM, College of Business, Charlotte, NC, 28223, United States, mjkhouja@uncc.edu, Yulan Wang

We explore the impact of unbundling a product and using a digital distribution channel on the profits of firms in the information goods industry. The primary example of such firms are the record labels. We consider a situation where a firm can sell a bundled product through traditional brick-and-mortar retailers and Internet retailer, unbundled product downloaded through the Internet, or both. Such distribution possibilities are now available to firms selling music recordings and motion pictures. We identify the conditions under which each distribution alternative is optimal.

4 - Antecedents and Consequences of Open Innovation

Yutaka Hamaoka, Keio University, 2-15-45 Minato-ku, Mita, Tokyo, 108-8345, Japan, hamaoka@fbc.keio.ac.jp

A comprehensive theoretical framework for understanding Open Innovation(OI) is proposed. Unlike previous research, our model identifies external factors (technological change and available resources), internal factors (absorptive capacity, NIH syndrome, integrated strategy form R&D through marketing, and technological resource), and relational factors (trust) that influence adoption and performance of OI. The model is empirically tested through mail survey data collected from Japanese firms.

■ WB58

S-Pike (Lev. 4)

New Product Development

Contributed Session

Chair: Ankur Goel, University of Texas-Austin, 10926 Jollyville Road, #708, Austin, TX, United States, goel@mail.utexas.edu

1 - Product Innovation with Design Tradeoffs Along Pareto Efficient Frontiers

Chialin Chen, Queen's University, Queen's School of Business, Kingston, ON, K7L 3N6, Canada, cchen@business.queensu.ca, Jun Zhang

We analyze the product design decisions with tradeoff between vehicle weight and fuel efficiency. The empirical analysis shows that the efficient frontiers for the Big Three were convex in most data years. The theoretical model shows that the convex efficient frontiers allow an automaker to achieve a higher average fleet fuel economy with the product variety strategy, but they also preclude the existence of the preferred design in which both product attributes are properly addressed.

2 - CFT (cross functional team) as an Enabler of Fidelity Between R&D and Manufacturing

Jongjoo Kim, Doctoral Candidate, KAIST Graduate School of Management, 207-43 Cheongyangri 2-dong, Dongdaemoon-gu, Seoul, Korea, Republic of, FOREST@KGSM.KAIST.AC.KR, Bowon Kim

For successful new product development and effective ramp-up production, a firm should manage dynamic interfaces among various functions systematically. Based on data analysis and case studies for a global company, we put forth that balanced participation of diverse functions in Cross Functional Team generates better quality performance.

3 - An Integrated Strategy for New Product Development and Production Capacity

Bowon Kim, Professor, KAIST Graduate School of Management, 207-43 Cheongryangri, Seoul, 130-722, Korea, Republic of, BowonKim@kgsm.kaist.ac.kr, Sangsun Park

In order to optimize profit, the firm should manage introduction timing, pricing, and technology level of its new product, and plan for production capacity before the new product is completed. In essence, the firm has to design an integrated strategy that takes into account market, technology, and operations readiness.

4 - The Impact of Product Architecture and Organization Structure on Complex Product Development

Bilal Gokpinar, PhD Student, Northwestern University, Industrial Eng. and Management Sciences, Evanston, IL, United States, bilal@northwestern.edu, Wallace Hopp, Seyed Iravani

Product innovation has always been central to business creation and growth. From an operational perspective, two key measures of innovation performance are speed (time from concept to commercialization) and quality (conformance to customer preferences). In this study, we make use of social network tools and statistical analysis to examine a vehicle design process and identify the technical, individual and organizational factors that affect performance on these dimensions.

5 - Coordinated Inventory and New Product Launch Decisions Under Development Uncertainty

Ankur Goel, University of Texas-Austin, 10926 Jollyville Road, #708, Austin, TX, United States, goel@mail.utexas.edu, Karthik Ramachandran, Sreekumar Bhaskaran

The timing of a new product launch depends typically on actual realization of design and development parameters obtained during pre-launch tests which is uncertain when firms make inventory decisions for an existing line of products. In this paper, we characterize the optimal policy of product launch and inventory decisions as a function of technological uncertainty.

■ WB59

S-Seneca (Lev. 4)

Techology Management I

Contributed Session

Chair: Ilhyung Kim, Assistant Professor, Western Washington University, 516 High Street, Bellingham, WA, 98225-9077, United States, ilhyunk@wwu.edu

1 - Exploration of Conditions for Effective Knowledge Management Applications in Virtual Environments

Joy Oguntebi, PhD Candidate, University of Michigan, Industrial & Operations Engineering, 1205 Beal Ave, Ann Arbor, MI, 48109, United States, ogunjoy@umich.edu

Within the knowledge management and org. learning arenas, explorations of communication and knowledge transfer constructs in virtual organizations exist but remain limited even as interest in virtual environments continues to increase. As prior studies have indicated that transactive memory system (TMS) emergence leads to improved team performance, our research study intends to explore and analyze the roles that influential factors play in TMS emergence and maintenance in virtual teams.

2 - Worker Mobility, Process Knowledge Flows, and Productivity
Prasanna Tambe, PhD Candidate, University of Pennsylvania, Wharton School, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States, tambe@wharton.upenn.edu, Lorin Hitt

We explore how the mobility of workers with access to business process level knowledge creates knowledge spillovers between industries. Using interfirm mobility data created from the employment histories of a very large sample of knowledge workers, we find evidence that industries that absorb workers from other industries with large process knowledge stocks benefit from these knowledge in-flows. These effects can be isolated to the mobility of specific types of workers.

3 - Capabilities for the Dynamic Delivery of Business Development Projects
Ronald Klingebiel, University of Cambridge, Downing College, Cambridge, United Kingdom, rk322@cam.ac.uk

I explore capabilities for the realisation of flexibility value. I find that a real options-type assessment of flexibility value is insufficient to explain the variation in realised value among 61 business development projects. Instead, realised flexibility value seems positively linked with i) project managers gathering and processing information, ii) managers' ability to switch to alternative course of action, and iii) organisational contexts encouraging and controlling flexibility usage.

4 - Dynamic Behavior of Organizational Learning: An Empirical Exploration of Shipbuilding Process
Ilhyung Kim, Assistant Professor, Western Washington University, 516 High Street, Bellingham, WA, 98225-9077, United States, ilhyunk@wwu.edu

Using the benchmark dataset of Liberty ships built in sixteen shipyards during World War II, this research addresses the following three empirical questions: (1) How did the amount of learning, direct and indirect, changes over the life of the Liberty ship? (2) How much did the shipbuilders forget? Who did forget more, at the shipway level or at the shipyard level? (3) Did a faster learning organization also forget more? What factors could explain different learning and forgetting rates?

■ WB60

S-University (Lev. 4)

Decision Modeling in Technology Management

Sponsor: Technology Management
Sponsored Session

Chair: Dundar Kocaoglu, Professor, Portland State University, P.O. Box 751, Eng. & Tech. Management, Portland, OR, 97207, United States, kocaoglu@etm.pdx.edu

1 - Fleet Vehicle Purchase Decision Modeling
Tarcan Tarman, Doctoral Student, Portland State University, P.O. Box 751, Eng. & Tech. Management, Portland, OR, 97207, United States, tarman@pdx.edu, Min-Jeong Cho, Robin Dorociak, Bertha Jimenez, Fouad Aljuhani

The paper presents a decision-making model to help companies' with their fleet vehicle purchase process. A hierarchical decision model is developed based on a set of criteria identified by the market values. Pair-wise comparison methodology as well as utility curves are employed to rank the alternatives in the order of preference. Scenario analysis used to validate the reliability of the model. The model provides the companies with a recommended option for their vehicle choice.

2 - Minimizing U.S. Energy Dependency From Foreign Energy Sources
Darin Colby, Portland State University, P.O. Box 751, Portland, OR, United States, darin.colby@gmail.com, Edwin Garces

This paper analyzes the reduction of U.S. dependency on foreign energy sources using the Hierarchical Decision Model. Utilizing pair wise comparison methodology, the paper identifies the energy technologies that the U.S. should pursue. The findings support that the U.S. should exploit coal technologies and that they should invest in renewable technologies.

3 - Treatment Decision Flow of Acute Myeloid Leukemia (AML)
Andrew J. Blair, Portland State University, P.O. Box 751, Portland, OR, United States, blairaj@gmail.com, Baqer Alali

This paper discusses the various leukemia and posts statistical numbers that show how this disease is contributing to cancer fatalities. The most common types of treatment are reviewed. Through literature reviews and interviews, a decision flow diagram is proposed that shows steps and options available to the patient and oncologist to use in treatment of Acute Myeloid Leukemia.

4 - Application of Hierarchical Decision Modeling: Laptop Selection
Kenny Phan, Portland State University, P.O. Box 751, Portland, OR, 97207, United States, kenny.phan@gmail.com, Rimal Abu Taha, Phakphoom Chuenparsitporn, Qian Gu, Byung Chul Choi, Adriana Cutar

This paper presents the application of the hierarchical decision modeling approach to the decision making process for selection of the best laptop for a college student to buy. After establishing a hierarchy of criteria, the model is populated with the data for ten of the most popular laptops available in the market. The laptop that fits each student's objectives best is determined by pairwise comparisons of the attributes of the alternatives.

Wednesday, 1:30pm - 3:00pm

■ WC01

C-Room 602

Supply Chain Competition and Coordination II

Contributed Session

Chair: Chang Hwan Lee, Department of Operations Management, School of Business Administration, Ajou University, 5 Wonchon-Dong, Paldal-Gu, Suwon, Korea, Republic of, chlee@ajou.ac.kr

1 - A Producer Service Provider Model with Variable Product Life and Remanufacturability
Sasidhar Malladi, PhD Candidate, Iowa State University, 1400 gateway hills pk drive apt 907, Ames, IA, 50014, United States, sasi@iastate.edu, Jo Min

We consider a producer who sells his new and remanufactured products to a service provider who in turn utilizes them to meet her customers demand. The producer can vary the remanufacturability as well as the product life via technology investments and utilizing more durable components. We analyze various leader/follower scenarios in this supply chain and determine the conditions under which a higher remanufacturability or conversely a higher product life is preferred.

2 - Competition and Cooperation in a Two-Stage Supply Chain with Demand Forecasts
Tetsuo Iida, Associate Professor, Faculty of Business Administration, Komazawa University, 1-23-1 Komazawa Setagaya-ku, Tokyo, 154-8525, Japan, iida@komazawa-u.ac.jp, Paul Zipkin

We consider a serial supply chain with one supplier and one retailer, where demand forecast information may be shared. We investigate the membersÅf benefits from sharing information. The forecasts follow a variant of the Martingale Model of Forecast Evolution (MMFE). We analyze Nash equilibria in both competitive and cooperative settings.

3 - Coordinating Supply Chain Contracts Under Sales Promotions
Charles Munson, Associate Professor, Washington State University, P.O. Box 644736, Pullman, WA, 99164-4736, United States, munson@wsu.edu, Shilei Yang, Bintong Chen

We study contracting coordination issues within a tree-way promotion loop (consumer promotions, retailer promotions, and trade deals) in a supply chain. When the manufacturer can influence consumer demand directly through mail-in rebates while the retailer simultaneously exerts promotional effort to further spur demand, we find that trade dealing via quantity discounts plus buy-back is sufficient to coordinate the supply chain.

4 - Supply Chain Coordination in the New Product Development
Chulsoon Park, Student, KAIST Graduate School of Management, 207-43, Cheongryangri-dong, Dongdaemun-gu, Seoul, 103-722, Korea, Republic of, mgatasa@business.kaist.ac.kr, Bowon Kim

We study supplier-manufacturer coordination in new product development. In order to explore how supply chain coordination (SCC) improves new product innovation (NPI), we develop an optimal control theory model. Using real cases for numerical analysis, we endeavor to identify critical conditions and SCC mechanisms that enhance the NPI performance.

5 - Coordination Contracts for Supply Chains with Inventory Financing
Chang Hwan Lee, Department of Operations Management, School of Business Administration, Ajou University, 5 Wonchon-Dong, Paldal-Gu, Suwon, Korea, Republic of, chlee@ajou.ac.kr, Byong-Duk Rhee

During the past decades, a considerable number of financial theories have been proposed to explain why a seller should borrow from a financial institution and then provide a trade credit to a buyer. It has been an important issue not only in

finance, but also in supply chain. Surprisingly, however, trade credit has not been sufficiently investigated by supply chain academics. This paper attempts to examine this issue from a supply chain management perspective and presents trade credit as a tool for supply chain coordination. Specifically, we assume that the supply chain members incur unequal interest rates in financing working capital. Following a Newsvendor framework, we consider a supply chain with two risk neutral participants: a retailer and a supplier. Both the retailer and the supplier can obtain credits from a financial institution. We assume that the supplier offers trade credit, quantity discount, and buyback. Given the supplier's offer, the retailer determines order quantity and financing option for the inventory: either trade credit or direct financing. Our result shows that the supplier can fully coordinate the retailer's decisions with the optimal trade credit, quantity discount, and buyback. These three incentives lead not only to the maximization of joint supply chain profits, but also the supplier's own profit.

■ WC02

C-Room 603

Facility Location in Closed-loop Supply Chains

Cluster: Closed-Loop Supply Chains and Sustainable Operations
Invited Session

Chair: Michael Galbreth, Assistant Professor of Management Science, Moore School of Business, University of South Carolina, 1705 College Street, Columbia, SC, 29208, United States, galbreth@moore.sc.edu

1 - Configuration of Procurement Networks for Secondary Raw Materials

Alexander Uffinger, University of Augsburg, Universitaetsstr. 16, Augsburg, BY, 86159, Germany, alexander.uffinger@wiwi.uni-augsburg.de, Axel Tuma

The globalization not only causes a shortage situation for primary raw materials like steel or oils but also affect the markets for secondary raw materials like recycled paper. In this context, the structure of a paper's manufacture sourcing network needs to be (re)defined with care by paper manufacturers. After a presentation of the economics of paper manufacturers in Europe, we will present in the keynote a mathematical approach (MIP) developed together with a major European paper mill.

2 - Optimizing Warranty Returns Networks: The Case of a Consumer Electronics Manufacturer

Baptiste Lebreton, Senior Research Fellow, INSEAD, TOM - 19, bd de Constance, Fontainebleau, MI, 77300, France, baptiste.lebreton@insead.edu, Stephan Satijn, Atalay Atasu, Luk Van Wassenhove

We present the results of a recent project performed with an OEM in Western Europe. This project intended at identifying potentials to improve the trade-off between cost efficiency and customer satisfaction / reactivity in the warranty returns network. Next to the MIP-based approach used, we also address the issue of managing incentives and service level agreements in a decentralized network of LSPs.

3 - A Case Study on Offshore Remanufacturing

Joao Quariguasi, Drs., Rotterndam School of Management, Rotterdam, Netherlands, jquariguasi@rsm.nl

One of the largest dutch OEM has recently decided to relocate parts of its re-manufacturing activities to the far East. There are a number of advantages in off-shoring remanufacturing ,i.e. labor costs are reduced. There are, however, a number of foreseen drawbacks as well, i.e. reduction of control over the remanufacturing processes. We intend here to present the initial results of our case research, with respect to the main threats and opportunities facing offshore remanufacturing.

4 - A Facility Location Model for Remanufacturing Network System

Qingli Da, School of Economics and Management, Southeast University, Si Pai Lou 2, Nanjing, JS, China, dqlseunj@126.com, Wen-ping Wang, Wei-da Chen, Hao Sun

In this paper, a remanufacturing network system with six types of facility to be located is constructed, in which both the forward and the reverse logistics are of two-level structure and all the logistics facilities are capacitated. A mixed-integer non-linear programming facility-location model of the remanufacturing network is then developed to minimize the total cost of the system. A numerical example is solved by means of Lingo 8.0 to show the application of the model.

5 - Offshore Facility Location for Remanufacturing

Michael Galbreth, Assistant Professor of Management Science, Moore School of Business, University of South Carolina, 1705 College Street, Columbia, SC, 29208, United States, galbreth@moore.sc.edu, Joseph Blackburn

The potential to locate remanufacturing facilities offshore presents an important strategic decision for many remanufacturers. We describe the tradeoffs inherent in offshoring decisions in general and discuss how these can change in a remanufacturing context. Using a simple model, we derive some high-level insights regarding the value of offshoring for a remanufacturer facing variability in used product condition.

■ WC03

C-Room 604

Demand Characteristics in Supply Chain Models: Dependence on Inventory, Substitution, Pricing, and Time

Cluster: Supply Chain
Invited Session

Chair: Apurva Jain, University of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, apurva@u.washington.edu

1 - A Newsvendor Model with Endogenized Demand and Search Costs

Kwan Eng Wee, Assistant Professor, Singapore Management University, LKC School of Business, 50 Stamford Road #04-01, Singapore, 178899, kewee@smu.edu.sg, Nicholas Petruzzi, Maqbool Dada

In this paper we consider a newsvendor problem with inventory-dependent demand. Demand depends on the inventory decision because it is costly to look for the goods so the likelihood of its availability must be taken into account. A modeling framework is introduced and the resulting control problem is shown to reduce to an optimization problem in one variable. We also develop technical conditions under which the profit function is unimodal.

2 - Strategic Rationale for Outsourcing

Sarang Deo, Kellogg School of Management, 596 Leverone, 2001 Sheridan Road, Evanston, IL, 60208, United States, s-deo@northwestern.edu, Pradeep Bhardwaj

Outsourcing decision is usually justified on the basis of operational levers such as cost-reduction. Our objective here is to investigate non-operational levers for outsourcing. Using a bargaining model under duopoly we show that if the products are sufficiently substitutable, it is a dominant strategy for both firms to outsource only if the supplier has a higher cost of production. We also characterize the impact of the outsourcing decisions on the level of innovation in the outsourcing firms.

3 - Value of Retail Pricing Flexibility in a Decentralized Supply Chain

Saibal Ray, Associate Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, saibal.ray@MCGILL.CA, Tamer Boyaci, Yuyue Song

There are a number of papers in the OM literature which establishes the value of retail pricing flexibility in a centralized system. In this research we investigate the value of such flexibility to the individual channel members (and the whole chain) in a decentralized setting. We also show how dynamic contracting affects the value of retail pricing flexibility.

4 - Scheduling Priority Classes in Subscription-based Rental Service

Apurva Jain, University of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, apurva@u.washington.edu, Kamran Moinzadeh, Aussadavut Dumrongsiri

This paper offers a model and analysis of the rental process at a subscription-based business like Netflix. We analyze a priority scheduling scheme, currently in use, that gives priority to light renters over heavy renters and show that, in some situations, it may be more profitable for the firm to give priority to heavy renters. Several extensions are discussed.

■ WC04

C-Room 606

Tutorial: Differential Game Models in Marketing Science

Cluster: Tutorials
Invited Session

1 - Differential Game Models in Marketing Science

Gary Erickson, Professor, University of Washington Business School, Box 353200, Seattle, WA, 98195-3200, United States, erick@u.washington.edu

Markets are dynamic and involve oligopolistic competition, so the fit between differential games and marketing science is a natural one. This tutorial presents an overview of differential games, and discusses examples of differential game models used in marketing science, focusing on models involving advertising. The challenge of applying differential games empirically is also discussed, and example applications are presented.

■ WC05

C-Room 607

Discussion: Unconscious and Implicit Biases and the Impact on Women and Underrepresented Groups in Science and Engineering

Sponsor: Women in OR/MS
Sponsored Session

Chair: Joyce Yen, University of Washington, Box 352180, Loew 367, Seattle, WA, 98195-2180, United States, joyceyen@u.washington.edu

1 - Unconscious and Implicit Biases and the Impact on Women and Underrepresented Groups in S&E

Joyce Yen, University of Washington, Box 352180, Loew 367, Seattle, WA, 98195-2180, United States, joyceyen@u.washington.edu

In this session we will explore how we all have unconscious biases, how those biases manifest themselves in experiences such as evaluation, recruitment, selection, etc., the impact of unconscious and implicit biases on women and underrepresented minorities, and strategies for counteracting these biases.

■ WC06

C-Room 608

Resource Allocation Models in Software Management

Sponsor: Manufacturing & Service Oper Mgmt
Sponsored Session

Chair: Sriram Narayanan, Assistant Professor, Michigan State University, N370 BCC, Michigan State University, East Lansing, MI, 48824, United States, sriram@msu.edu

1 - Resource Allocation in Software Maintenance

Sriram Narayanan, Assistant Professor, Michigan State University, N370 BCC, Michigan State University, East Lansing, MI, 48824, United States, sriram@msu.edu, Jayashankar Swaminathan, Sridhar Balasubramanian

We study allocation of engineering resources in software maintenance. We show that as software bugs stay in the system longer, the probability of successfully resolving them reduces. We use this insight to estimate engineering resources required to manage debugging effort. We explore cut off policy based on threshold time without finding a successful resolution. Our analysis shows that such policies minimally impact rate of successful resolution and reduce waiting times for incoming bugs.

2 - On Software Diversification and Risk Management

Ramayya Krishnan, Heinz School, Carnegie Mellon University, Pittsburgh, PA, United States, rk2x@cmu.edu, Gaurav Kataria, Pei-Yu Chen

Shared vulnerabilities in homogeneous software deployment in a firm can be exploited resulting in correlated failure in the network. Software diversification using heterogeenous software is a way to reduce this risk but is not withut its costs. We present optimization models that take into account both the network benefits of homogeneous software deployment as well as the costs of correlated failure in helping IT managers assess software diversification.

3 - Matching Project Managers to Outsourced Information Technology Projects: An Empirical Study

Sandra Slaughter, Professor, Carnegie Mellon University, Tepper School, Pittsburgh, PA, 15213, United States, sandras@andrew.cmu.edu, Nishtha Langer, Tridas Mukhopadhyay

This study explores how information technology (IT) vendors match managers to outsourcing projects. Selecting the right person to lead an IT project is challenging, especially for larger vendors who have access to a myriad pool of talent and a vast divergence in projects. A consistent method of resource allocation is critical. We develop a two-stage model to optimize the fit between IT projects and project managers and evaluate the model using data collected from a major IT vendor.

4 - Complementarities Between IT and HR Practices in Knowledge Work

Ali Reza Tafti, PhD Student, University of Michigan, Ross School of Business, E0401 Elec Educ Resources Bldg, Ann Arbor, MI, 48502, United States, atafti@umich.edu, M. S. Krishnan, Sunil Mithas

We develop and validate a framework of Human Resources (HR) and Information Technology (IT) alignment. First, we examine the interaction between innovative HR-related work practices and specific IT-related practices in firm productivity outcomes. Next, we examine quantitative firm productivity impacts of IT investment and innovative HR-related work practices in the work of IT professionals. We utilize both objective economic metrics and managers' subjective assessments of firm productivity.

■ WC07

C-Room 609

Inventory

Contributed Session

Chair: Wikrom Jaruphongsa, Department of Industrial and Systems Engineering, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260, isejw@nus.edu.sg

1 - To Assemble or Not to Assemble: Optimal Policies for Assembly Systems with Echelon Stock Disposal

Alexandar Angelus, Associate Professor of Operations Management, Singapore Management University, 50 Stamford Road, Singapore, 178899, angelus@smu.edu.sg

We model a non-stationary assembly system under stochastic demand. The asset being assembled from multiple components is either a single product consumed by the demand or non-consumable production capacity. Components can be moved downstream, deferred, or disposed at each echelon. We find conditions that reduce this assembly system to an equivalent series system. We determine the form of the optimal multiechelon policy and provide managerial insights.

2 - A Short Range Scheduling Model for Blockbuster's Order Processing Operation

Casey Chung, University of Texas at Dallas, TX, casey.chung@utdallas.edu

Blockbuster distribution, a leader in the rental DVD and game media industry, has developed a highly specialized distribution network. Blockbuster operates in an environment where there is a high SKU base, product is time sensitive with an extremely short life cycle. The SKU base and volume is highly volatile from week to week and there are short lead times due to manufacturing delays from the suppliers. To accommodate this, Blockbuster maintains a single source distribution network where these products are processed and packed for shipping to over 5,600 stores across the United States based on a demand forecast. Thus Blockbuster must schedule these processing and packing operations through a variety of parallel departments which compete for subsequent merge conveyors and sortation system so that business and store service level requirements are met with a primary objective of minimizing the total processing and transportation costs with a secondary objective of balancing workload throughout the planning horizon. To address this problem we describe here the creation of a short range scheduling model developed at Blockbuster which uses mixed integer programming techniques that is expected to result in annual cost savings of over $1.5 million in addition to an increased system capacity of 36% as compared to current methods. This model is programmed in AMPL using CPLEX version 10.1 which was purchased by Blockbuster solely for the purpose of running this model. As the need and desire to continually reduce costs while maintaining capacities is a common thread across all supply chain practitioners, we also discuss the adaptability of this model to other organizations as this system of multiple processing departments which must then compete for subsequent shared constraints is very typical in industry. Additionally, to the best of our knowledge, this is to be the first model developed in theory and in practice to address this problem.

3 - Dynamic Lot-sizing Model with Demand Time Windows and Speculative Cost Structure

Wikrom Jaruphongsa, Department of Industrial and Systems Engineering, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260, isejw@nus.edu.sg, Hark-Chin Hwang

We study a dynamic lot-sizing model with demand time windows, during which items can be delivered to a customer without penalties. In this paper, we consider a general cost function allowing speculative motive. Utilizing an untraditional decomposition principle, we present a polynomial-time algorithm based on a dynamic programming approach.

■ WC08

C-Room 611

Inventory Management - Pricing

Contributed Session

Chair: Bram Desmet, Supply Chain Consultant / Researcher, MÖBIUS Research & Consulting / Ghent University, Latemstraat 93, Sint-Martens-Latem, BE-9830, Belgium, bram.desmet@mobius.eu

1 - Aircraft Spare Parts Inventory Control for End-of-life Service

Mansik Hur, PhD Student, University of Alabama, 1130 University Blvd., STE B9-415, Tuscaloosa, AL, 35401, United States, mhur@cba.ua.edu, Charles Schmidt

We consider an aircraft spare parts inventory control problem during the End-of-Life fleet operation. Typically customers place final purchase orders for spare parts for remaining lifetime demand. We seek to decide final order size of aircraft components such that target aircraft availability can be achieved over the EOL period. Modeling the failure process of parts as a continuous time Markov Chain, we derive a closed-form solution that computes final order size and perform numerical analysis.

2 - Stockout Compensation in Online Retailing
Daewon Sun, University of Notre Dame, dsun@nd.edu

In this presentation, we discuss stockout compensation policy in online retailing. First, we investigate the effect of offering a lower price during stockout to compensate for a customer's waiting time, solving simultaneously for both the optimal prices and the lengths of the in-stock and stockout periods. Second, we consider duopoly competition in which two retailers compete to maximize profit by jointly optimizing their pricing and inventory decisions.

3 - Inventory Models Under New Conditions
Marco Bijvank, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, mbijvank@few.vu.nl, Iris Vis, Ger Koole

Customers are not willing to wait for products that are out-of-stock.So,demand is lost.Retailers have to be careful in choosing their suppliers to achieve high service.Smaller order sizes and increasing order frequencies can also be noticed.We develop a model which reflects these trends:flexible lead times,lost sales,service level constraints.We determine near optimal parameter values for this model and compare the corresponding performances with classical inventory systems.

4 - Normal Approximations for Multi-echelon Safety Stock Optimization
Bram Desmet, Supply Chain Consultant / Researcher, MÖBIUS Research & Consulting / Ghent University, Latemstraat 93, Sint-Martens-Latem, BE-9830, Belgium, bram.desmet@mobius.eu, Hendrik Vanmaele

Multi-Echelon inventory models exploit the network structure of real-life supply chains in aggregating risk and uncertainty in a limited number of well chosen inventory points. We present a new approach to the problem that accounts for the variance on lead times and service times. We present a real-life application at a European leader in air conditioning leading to a 30 percent stock reduction for a baseline of 120Mi Euro.

■ WC09

C-Room 612

Project Management I

Contributed Session

Chair: Karolina Glowacka, University of Pittsburgh, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, kaglowacka@katz.pitt.edu

1 - Incorporating Customer Values in Trade-off Decisions
Al Thal, Assistant Professor, Air Force Institute of Technology, Wright Patterson Air Force Base, 2950 Hobson Way, Dayton, OH, 45433, United States, alfred.thal@afit.edu, David Shahady, Adedeji Badiru, John Bedingfield

Since many completed projects do not meet customer expectations, an integrated approach to incorporate user desirability may facilitate trade-off decisions when considering typical project dimensions (time, cost, and performance). Therefore, this presentation introduces the trade-off decision value cube. Customer values can be used to quantify the desirability of the cost and schedule dimensions at various levels of performance. The resulting cube provides a visual tool to help guide the project to a more successful completion.

2 - Organizational Strategy Within Project Management Framework
Antonio Amaral, PhD Student, Dept. Production and Systems, Azurém, Guimaraes, 4800-058, Portugal, antonio.manuel.amaral@gmail.com, Madalena Araujo

Despite all the differences on markets, cultural environment, and organizational objectives, some changes are modifying the way business occurs, turning competitive advantages difficult to accomplish. To achieve the strategy flexibility needed to obtain success, organizations are advised to develop their strategy based on, among others, Portfolio Management, Organizational Knowledge, Decision Support Systems and Organizational Maturity.

3 - Risk Management in the Contractual Language in the Construction Industry
Bashar Haddad, Assistant Professor, Indiana State University, MCT Department, College of Technology, Terre haute, IN, 47809, United States, bhaddad@isugw.indstate.edu

Exculpatory clauses are often used in construction contracts to shift potential risks of construction from one party to another. Hartman (1998) suggests that Canadian contractors use a risk premium between 9% and 19% to alleviate risks associated with accepting exculpatory clauses. The presentation highlights the results of a research study conducted on U.S. contractors to identify and quantify the risk premiums they use to mitigate the risk associated with accepting five exculpatory clauses.

4 - Petri Net Modeling of Project Management Systems
Houshang Darabi, Associate Professor, University of Illinois at Chicago, 842 W Taylor St, 2039 ERF, Chicago, IL, 60607, United States, hdarabi@uic.edu, Maryam Haji

Petri net (PN) based supervisory control is used to model a project management problem. The task net is modeled by a time PN. This PN establishes the plant model of a supervisory control problem. The resources are modeled by linear constraints defined on the marking of the PN. The constraints model the control specifications. A supervisory controller is constructed. The reconfiguration of the supervisory controller computes the optimal decisions when the actual project events are detected.

5 - Exercising Speed-up Options in General Stochastic Project Networks
Karolina Glowacka, University of Pittsburgh, 343 Mervis Hall, Pittsburgh, PA, 15260, United States, kaglowacka@katz.pitt.edu, Richard Wendell

Managing projects in an uncertain environment is a difficult problem. One approach to managing the risks is to incorporate contingency plans or options into the project. However, even with such options there is a question of when to exercise them. In this research we consider heuristic methods for exercising speed-up options when task durations are stochastic and present extensive computational results.

■ WC10

C-Room 613

Optimization Issues in Inventory Models

Cluster: Inventory

Invited Session

Chair: Markus Ettl, IBM T.J. Watson Research Center, Yorktown Heights, NY, 10598, msettl@us.ibm.com

1 - Correcting the Externalities of Price Protection
Karthik Sourirajan, IBM T.J. Watson Research Center, Yorktown Heights, NY, 10598, ksourira@us.ibm.com, Roman Kapuscinski, Pu Huang, Markus Ettl

In high-tech industries where technological obsolescence is high, price protection has become a standard element of contracts between manufacturers and distributors. While price protection was intended to give distributors sufficient incentives to stock enough inventory, empirical evidence suggests that price protection often leads to overstocking. We analyze acceptable mechanisms to reduce excess inventory caused by price protection.

2 - New Conditions and Proofs for (s, S) Policies
Liming Liu, Hong Kong Polytechnic University, LGT, Hong Kong Polytechnic University, Hong Kong, China, lgtliulm@polyu.edu.hk, Xiaolan Xie

With a proposed DXING-convexity, we show by K-convexity that for a wide range of demand distributions, the (st, St) policies or the modified (st, St) policies are optimal for finite-horizon periodic-review inventory systems with both backlogging and lost sales, and with both proportional and lump-sum shortage penalty costs.

3 - Shaping Demand in Supply Chains with Configurable Products
Markus Ettl, IBM T.J. Watson Research Center, Yorktown Heights, NY, 10598, msettl@us.ibm.com, Karthik Sourirajan, Feng Cheng, Pu Huang

We describe a methodology for effectively balancing supply and demand through an integrated use of demand flexibility and stochastic inventory planning. Demand flexibility is modeled by firm-driven product substitution where the firm recognizes customer buying preferences. We formulate a nonlinear optimization model and show how to exploit the structural properties of the model to develop an efficient solution procedure, utilizing sub-gradient derivative methods and integer programming techniques.

■ WC11

C-Room 614

Production & Scheduling II

Contributed Session

Chair: Sukgon Kim, School of Industrial Engineering, Grissom Hall, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907-202, Sukgon.kim@intel.com

1 - Determining Minimum Project Completion Time When Work Performance Dependents on Experience
Jordi Olivella, Assistant Professor, IOC Research Institute and Management Department. Technical University of Catalonia, Av. Diagonal, 647, planta 11, Barcelona, 08028, Spain, jorge.olivella@upc.edu, Albert Corominas, Rafael Pastor

Performance in doing a task depends on experience in this task, time without doing it and experience of other tasks. Then, in project planning, each task assignment is subject to the previous experience and also influences the future performances by providing practice. This is a very intuitive phenomenon but usually is only taken into account informally or partially. We present a mixed linear program to minimize the time of completion of a project considering these elements.

2 - Solving Two-plant Integrated Production-distribution Scheduling Problem for a Perishable Product

Priyantha Devapriya, PhD Candidate, Clemson University, 110, Freeman Hall, Dept.. of Industrial Engineering, Clemson, SC, 29634, United States, ddevapr@clemson.edu, William Ferrell

We consider fleet sizing of two-plant integrated production-distribution scheduling problem for a perishable product. The existence of two-plants adds an allocation problem making the problem harder to solve. Two genetic algorithm (GA) based solution approaches; 1) static allocation, and 2) dynamic allocation are given to solve this problem. The GA solution is compared to the optimal solution of moderate size problems obtained using complete enumeration with Condor.

3 - The One Dimensional Cutting Stock Problem with Due Dates

Harald Reinertsen, Leeds School of Business, University of Colorado, Boulder, CO, 80309-0419, United States, Harald.Reinertsen@colorado.edu, Thomas Vossen

Meeting due dates is often more important than minimizing scrap in cutting operations. We propose models and solution procedures which, in contrast to previous models, can solve industrial size problems with due date constraints. We are also able to consider different types and lengths of stock material. The model has been tested over 415 days of reinforcement steel production and results in significant improvements over current industry practice, both in terms of due date and scrap performance.

4 - Hierarchical Production Planning for Wafer Fabrication

Joonyoung Lee, Arizona State University, P.O. Box 875906, Dept.. of Industrial Eng, MASM lab, Tempe, AZ, 85287, United States, joon.lee@asu.edu, John Fowler

This paper presents hierarchical production planning of wafer fabrication with multiple objectives. Long-term production planning (LPP) is built using given demand and demand forecasts. Short-term production planning (SPP) uses the LPP results to determine production rate assignments to meet demand. Simulation is used to reflect dynamic changes in the fab. Trade-offs between WIP minimization and production maximization are shown.

5 - Integrated Planning of Production and Engineering Process Improvement

Sukgon Kim, School of Industrial Engineering, Grissom Hall, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907-202, Sukgon.kim@intel.com, Reha Uzsoy

In many high technology industries, production lots that generate revenue compete for the same equipment capacity with engineering lots aimed at process and yield improvement. We present a planning model that allocates production capacity between production and engineering activity to capture the tradeoff between engineering activity that results in increased output in the future, and production that meets demand and generates revenue immediately.

■ WC12

C-Room 615

Scheduling IV

Contributed Session

Chair: Chia-Shin Chung, Cleveland State University, 1860 E.18 Street, Cleveland, OH, 44139, United States, cschung00@hotmail.com

1 - Bi-objective Scheduling for Reentrant Hybrid Flow Shop: Application to a TFT-LCD Manufacturing

Hang-Min Cho, Doctor Course, Dept.. of Industrial Engineering, Hanyang University, 17 Haengdang-dong, Seongdong-gu, Seoul, 133-791, Korea, Republic of, yahmin@hanyang.ac.kr, In-Jae Jeong, Jungwuk Kim, Suk-Joo Bae

This article proposes local search based pareto genetic algorithms to solve the bi-objective scheduling problem to minimize makespan and total tardiness for a reentrant hybrid flowshop. The pareto genetic algorithms are compared with existing dispatching rules under a variety of experimental conditions. We also compare the performance of the proposed genetic algorithms with that of a commercial scheduling software based on real scheduling data provided by a TFT-LCD factory in Korea.

2 - Dynamic Pricing Using Real-time Reinforcement Learning

Rupal Rana, warwick university, 46 Flax Road, Leicester, le4 6qd, United Kingdom, Rupal.Rana06@PhDwbs.ac.uk, Fernando Oliveira

In this paper we analyze the service industry. We assume the service time is separated into three different time segments and customers from different segments arrive simultaneously into an electronic market. We use dynamic pricing to maximize revenue and improve resource management. We implement a real-time reinforcement learning algorithm which is able to forecast demand and maximize revenue simultaneously by taking into account the inter-dependencies between the different market segments.

3 - A Novel Neighborhood Search for General Integer Program (NSIP)

Xinhui Zhang, Assistant Professor, Wright State University, 207 Russ Center, 3640 Colonel Glen Hwy, Dayton, OH, 45435, United States, xinhui.zhang@wright.edu, Qun Gu

The research present a novel neighborhood search algorithm for general integer programs (NSIP). The algorithm generates diverse, multiple seed solutions to probe the solution landscape and uses LP-based neighborhood structures for optimization problems. Rhe algorithm has been tested on set covering, knapsack, and staff scheduling problem and has produced promising results – it is able to yield multiple high-quality solutions 5 t0 10 times faster than state-of-the-art solvers.

4 - Combining Process Selection and Lot Sizing Models for Production Scheduling of Electrofused Grains

Reinaldo Morabito, Associate Professor, Universidade Federal de Sao Carlos, Departamento de Engenharia de Producao, UFSCar, Sao Carlos, SP, 13565-905, Brazil, morabito@power.ufscar.br, Jose R. D. Luche, Vitoria Pureza

This work presents optimisation models to support decisions in the production planning and control of the electrofused grain industry. A case study was carried out in a Brazilian company with the aim of helping to increase productivity and improve customer service concerning meeting deadlines. Mixed integer linear programming models combining known models of process selection and single-stage lot sizing are applied for the production scheduling of electrofused grains.

5 - A Genetic Algorithm to Minimize the Total Tardiness for M-machine

Chia-Shin Chung, Cleveland State University, 1860 E.18 Street, Cleveland, OH, 44139, United States, cschung00@hotmail.com

The m-machine, n-job, permutation flowshop problem with the total tardiness objective is a common scheduling problem, which is known to be NP-hard. We develop a genetic algorithm that is capable of handling problems with larger n. We also undertake a numerical study that compares the performance of our genetic algorithm with various heuristic algorithms, including the well known NEH algorithm. Extensive computational experiments indicate that our algorithm is effective.

■ WC13

C-Room 616

Integer Programming Theory

Contributed Session

Chair: Chun Wang, University of Wisconsin - Madison, 1513 University Avenue, Room 4126, Madison, 53705, United States, wang26@wisc.edu

1 - Utilizing MIR Mixing for a Path-based Separation Algorithm

Philipp Christophel, DS&OR Lab, University of Paderborn, Warburger Strafle 100, Paderborn, 33098, Germany, christophel@dsor.de, Laurence Wolsey

Modern MIP solvers use a number of cutting plane separation algorithms to strengthen the initial formulation of mixed integer programming problems. Complemented mixed integer rounding (c-MIR) cuts are successfully used in this context. MIR mixing can be seen as an extension of mixed integer rounding to utilize more than a single row of the problems constraint matrix. We suggest a MIR mixing-based separation algorithm, discuss the relation to flow path cuts and report computational results.

2 - A Theoretical Examination of Cutting Planes for Generalized Disjunctive Programming

Nicolas Sawaya, Carnegie Mellon University, Dept.. Chemical Eng., Pittsburgh, PA, United States, nws@andrew.cmu.edu, Ignacio Grossmann

In this presentation, we examine the theoretical framework underlying cutting planes for Generalized Disjunctive Programming (GDP), and report some exciting insights and connections between Disjunctive Programming as originally proposed by Egon Balas, and GDP, emphasizing fundamental understanding of their corresponding cutting planes. Specifically, we focus on the connections that exist between cuts for GDP and disjunctive and lift and project cuts.

3 - Facets of a Resource-constrained Scheduling Problem
Herve Kerivin, Assistant Professor, Universite Blaise Pascal, Clermont-Ferand II, Laboratoire LIMOS, CNRS UMR 6158, Complexe scientifique des Cezeaux, Aubiere, 63177, France, kerivin@math.univ-bpclermont.fr

The process move programming problem consists of finding the least disruptive sequence of operations to reconfigure certain distributed systems. This problem can be formulated as an integer linear program based on the notion of partial linear ordering fulfilling some resource constraints. We strengthen our formulation by adding new classes of facet-defining inequalities. We also discuss their separation problems as well as their practical relevance when embedded in a branch-and-cut algorithm.

4 - The Robust 0-1 Knapsack Polyhedron
Muhong Zhang, Assistant Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287, United States, muhong.zhang@asu.edu, Alper Atamturk

In this talk we present a study of the polyhedral structure of the robust 0-1 knapsack problem with uncertain constraint coefficients. We introduce new facet-defining inequalities. Results of numerical experiments are presented.

5 - Embed Nested Partitions Within Column Generation and Lagrangian Relaxation
Chun Wang, University of Wisconsin - Madison, 1513 University Avenue, Room 4126, Madison, 53705, United States, wang26@wisc.edu, Andrew Miller

Nested Partitions is an effective metaheuristic that focuses on the promising region while maintaining a global perspective on the whole space. We discuss ways to embed NP within Column Generation and Lagrangian Relaxation. By integrating information from the pricing problem into the NP sampling scheme, we generate columns by sampling that have negative reduced cost for the RMP. This approach can thus help NP find better samples, and improve the computational efficiency and convergence speed.

■ WC14

C-Room 617

Network Optimization I

Contributed Session

Chair: Gang Li, The University of Texas at Austin, McCombs School of Business, Austin, TX, United States, gang.li@mail.utexas.edu

1 - System Optimal Flow Patterns by Different Traffic Dynamics Models: Properties and Implications
Wei Shen, PhD Candidate, Department of Civil and Environmental Engineering, University of California, Davis, 1001 EUIII, One Shields Avenue, Davis, CA, 95616, United States, wshen@ucdavis.edu, Michael Zhang

This paper studies the system optimal traffic patterns by various traffic models, and exploits their relationship to efficiently find a traffic-consistent solution. Focusing on networks without diverges, we show that the minimum system cost is free of traffic dynamics, and an optimal solution consistent with all the traffic dynamics can be obtained by solving a much smaller linear system than the original program. The model can be applied in emergency evacuation and corridor ramp control.

2 - Computational Study of the Probabilistic Network Design Problem
Pietro Belotti, Tepper S. of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, United States, belotti@andrew.cmu.edu, Anureet Saxena

We study the variant of the Multi-commodity Network Design problem, where the point-to-point traffic demands are assumed to be random 0-1 vectors. We reduce this problem to the Probabilistic Set Covering (PSC) problem and discuss a large scale implementation of a recently proposed cut-and-branch algorithm to solve it. Our computational results on a test-bed of mid-size network topologies from real-world backbone and metropolitan networks attest to the effectiveness of our procedure.

3 - On Minimizing an Upper Confidence Limit for a Shortest Path
Kevin Hutson, Assistant Professor, Furman University, Dept.. of Mathematics, 3300 Poinsett Hwy, Greenville, SC, 29613, United States, kevin.hutson@furman.edu, Douglas Shier

Given a network where arc lengths are independent random variables with finite mean and variance, we consider the problem of finding an s-t path that minimizes an upper confidence limit for the path length. This approach to finding a probabilistically short path can be formulated as a bicriterion shortest path problem. We derive conditions to reduce the number of efficient (Pareto optimal) paths needed to be considered and computationally investigate a label-correcting algorithm.

4 - Decomposition Approach to Convex Hall Computation and Its Application to Computer Networks
Svetlana Peltsverger, Assistant Professor, Southern Polytechnic State University, 1100 S Marietta Pkwy, Marietta, GA, 30060, United States, speltsve@spsu.edu

Traditionally nodes in an ad hoc network associated with 2D points. In order to take into consideration other important characteristics including power consumption, requested bandwidth, the dimension of the node's state vector should be RD (R>2). Computations in ad hoc networks should be distributed due to the lack of the fixed infrastructure. Proposed decomposition approach allows performing the above mentioned computation in an effective way. Computational results will be reported.

5 - Network Selection Problem: Constructing Smaller Approximate Networks
Gang Li, The University of Texas at Austin, McCombs School of Business, Austin, TX, United States, gang.li@mail.utexas.edu, Hari Natarajan, Anant Balakrishnan

We consider the problem of constructing a smaller network in place of an existing complex network to reduce the size of model formulations for optimizing flows on the network. The new network uses only a subset of arcs/nodes of the original network, but can have longer end-to-end path lengths. We develop an integer programming modeling framework to construct the condensed network while also ensuring good approximation of the true path lengths, and develop methods to solve the problem effectively.

■ WC15

C-Room 618

Stochastic Optimization/Large Scale Optimization I

Contributed Session

Chair: Erim Kardes, USC, USC, Ronal Tutor Hall, 3710 McClintock Ave,Room 314, Los Angeles, CA, 90089, United States, kardes@usc.edu

1 - A Tabu Search for Stochastic Programs with Discretely Distributed Probabilistic Constraints
Eric Beier, Graduate Student, Texas A&M University Department of Industrial and Systems Engineering, Zachry Hall, College Station, TX, 77840, United States, ebeier@tamu.edu, Matthew Tanner

I present a tabu search metaheuristic for solving stochastic programs with discretely distributed probabilistic constraints. The proposed strategy exploits the scenario structure of the model by iterating through feasible solutions defined by sets of scenarios required to be satisfied. An implementation is described and numerical results from instances of a disease control application are reported. The effectiveness of the algorithm is demonstrated empirically.

2 - Analysis of the M/G/1 Queue Under the (N,D,T)-policy
Ho Woo Lee, Professor, Sungkyunkwan University, Dept.. of Syst Magmnt Engr, Sungkyunkwan Univ, Suwon, 440-746, Korea, Republic of, hwlee@skku.edu, Jung Woo Baek, Won Joo Seo, Se Won Lee

In this talk, we anlyze the M/G/1 queueing system under the mixed control of N-, D- and T-policy. The server leaves for repeated vacations until, at the end of a vacation, he finds N or more customers or the workload greater than D whichever occurs first.

3 - An Optimization Model for Internet Bandwidth Trading in a Hub-&-Spoke Interconnection Architecture
Dohoon Kim, Professor, Kyung Hee Univ., School of Business, Kyung Hee Univ., Hoegi-dong 1, Dongdaemoon-gu, Seoul, 130-701, Korea, Republic of, dyohaan@khu.ac.kr

This study presents Hub-&-Spoke(H&S) ISP interconnection model for end-to-end Quality of Service in the next generation Internet regime. The hub also arranges Bandwidth Trading(BT) based on the market mechanism. After introducing qualitative and quantitative justification of the H&S interconnection model, we present a decision model for BT embedded in the H&S architecture.

4 - Solving a Stochastic Dispatching and Routing Problem Using Approximate Dynamic Programming Algorithm
Siqian Shen, PhD Student, Department of Industrial and System Engineering, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, sshen@ufl.edu, Lefei Li

We analyze the vehicle dispatching and routing problem with uncertain exogenous information in Emergency Response Service (ERS). We consider a disaster relief scenario with three parties involved in: a relief vehicle, casualties and hospitals, applying the Approximate Dynamic Programming to integrate both dispatching and routing phases. Linear,weight reciprocal and decaying exponential functions are used to approximate the value function respectively.

5 - Discounted Robust Stochastic Games and an Application to Queuing Control

Erim Kardes, USC, USC, Ronal Tutor Hall, 3710 McClintock Ave., Room 314, Los Angeles, CA, 90089, United States, kardes@usc.edu, Fernando Ordonez, Randolph Hall

We consider n-person non-zero sum discounted stochastic games in which none of the players knows the true data of the game and each player considers a distribution-free incomplete information stochastic game to be played using robust optimization.We prove the existence of an equilibrium point in such games and propose an explicit formulation for equilibrium calculation. We illustrate the use of discounted robust stochastic games in a single server queuing control problem.

■ WC16

C-Room 619

OR Models in Healthcare II

Contributed Session

Chair: Lawrence V. Fulton, ORSA Branch / Sr. Mil. Analyst, Lawrence.Fulton@AMEDD.ARMY.MIL

1 - Analysis of Breast Cancer Cost and Treatment Using Sas

Beatrice Ugiliweneza, Mrs, University of Louisville, Departement of Math, Louisville, ky, 40292, United States, b0ugil01@louisville.edu, Patricia Cerrito

Objective: To extract information on breast cancer treatment. Methods: Two incomplete datasets were used to define one complete dataset with predictive modeling on the first to score the second. The second contains longitudinal information on patient outcomes for additional analyses. Results: Scoring achieved the goal of defining a complete dataset.

2 - Biological Cell's Production System

Harun Pirim, PhD Student, MS State University, Industrial Engineering Dept., Starkville, MS, 39362, hp100@msstate.edu

Today's production systems tend to eliminate waste at most, increase quality of product while producing with little lead times. For this case inspirations from nature may find solutions that address to such manufacturing conflicts. This paper discusses analyzing nature especially biological cell to have insights about the innovations for operation techniques and future of manufacturing.

3 - 911 Calls as a Predictor for Ambulance Diversion

Abey Kuruvilla, University of Wisconsin Parkside School of Business, Kenosha, WI, abeykuruvilla@gmail.com, Suraj M. Alexander, Ryan Gill

This research effort is undertaken to develop a predictor for ambulance diversion. Various logistic and multinomial regression models are used to establish the relationship between 911 calls and diversion. The models are developed using real data from five hospitals and the EMS system of Kansas City Missouri, for a period of two years. A program is developed using R', a statistical software, to analyze the unique form of the data obtained - 911 calls coming into a region and the hospital diversion data of that region. Once the correlation between 911 calls and diversion is established, other causal factors are taken into consideration and a model is developed whereby a region could predict the likelihood for diversion to occur in hospitals of that region. The research, therefore, develops tools that EMS communities and hospitals can use to predict the probability of the occurrence of diversion in a region or in specific hospitals based on 911 calls as well as other explanatory variables.

4 - Optimization Approaches for the Relocation of Medical Assets

Lawrence V. Fulton, ORSA Branch / Sr. Mil. Analyst, Lawrence.Fulton@AMEDD.ARMY.MIL, Reuben McDaniel, Harrison Hassell, Leon Lasdon, Barbara Wojcik

This study describes optimization models for decision support in the relocation of medical treatment facilities (MTF) and aeromedical evacuation assets during steady-state military combat operations. The objective to be minimized is the sum of the distances among potential evacuation and hospitalization sites and recently observed point of injury locations. Results of this approach (modified due to time and software limitations) were used during recent deployment operations and provided decision support for the movement and construction of a field hospital at Al Asad as well as the relocation of an evacuation site. Further, the use of stochastic programming is suggested for determining optimal locations given uncertainty over time. There is great potential for widespread use of this approach in operations that involve logistical consolidation (e.g., military consolidation in Europe and in combat theaters).

■ WC17

C-Room 620

Information Systems and Security

Contributed Session

Chair: Michael D. Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15217, United States, mds@cmu.edu

1 - A Mathematical Model for Optimizing the Number of Managerial Layers for Organization Structure Design

Lixiang Jiang, LJian001@fiu.edu

The purpose of this paper is to develop a mathematical model to decide the number of layers for designing the structure of organization characterized with mass production. The objective function represents the minimal cost of unit product produced. The division of labors, span of control and overhead of the managerial roles to coordinate and control the work activities are considered to be constraints for the model. An experimental case study is conducted to verify the model and the analysis result is given.

2 - Computer Crimes and Their Prosecution

Cynthia Knott Eck, Assistant Professor, Marymount University, 1000 North Glebe Road, Arlington, 22207, United States, cynthia.knott@marymount.edu, Diane Murphy

The Department of Justice has successfully prosecuted many criminal cyber crime cases over the past five years. Is the type of crime changing over time as cyber criminals become sophisticated? Are they U.S-based or are they attacking U.S. systems from other countries? What type of punishment do cyber criminals receive from the courts? This study sets out to analyze over 100 recent cases examining correlations between some 20 factors to answer the questions above.

3 - Choosing Internet or Social Contacts for Information Source: An Exploratory Experiment

Jinyoung Min, KAIST Graduate School of Management, 207-43 Cheongryangri-Dong Dongdaemun-Gu, Seoul, 130-012, Korea, Republic of, saharamin@business.kaist.ac.kr, Heeseok Lee

Most of information sources such as newspapers, or firm homepages provide information on the Internet. However, people still ask their acquaintances for information. Choosing an information source depends on what information they are looking for. The primary objective of this paper is to find that while Internet is a more suitable source for functional, general or less credible information, a social contact is a more suitable for expressive, context specific, or more credible information.

4 - Piracy or Promotion? The Impact of the Broadband Internet Penetration on DVD Sales

Michael D. Smith, Associate Professor, Carnegie Mellon University, 4800 Forbes Avenue, HBH 2105D, Pittsburgh, PA, 15217, United States, mds@cmu.edu, Rahul Telang

We analyze the impact of broadband Internet access on DVD sales using a local-level dataset covering 2000 to 2003. Contrary to industry concerns, we find that increased Internet penetration led to an increase in DVD sales. Using the most conservative results, 9.3% of the $14.1 billion increase in DVD sales during our study period can be directly attributed to increased broadband Internet penetration. This corresponds to a $1.3 billion increase in revenue and a $630 million increase in profits.

■ WC18

C-Room 201

Computing and Optimization Challenges in Multiplayer Games

Sponsor: INFORMS Computing Society

Sponsored Session

Chair: J. Cole Smith, Associate Professor, University of Florida, P.O. Box 116595, Gainesville, FL, 32607, United States, cole@ise.ufl.edu

1 - Bilevel and Trilevel Models for Electric Power Grid Interdiction and Defense

Javier Salmeron, Associate Professor, Naval Postgraduate School, Operations Research Dept., Monterey, CA, 93933, United States, jsalmero@nps.edu, Kevin Wood

We describe defender-attacker-defender (DAD) models for protecting an electrical power grid physical infrastructure. We first discuss the attacker-defender (AD) problem as one of interdiction: Use limited attacks on system components to maximize energy disruption. The DAD model uses limited defensive resources to protect components: We interdict the interdictor. We discuss decomposition techniques to solve realistic electric power-transmission instances of AD, and smaller instances of DAD.

2 - Renewing, Building, and Maintaining Infrastructure in Basra, Iraq
Dale Henderson, Assistant Professor, United States Military Academy, 272A Bowman Loop, West Point, NY, 10996, United States, Dale.Henderson@usma.edu

We describe our experiences as part of a military study team in Basra, Iraq in the summer of 2007. We assisted the provincial reconstruction team and the provincial technical directorates in assessing power, water, and sewerage infrastructure, in determining the best way to allocate investments in these areas, in developing and implementing maintenance operations practices, and in growing a pool of skilled engineers through the University of Basrah.

3 - Basis Enumeration Algorithm for Solving Bilinear Programming Problems
Churlzu Lim, Assistant Professor, UNC-Charlotte, 9201 University City Blvd., College of Engineering, Charlotte, NC, 28223, United States, clim2@uncc.edu

We consider a bilinear programming problem in which two disjoint sets of variables are constrained by respective nonempty polytopes while comprising bilinear terms in the objective function. This problem has a broad applicability from bimatrix games to Markovian decision problems. In this talk, we briefly survey bilinear programming solution methods. Then, we propose a new finitely convergent algorithm that implicitly enumerates bases by sequentially covering a polytope.

■ WC19

C-Room 203

Work Sharing through Bucket Brigades

Cluster: Workforce Engineering
Invited Session

Chair: Yun Fong Lim, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, SG, 178899, Singapore, yflim@smu.edu.sg

1 - Flexible Servers in Tandem Lines with Fewer Servers Than Stations
H. Eser Kirkizlar, Georgia Tech, H. Milton Stewart School of ISyE, Atlanta, GA, 30332, United States, ekirkizl@isye.gatech.edu, Sigrun Andradottir, Hayriye Ayhan

Consider a tandem line with infinite or finite buffers between stations, infinite supply of jobs in front of the first station, and infinite room for storage after the last station. We study optimal and heuristic server assignment policies when the number of servers is smaller than the number of stations, and also compare the performance of such systems as a function of how flexible the servers are.

2 - Chaos on a Discrete Assembly Line
Donald Eisenstein, University of Chicago, Graduate School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States, don.eisenstein@ChicagoGSB.edu, John Bartholdi, Yun Fong Lim

A natural extension of the bucket brigade model of manufacturing is capable of chaotic behavior in which the instantaneous production rate is, in effect, random, even though the model is completely deterministic. This is, we believe, the first proven instance of chaos in discrete manufacturing.

3 - Maximizing Throughput of Bucket Brigades on Discrete Work Stations
Yun Fong Lim, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, SG, 178899, yflim@smu.edu.sg, Kum Khiong Yang

The throughput of a bucket brigade on discrete work stations may be suboptimal because workers can be blocked even with the slowest-to-fastest ordering. We develop an analytical procedure to find policies that maximize the throughput for a given work distribution on the stations. When workers have very different velocities fully cross-training and sequencing them from slowest to fastest is almost always the best policy. Furthermore, limiting the work zone of workers may improve the throughput.

■ WC20

C-Room 204

Decision Analysis: Socio-technical Perspectives

Sponsor: Decision Analysis
Sponsored Session

Chair: Alec Morton, Dr, London School of Economics and Political Science, Operational Research Group, London, WC2A 2AE, United Kingdom, A.Morton@lse.ac.uk

1 - The Social Side of Decision Analysis: Is Scientific Knowledge Possible?
Alec Morton, Dr, London School of Economics and Political Science, Operational Research Group, London, WC2A 2AE, United Kingdom, A.Morton@lse.ac.uk, Gilberto Montibeller

What do people learn from modelling? Are there good ways to structure models? Why do some organisations institutionalise orderly approaches to decision making and others fail? This talk will discuss what lessons Decision Analysis can draw from other areas of management science where serious efforts have been made to study such questions systematically.

2 - Socio-technical Decision Analysis
Larry Phillips, larry_phillips@msn.com

Although decision analyses are often conducted to resolve difficult technical issues, they can, with careful design, additionally resolve social issues, such as building trust, increasing communication, creating shared understanding, providing authority to recommendations and gaining commitment to the way forward. This paper explains how decision analysis can be carried out to achieve social goals as well as resolve technical issues.

3 - Socio-technical Methodologies for Strategic Policy-making
Martin Schilling, m.schilling@lse.ac.uk, Cornelius Schaub, Nadine Oeser

Analytical-deliberative methodologies can aid politicians and civil servants with the formulation of strategic policies. In this session, we introduce a framework to classify these methodologies and discuss the potential contribution of decision analyses for strategic policymaking.

4 - Building Collaborative Networks for the Fight Against Undernourishment with Decision Conferencing
Andres Lartigue Debian, Fundaciòn MARA, Marcelo T. de Alvear 1261 of 29, Buenos Aires, BA, Argentina, alartigue@binova.com.ar

Fundaciòn MARA facilitated a series of Decision Conferences for a group of representatives that came from various organizations and companies from the agricultural sector in Argentina. An NGO who pursues this goal named CONIN, would serve as the base of a network committed in the fight against undernourishment. The DA methodologies applied on this project, still in progress, helped to build trust between all the participants and on a best way forward to achieve this goal.

■ WC21

C-Room 205

Energy and the Environment

Sponsor: Decision Analysis
Sponsored Session

Chair: Eric Chung, Senior Consultant, Strategic Decisions Group, 4548 NE 27th Avenue, Portland, OR, 97211, United States, EChung@sdg.com

1 - Evaluation of Immobilization Alternatives for Eurex Process Waste Stored in Saluggia, Italy
Alan Brothers, Senior Research Scientist, Battelle Pacific Northwest National Laboratory, 902 Battelle Boulevard, P.O. Box 999 MSIN: K6-08, Richland, WA, 99352, United States, alan.brothers@pnl.gov, Shas Mattigod, Denis Strachan, Gordon Beeman

Using technical descriptions of alternative performance, Sicieta Gestione Impianti Nucleari (Sogin) staff evaluated three alternatives to treat and immobilize radioactive Saluggia nuclear waste. Battelle staff mapped technical performance to a broader set of decision objectives and used a modified SMART decision process without explicitly defining measurement scales and value functions. Through this process, the Battelle staff verified the selection made by the Sogin staff.

2 - Integrating Real Options and Decision Analysis: Case Studies From the Energy Sector
Eric Chung, Senior Consultant, Strategic Decisions Group, 4548 NE 27th Avenue, Portland, OR, 97211, United States, EChung@sdg.com

SDG assists many energy companies with major environmental investment decisions. While we typically use a traditional decision analysis framework to address such investments, we have found it valuable to apply real option analysis as a parallel, complementary tool. In this presentation, we will revisit differences between real options and decision analysis, build an integrated framework, and review a case study where we applied this technique to an emissions control investment decision.

3 - How Does Problem Representation Influence Decision Performance and Attitudes?

Michael Johnson, Associate Professor, Department of Public Policy and Public Affairs, John W. McCormack Graduate School of Policy Studies, University of Massachusetts Boston, 100 Morrissey Blvd, Boston, MA, 02125-3393, United States, michael.johnson@umb.edu, Jennifer Mankoff, Susan Fussell, Deanna Matthews

Current research on individual decision support to reduce negative environmental impacts relies on users to evaluate multiple suggestions for daily behavioral change. In this paper we examine the impact of length and level of information content of the suggestions on quality of decisions and satisfaction with the decision process. Experimental results provide specific guidance for decision support system development, especially for routine decisions performed quickly and often.

4 - Using Decision Analysis to Make Effective Decisions in Local Government

Dan Pitzler, Consulting Economist, Decision Analysis, CH2M HILL, P.O. Box 91500, Bellevue, WA, 98033, United States, Dan.Pitzler@ch2m.com

Decision analysis is becoming more popular as an approach to decision making in local government. This presentation will provide some examples of how decision analysis is currently being practiced in local government, and explore some of the unique challenges experienced by decision analysts in this venue.

■ WC22

C-Room 206

Decision Support Systems Tools

Contributed Session

Chair: Zhenying Zhao, Intel, 5000 W. Chandler Blvd, Chandler, 85226, United States, zhenying.zhao@intel.com

1 - Modeling System of System Behavior

Surya Pathak, Research Associate Faculty, Vanderbilt University, Featheringill Hall, 271, Nashville, TN, 37235, United States, surya.pathak@vanderbilt.edu, Mark McDonald, Sankaran Mahadevan

We address the problem of modeling and analyzing System of Systems (SOS) behavior by combining agent based modeling, chaos analysis and response surface estimation methods. We present a traffic flow network to demonstrate the framework. We further discuss how these results could be used for policy optimization in SOS.

2 - Bringing Operations Research to the Forefront

Ximena Cerda, AIMMS Specialist, Paragon Decision Technology Inc., 5400 Carillon Point, Kirkland, WA, 98033, United States, x.cerda@aimms.com

Operations Research is still an area largely dominated by experts of the field. This presentation will focus on how to bridge the gap between the experts and the business users by using the most stylish mathematical modeling tool available. AIMMS provides an optimization environment to not only formulate optimization models but to create integrated decision support systems for practical use in any business.

3 - Credible and Noncredible Solution - When One Party Optimse Utilization of a Common Network

Thor Bjorkvoll, senior scientist, SINTEF Applied Economics and Operations Research, S.P. Andersens vei 5, Trondheim, 7465, Norway, Thor.bjorkvoll@sintef.no

The norwegian gas export network is partly privately owned. Due to gas demand the network is a botleneck. Maximizing profit, companies producing gas and utilizing the network must take into account both network ownership shares and field ownership shares. Modelling and optimizing production and the joint use of the network, persuing the interest of a single company, raises credibilty as a major issue. Problems and simple solutions will be presented

4 - Goal Programming and Sequential Solve for Large Prodcution Planning Problem

Zhenying Zhao, Intel, 5000 W. Chandler Blvd, Chandler, 85226, United States, zhenying.zhao@intel.com

A real-life production plannig problem is required to trade off multiple objectives to generate a reasonable master production schedule (MPS). In this paper, goal programming and sequential sovle approach are used for solving a large-schedule MPS problem in semiconductor industry. Detailed algorithm on goal calcualtion and estimation, and constraints geenration are discussed. One case study and application results are presented.

■ WC23

C-Room 208

Queueing Models II

Contributed Session

Chair: Sunkyo Kim, Associate Professor, School of Business, Ajou University, San-5, Woncheon-dong, Suwon, Korea, Republic of, sunkyo@ajou.ac.kr

1 - On Extensions of the Parametric Decomposition Approach to Evaluate Production-Inventory Networks

Sandeep Srivathsan, Graduate Research Assistant, Oklahoma State University, School of Industrial Engr. & Mgmt., 322 Engineering North, Stillwater, OK, 74078, United States, sandeep.srivathsan@okstate.edu, Manjunath Kamath

We first review extensions of the parametric decomposition approach for solving queueing models of production inventory networks. We then present a modification where the backorder distribution plays a more direct role in linking successive stages of the production network model within the solution approach. We discuss the accuracy of the modified approach using production-inventory network examples that include features such as multi-server stages and batch service.

2 - Bandwidth Allocation for Generalized Processor Sharing Servers with Fluid Input

Sunggon Kim, Dept.. of Information Statistics, Gyeongsang National Univ., Gajaw 900, Jinju, 660-701, Korea, Republic of, sgkim@gnu.ac.kr, Dan Keun Sung, Ju Yong Lee

We analyze the bandwidth allocation for fuid simulation in Generalized Processor Sharing(GPS) servers. Four properties which define GPS servers with fluid input are discussed. We obtain a representation of bandwidth allocation satisfying the four properties. Using the representation, we show that there exists a unique allocation with the properties. A bandwidth allocation algorithm is proposed and its performance is compared with the conventional packet level simulation.

3 - A Framework for Modeling Simple Web Based Applications as Queuing Systems with Resource Locking

Mohammad Alam, Student, Arizona State University, 6861 West St Charles Avenue, Laveen, AZ, 85339, United States, Mohammad.Alam@asu.edu, Srimathy Mohan, Antonios Printezis

The main elements of a web-based application are web servers, application servers and external servers or databases. Resource locking is a feature in server interaction that greatly affects the entire system performance. In this study, we model a web-based application as a queuing system with resource locking and present an algorithm to solve the model. A comparison to simulation shows that our algorithm produces fast and accurate results. Finally, we discuss possible extensions to the model.

4 - Regression Approximation of the Variability Function in Queueing Analysis

Sunkyo Kim, Associate Professor, School of Business, Ajou University, San-5, Woncheon-dong, Suwon, Korea, Republic of, sunkyo@ajou.ac.kr

In queueing analysis, arrival processes are typically modeled as renewal processes. Under moderate conditions the renewal approximation performs well. However, it has been noted that high variability in external arrival process or in service process requires more sophisticated approximation. Whitt's variability function is one example of refinements in this regard. We propose a regression approach to approximate the k-interval squared coefficient of variation, c^2(k).

■ WC25

C-Room 210

Statistics/Quality Control II

Contributed Session

Chair: Lei Zhang, Assistant Professor, Oregon State University, School of Civil & Construction Eng., 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

1 - Conditional Quantile Processes Under Increasing Dimension

Alexandre Belloni, Duke University, The Fuqua School of Business, Durham, NC, United States, belloni@mit.edu, Victor Chernozhukov

We study high-dimensional parametric quantile regression models and nonparametric series frameworks, where the dimension of the model increases with the sample size, using quantile regression processes. We derive growth conditions under which uniform results hold (rates, linear approximations, CLT). Moreover, we discuss a rearrangement procedure to obtain monotonic estimates of conditional quantile curves which are always closer to the true curves in the Lp sense, p>=1.

2 - Optimization of Experiments with Functional Response Variables
Flavio Fogliatto, Professor, Federal Univ. of Rio Grande do Sul, Av. Osvaldo Aranha, 99 - 5o andar, Porto Alegre, RS, 90040020, Brazil, ffogliatto@producao.ufrgs.br

We investigate the optimization of experiments with functional responses. Such responses give one or more profiles as observed outcomes at each treatment, and the objective is to identify the outcome closest to a target profile. We propose the use of the Hausdorff Distance in combination with a desirability function to obtain a utility function that gives the distance of a functional outcome to its desired target. We compare the performance of three proposed metrics based on a case example.

3 - An Approach to Robust Optimization for Quality Loss Functions
Ng Szu Hui, Department of Industrial & Systems Engineering, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, isensh@nus.edu.sg

In the design or improvement of systems and processes, the quadratic loss functions have been commonly used. Typically, these loss functions have to be estimated based on the experimental data. Under the normal linear model assumption, we account for the parameter uncertainty in the estimated model, and derive an unbiased estimator for the average quadratic loss. This unbiased estimator is then used as the objective to determine the optimal levels of the design variables. We further propose an alternative approach to determine more robust solutions for this problem.

4 - The Influence of Supply and Demand Fluctuations on Travel Time Reliability
Lei Zhang, Assistant Professor, Oregon State University, School of Civil & Construction Eng., 220 Owen Hall, Corvallis, OR, 97331, United States, lei.zhang@oregonstate.edu

Travel demand exhibits temporal variations. Transportation facilities may experience reduced capacity due to (non)recurrent events. This paper analyzes the influence of these supply-demand uncertainties on travel time reliability using the behavioral user equilibrium model. An important practical implication/complication from the findings is that reducing supply or demand uncertainty alone could exacerbate travel time variation and worsen travel reliability.

■ WC26

C-Room 211

Data Mining Applications in Neuroscience

Sponsor: Data Mining (Sponsored)
Sponsored Session

Chair: Onur Seref, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, seref@ufl.edu

Co-Chair: Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, petrosx@ufl.edu

1 - Quantitative Analysis of Eye Movement Datasets for Controlling Neurodegenerative Diseases
Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States, petrosx@ufl.edu, J. Chris Sackellares, Frank Skidmore, Panos Pardalos, Chang-Chia Liu, Onur Seref, Alla Kammerdiner

Eye movement measurement plays an important role in the examination the progress of the neurodegenerative diseases. There are several techniques for measuring eye movement, the Infrared detection technique (IR), Videooculography (VOG), Scleral eye coil and EOG. In this paper methods for utilizing eye movement recordings towards controlling neurodegenerative diseases as Parkinson's disease are presented and evaluated onto real datasets.

2 - Biclustering EEG Data from Epileptic Patients Treated with Vagus Nerve Stimulation
Nikita Boyko, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States, nikita@ufl.edu, Stanislav Busygin, Mike Bewernitz, Panos Pardalos, Georges Ghacibeh

We present a pilot study of EEG recordings from two epileptic patients undergoing treatment with Vagus Nerve Stimulator (VNS). Raw EEG signal was transformed to a sequence of maximum Lyapunov Exponents (STLmax). Applying consistent biclustering to STLmax time series allowed us to separate stimulation states versus non stimulation states. The result of the experiment is a step forward towards developing a physiologic marker for optimal VNS parameters based on measures of scalp EEG signals.

3 - Approach for Evaluating Predictive Quality of Seizure Prediction Algorithms
Alla Kammerdiner, PhD Student, University of Florida, Gainesville, FL, alla@ufl.edu, Deng-Shan Shiau, Panos Pardalos

To show that a certain algorithm can be successfully applied to predict seizure occurrences, one must compare its predictive performance against the NaÔve predictors (periodic predictor or random predictor). In this study, we develop the outcome measure that allows one to properly evaluate the quality of prediction. The proposed approach for assessing validity of predictive scheme is applied to test the performance of the test algorithm with respect to NaÔve predictors on the test datasets.

4 - A Unified String Kernel for Biological Sequences
Altannar Chinchuluun, University of Florida, 303 Weil Hall, ISE Dept., University of Florida, Gainesville, FL, 32611, United States, altannar@ufl.edu, Panos Pardalos

The analysis of protein sequences becomes one of the most successful areas in bioinformatics. The researchers are increasingly relying on computational techniques to classify these sequences into functional and structural families based on sequence homology. String kernel methods with SVMs are a powerful approach to protein sequence classification. In this talk, we introduce a unified kernel for use with support vector machines in a discriminative approach to the protein classification problem.

■ WC27

C-Room 212

Spreadsheet Technology and Engineering

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Larry LeBlanc, Owen Graduate School of Management, Vanderbilt University, TN, United States, Larry.LeBlanc@owen.vanderbilt.edu

1 - An Investigation of Voice-controlled Debugging of Spreadsheets
Derek Flood, Dundalk Institute of Technology, Dublin Rd, Dundalk, Lh, Ireland, Derek.Flood@dkit.ie

It is not convenient for all users to control spreadsheets through a keyboard and mouse. With the move towards mobile computer devices and a rise in RSI, alternative systems are receiving much attention. Voice-control(VC) is one approach that has been used successfully. This study is the first to compare experienced spreadsheet developers debugging a spreadsheet using VC with those using a keyboard and mouse. The study showed that voice proved to be slower and resulted in a poorer performance.

2 - Spreadsheet vs. Algebraic Approaches for Optimization Modeling
Larry LeBlanc, Owen Graduate School of Management, Vanderbilt University, TN, United States, Larry.LeBlanc@owen.vanderbilt.edu, Michael Galbreth

Because of their familiarity to managers, spreadsheets have been suggested as preferable to specialized mathematical packages for optimization modeling in some contexts. However, spreadsheets often require extensive use of VBA to accommodate large models. Thus, for large models the choice is not a specialized package vs. simple Excel, but rather a specialized package vs. very complex Excel and VBA. We discuss the pros and cons of this decision and suggest the best approach in various situations.

■ WC28

C-Room 213

Operations Management IV

Contributed Session

Chair: Tim Lortz, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave, Ann Arbor, MI, 48109, United States, tlortz@umich.edu

1 - A Stochastic Programming Model for Call Centers with Service Level Agreements
Tom Robbins, Penn State University, 462A Business Building, University Park, PA, 16803, trr147@psu.edu, Terry Harrison

We develop a new model for call center scheduling that combines the server sizing and staff scheduling steps into a single optimization model. The model is formulated as a stochastic MIP that seeks to minimize the staffing cost plus a penalty associated with the probability of failing to achieve the service level agreement. We solve the model via decomposition and find the model is quite tractable.

2 - Optimal Investment in Quality: Quality-improvement, Inspection, and Monitoring

Benjamin Armbruster, Stanford University, 121 W. Campus Dr. #1405A, Stanford, CA, 94305, United States, armbruster@stanford.edu, Johannes Freiesleben

We model the introduction of defects in a simple production line and their effect on the quality level and the unit production cost of the finished product. The goal is to maximize the quality of the final product subject to a budget constraint. Money can be spent at each production stage on quality-improvement efforts to reduce defect rates, on inspecting the product leaving that stage, and on an in-process monitoring system as a substitute for inspection.

3 - Discrete-order Admission Model with Joint Effect of Margin and Order Size in an MTO Environment

Andy Wu, PhD Student, National Taiwan University, College of Management, Floor 9, No.1, Se, Taipei, Taiwan - ROC, d92741003@ntu.edu.tw, David Chiang

Swarming demands and seasonality periodically induce a stringent capacity problem in the MTO B2B environment. A real-time order admission problem with limited major-customer population and batch-size demand with heterogeneous distributions is modeled as a dynamic and stochastic knapsack problem. The optimality of the Markovian deterministic reward-threshold policy is verified. Optimal policy, basic policy, and the capacity rationing method are compared in the designed experiment.

4 - Solvability of the Infinite Horizon Asset Selling Problem

Tim Lortz, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave, Ann Arbor, MI, 48109, United States, tlortz@umich.edu, Robert L Smith, Archis Ghate

We consider a nonstationary, infinite horizon, discrete-valued asset selling problem. Under mild assumptions, we show that a forecast horizon exists for the optimal initial threshold if and only if the initial threshold is unique. We show that the uniqueness condition is practically always satisfied, and give a procedure to recursively solve for all optimal thresholds, each one in finite time, when they are all unique.

■ WC29

C-Room 214

Joint Session OS/ICS: Global Optimization: Software Development and Applications

Cluster: Optimization /Computational Optimization and Software, INFORMS Computing Society
Invited Session

Chair: Janos D. Pinter, Pintér Consulting Services, Inc., 129 Glenforest Drive, Halifax, NS, Canada, jdpinter@hfx.eastlink.ca

1 - Global (and Local Nonlinear) Optimization in Integrated Computing Systems

Janos D. Pinter, Pintér Consulting Services, Inc., 129 Glenforest Drive, Halifax, NS, Canada, jdpinter@hfx.eastlink.ca

Integrated scientific-technical computing (ISTC) systems support the development of sophisticated interactive documents that include computing, programming, visualization features. ISTC systems can be put to especially good use in the context of nonlinear systems modeling and optimization, in both education and research. We demonstrate global/local optimization capabilities of Maple and Mathematica, including both built-in and add-on functionality. We also highlight engineering and scientific application perspectives.

2 - Globally Optimized Sphere Packings: Models and Illustrative Results

Frank Kampas, Senior Developer, WAM Systems, 600 W. Germantown Pike, Suite 230, Plymouth Meeting, PA, 19462, United States, fkampas@wamsystems.com, Janos D. Pinter

A general sphere packing is to find the tightest possible arrangement of a given collection of spheres in a given container. The container can be e.g. a sphere, or a rectangular box. Tightness can be measured by the volume of the container, or by the pairwise distance between the sphere centres, or by a linear combination of these two objectives. We present a general formulation of such models in Mathematica and solve model instances using our MathOptimizer Professional software.

3 - A New Tunnel Function Method for Global Optimization

Yong Wang, SAS Institute Inc., 100 SAS Campus Drive, Cary, NC, 27513, United States, yong.wang@sas.com, Lian-Sheng Zhang, Shu-Cherng Fang

We introduce a new tunnel function for finding the global minimum of a general coercive C1 function. A tunnel function is constructed at a local minimizer of the objective function such that it achieves local maximum at the current solution. Moreover, a local minimizer of the tunnel function leads to a new solution to the original problem with lower objective value. Iteration follows in this manner to reach a global minimizer. Promising computational results are included and discussed.

■ WC30

C-Room 2A

Discussion Session: Challenges and Opportunities for QSR Community (I)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

1 - Challenges and Opportunities to QSR Community (I)

Yu Ding, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

INFORMS Section on Quality, Statistics, and Reliability was founded ten years ago and has grown into one of the most active sections within INFORMS. A panel of discussants will present their views and perspectives on the challenges the QSR community currently faces and the opportunities that QSR may be able to grasp for the next phase of growth. Audiences will be actively involved in the discussion in this session.

■ WC31

C-Room 2B

Discussion Session: QSR-related Curriculum Development (I)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53711, United States, szhou@engr.wisc.edu

1 - QSR-related Curriculum Development (I)

Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53711, United States, szhou@engr.wisc.edu

Recent technological innovation and methodological development raise new challenges to the QSR-related curriculum. A panel of discussants will share their experiences and perspectives in teaching the QSR-related courses at both the undergraduate and graduate levels, and exchange with the audience the ideas and information that might be helpful to reshape the QSR curriculum.

■ WC32

C-Room 302

Applied Probability I

Contributed Session

Chair: Mike O'Leary, Towson University / Department of Mathematics, Department of Mathematics, Towson University, Towson, MD, 21252, United States, moleary@towson.edu

1 - Revenue and Duration of Oral Auction

Junmin Shi, PhD, Rutgers Business School, MSIS Department, 180 University Ave, Newark, NJ, 07102, United States, jshi@pegasus.rutgers.edu

This paper investigates the oral auction which are generally used in practice e.g. Christie's. Unlike sealed bid auction, oral auction is featured by its dynamic property. Both the revenue and the duration perform randomly. The bidding process is analyzed by decomposing into descending phase and ascending phase. Consequently, the relationship between revenue and duration with the starting price are obtained.

2 - Approximation of Non-Stationary Queues Using Stationary Queueing Models

Raik Stolletz, Leibniz University Hannover, Department of Production Management, Koenigsworther Platz 1, Hannover, 30167, Germany, raik.stolletz@prod.uni-hannover.de

This presentation proposes the Stationary Backlog-Carryover (SBC) approach for the time-dependent analysis of stochastic and non-stationary queueing systems. The analysis of a series of stationary queueing models leads to a new approximation of time-dependent performance measures. Beside the main idea of the approach, the application to different queueing models is presented. Numerical experiments demonstrate the reliability of the SBC approach and compare it with other approaches.

3 - A Novel Feature Selection Method for the Quadratic Discriminant Function

Hugo Garcia, PhD Candidate, Arizona State University, 2414 E. University Dr., Tempe, AZ, 85281, United States, hugo.garcia@asu.edu, J Rene Villalobos

In this presentation we discuss a novel approach for the selection of features. This approach uses a normal approximation of the exact misclassification probabilities of the Quadratic Discriminant Function (QDF) as a way to identify the subset of features that render the lowest Misclassification Error Rate (MER). Our approach differs from other methods in two ways: the selection is based on the minimization of the probability of error and it is designed to optimize these particular functions.

4 - Finding the Optimal Search Area for a Serial Criminal

Mike O'Leary, Towson University / Department of Mathematics, Department of Mathematics, Towson University, Towson, MD, 21252, United States, moleary@towson.edu, Christopher Castillo

The primary question in geographic profiling is, given the locations of a series of crimes committed by a serial offender, to estimate the location of that offender's anchor point. We have developed a fundamentally new mathematical framework for the problem that begins with a probabilistic model of offender behavior and accounts for geographic features that affect the choice of the offender's target(s). We will present the mathematical model and its application to crimes in Baltimore County.

■ WC33

C-Room 303

Transportation IV

Contributed Session

Chair: Yu (Marco) Nie, Assistant Professor, Northwestern University, A328, 2145 Sheridan road, Civil and Environmental Engineering, Evanston, IL, 60208, United States, y-nie@northwestern.edu

1 - Evacuation Planning with Arterial Signal Control: A Case Study of Washington D.C.

Ying Liu, University of Maryland, Dept.. of Civil Engineering, University of Maryland, College Park, MD, 20742, United States, lyngwam@gmail.com, Gang-Len Chang

This study presents the application of a two-level modelling system in designing the emergency evacuation plans for Washington D.C. The example network covers 6 major evacuation routes in the northeastern DC area. The high-level model assigns traffic to different routes with simplified intersection constraints, while the low-level model aims to refine intersection control along each route. The numerical results have revealed the models' potential in designing evacuation plans for metropolitan areas and identified bottlenecks in the current DC evacuation network.

2 - An Integrated Modelling Framework for Strategic National/Regional Planning of Freight Transportation Systems

Jean Damay, Postdoctoral Fellow, Centre de Recherche sur les Transports, Université de Montréal, C.P. 6128, Succursale Centre-ville, Montréal, QC, H3C 3J7, Canada, damay@crt.umontreal.ca, Teodor Gabriel Crainic, Michel Gendreau

The objective of our work is to make significant progress towards the development of a new generation of strategic national/regional freight transportation models by providing two stepping stones along this path: first, a comprehensive survey of the main issues and challenges to be addressed in these new models; second, a proposal for a framework to be used in the comparative analysis and assessment of such models. This framework provides its first results on a large range of case studies, in order to proceed with a better simulation of current and future freight transportation systems.

3 - Modeling Congestion Pricing Options for Freight at the Pacific Highway Crossing

Mark Springer, Professor, Western Washington University, 516 High Street, Bellingham, WA, 98225, United States, mark.springer@wwu.edu, Matthew Roelofs

Congestion pricing refers to a scenario in which users are charged a variable price for the use of transportation facilities: increased congestion leads to a higher price, while the price of the facilities declines when usage decreases. With the aid of historical border crossing data and simulation analysis, the authors investigate the possibility of using congestion pricing to manage freight traffic across an international border crossing.

4 - Robust Synchronization for Coordinated Actuated Signal Systems

Lihui Zhang, University of Florida, 365 Weil Hall, Box 116580, Gainesville, Fl, 32611, United States, zhanglh0@ufl.edu, Yafeng Yin

The paper presents a robust approach to synchronize actuated traffic signals, under random traffic arrivals, for smooth and stable progression. The robust counterpart of the mixed-integer linear programming model for bandwidth maximization is developed and simulations are conducted to validate the robustness of the resulting timing plans.

5 - Solution Methods for the Relaxation-Based Off-Line Dynamic O-D Estimation Problem

Yu (Marco) Nie, Assistant Professor, Northwestern University, A328, 2145 Sheridan road, Civil and Environmental Engineering, Evanston, IL, 60208, United States, y-nie@northwestern.edu

This paper proposed a column generation procedure for solving the relaxation-based off-line dynamic O-D estimation problem which is formulated as a variational inequality (VI). The VI problem encapsulates traffic flow dynamics through a dynamic network loading model. It is shown that a space-time expansion network can be constructed to iteratively identify optimal paths. Projection-type algorithms are employed to solve restricted VI problems built in column generation.

■ WC34

C-Room 304

Transportation V

Contributed Session

Chair: Manish Verma, Assistant Professor, Faculty of Business Administration, Memorial University, St. John's, NL, A1B3X5, Canada, mverma@mun.ca

1 - System Optimal Traffic Assignment with Departure Time Choice

Andy H F Chow, Research Student, Centre for Transport Studies, University College London, Gower Street, London, WC1E 6BT, United Kingdom, andy_hf_chow@hotmail.co.uk

This paper investigates analytical dynamic system optimal assignment with departure time choice. Dynamic system optimal assignment is formulated here as an optimal control problem. A fixed volume of traffic is assigned to departure times and routes such that the total system travel cost is minimized. We also investigate alternative solution strategies on the quality of calculated assignments. Numerical examples are given and the results are discussed.

2 - Computational Manageability of Allocating Transportation Service Providers in a Global Organization

Zhou Xu, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong - ROC, centerwise@gmail.com, Andrew Lim

We study a service provider allocation problem for global shippers to procure transportation service with various preferences constrained by their business units all over the world. We formulate the problem by a constraint programming model, and introduce special patterns to structure the constraints to achieve both the expressibility and the tractability in the model. The model and solution approaches has been integrated into a decision support system for a multinational shipper.

3 - Car Sharing: A Dynamic Resource Allocation Problem

Wei Fan, Assistant Professor, Department of Civil and Environmental Engineering, The University of Texas at Tyler, 3900 University Blvd., Tyler, TX, 75799, United States, Wei_Fan@uttyler.edu, Randy Machemehl, Nicholas Lownes

This paper addresses the dynamic resource allocation problem in a car sharing context, i.e., a decision making problem for vehicle fleet management in both time and space in order to maximize profits for the car sharing service operator. A linear mixed integer model will be formulated and solution algorithm will be proposed. Preliminary results will be discussed based upon pilot studies.

4 - An Analysis of Modified Greenberg Speed-flow Traffic Model

Mostafa Ghandehari, Senior Lecturer, Univ. of Texas at Arlington, Box 19308, UT Arlington, Arlington, TX, 76019, United States, ghandeha@uta.edu, Siamak Ardekani

A modified Greenberg speed-flow model is proposed. We assume speed is a logorithmic function of free-flow speed, concentration and a minimum constant density. Optimization techniques are used to maximize the flow. Taylor's series approximation is utilized to find concentration which maximizes the flow. Data calibration is discussed to validate the model.

5 - A Lead-time Based Approach for Planning Rail-truck Intermodal Transportation of Dangerous Goods

Manish Verma, Assistant Professor, Faculty of Business Administration, Memorial University, St. John's, NL, A1B3X5, Canada, mverma@mun.ca, Vedat Verter

Intermodal transportation has experienced phenomenal growth over the past two decades, and is being increasingly used to move hazardous materials. Despite its significance in carrying hazmats, intermodal transportation has not been studied in hazmat literature. In this paper, we present a bi-objective optimization model to plan and manage intermodal shipments where route determination is driven by the delivery-time specified by the customers and appropriate solution methodology is developed.

■ WC35

C-Room 305

Statistics in OR

Contributed Session

Chair: Fariba Nowrouzi Kashan, Mathematics/ university of Louisvile, 1421 Audubon Pkwy, Louisville, 40213, United States, fariba.kashan@kysu.edu

1 - A Fresh Look at Residuals

Chaim M. Ehrman, Professor, Loyola University, Chicago, IL, 60611, cehrman@luc.edu

In Regression Analysis, the regression equation is typically used to predict future outcomes based on the values and coefficients of significant independent variables. These predictions are used to determine resource allocation to different product categories. It can be shown that negative residuals are a better predictor of future growth with proper resource allocation. A Harvard Data base is used to illustrate this point.

2 - Bayes' Sequential Analysis for a Binomial Proportion Using an Imprecise Prior Probability Distribution

Kathleen Whitcomb, Moore School of Business, University of South Carolina, Columbia, SC, 29208, whitcomb@moore.sc.edu

Bayesian sequential sampling plans for a binomial proportion, π, are constructed using imprecise beta prior distributions. Our procedure uses Coolen's method for computing upper and lower expected losses and the p-maximality optimality criterion to construct a sequential decision making procedure for a statistical parameter in low-information settings.

3 - Teaching Project Simulation in Excel Using Pert-beta Distributions

Ron Davis, San Jose State University, One Washington Square - BT750, San Jose, CA, 95192-0069, davis_r@cob.sjsu.edu

This paper presents the PERT-beta formulas for the beta distribution in the context of project duration simulation. The transformations between the [α,β,A,B] and [μ,σ2,A,B] parameterizations for the beta distribution are derived based on the method of matched moments. A numerical example illustrates utilization of these formulas together with a compact CPM implementation to carry out Monte Carlo simulations of project duration.

4 - Feature-based Clustering for Multivariate Time Series

Xiaozhe Wang, The University of Melbourne, Dept.. of Computer Science & Software Eng, Victoria, 3010, Australia, catwang@csse.unimelb.edu.au

We propose a new method for clustering multivariate time series. A univariate time series can be represented by a fixed-length vector with statistical features. These descriptive vectors of the multivariate time series are concatenated, before being clustered using a clustering algorithm. We demonstrate the effectiveness and simplicity of our method by clustering human motion sequences. This method based on univariate time series structure and statistical metrics provides a novel, simple and flexible way to cluster multivariate time series efficiently with promising accuracy.

5 - Using Data Mining to Define a Decision Tree Based on Conditional Probabilities

Fariba Nowrouzi Kashan, Mathematics/ university of Louisvile, 1421 Audubon Pkwy, Louisville, 40213, United States, fariba.kashan@kysu.edu

This project aims to estimate the risk of re-blocking an artery after treatment; stent or open-heart bypass surgery, and to make a decision tree of patient treatment choices. We use survival analysis to define the condition probabilities of having a second procedure when the first procedure is given are used.

■ WC36

C-Room 306

Transportation VI

Contributed Session

Chair: Erhan Bayraktar, Assistant Professor, University of Michigan, Dept.. Of Mathematics, Ann Arbor, MI, 48109, United States, erhan@umich.edu

1 - Public Logistics Network Design

Ling Xiang, NC State University, 2838 Avent Ferry Rd., Apt 202, Raleigh, NC, 27606, United States, lxiang@ncsu.edu

To evaluate different design for public logistics network (PLN), packages average waiting time in queue is the key criteria to be used. Since a PLN is a huge bulk arrival and bulk service queueing network, queueing approximation is used to obtain the package average waiting time.

2 - A Regional Traffic Control Algorithm Incorporating Emerging ITS Technologies

John McLin, Research Assistant, Systems Eng Dept./University of Virginia, P.O. Box 400747, 151 Engineer's Way, Charlottesville, VA, 22904, United States, jlm3xy@virginia.edu, William Scherer

Traffic congestion is an ever increasing problem in metropolitan transportation systems, resulting in undesirable consequences including increased travel time and delay. This research addresses non recurrent traffic congestion events by developing a regional traffic control algorithm which can determine optimal control policies as a result of a loss in capacity. Additionally, the algorithm incorporates aspects of VII (Vehicle Infrastructure Integration) to help determine the control policies.

3 - A Hybrid Logistic Regression/Neural Network Model for the Prediction of Broken Rails

Darwin Schafer, Graduate Research Assistant, University of Illinois at Urbana/Champaign, Newmark Civil Engineering Lab, B-118, 205 N. Mathews Ave., Urbana, IL, 61801, United States, dschafer@uiuc.edu, Christopher Barkan

The objective of this study is to develop an accurate, predictive tool that will enable railroads to identify locations at high probability for broken rail occurrence. A hybrid model is presented based on statistical regression and an artificial neural network. The factors considered include track & rail characteristics, maintenance activity, and track testing results. The results of this study will enable railroads to more effectively allocate resources to prevent broken rails.

4 - A Shipper-Carrier Dynamic Freight Assignment Model Using a Variational Inequality Approach

Thanasis Ziliaskopoulos, Professor, University of Thessaly, Pedion Areos, Volos, Vo, 38334, Greece, ziliasko@uth.gr

We develop a dynamic freight assignment model that captures the shipper-carrier mechanism of the freight industry. Shippers choose a combination of carriers such that all its shipments are shipped at the lowest possible cost. Each carrier optimizes its operations so that it can reduce its shipping costs and attract more business from the shippers. An iterative Variational Inequality formulation is used to model the market equilibrium including the feedback from the carriers to the shippers.

5 - Operations Management of Pipes for Air Conditioning and Breaking Systems: A Case Study in Man Turkiye A. S.

Engin Bayraktar, Department of Industrial and Systems Engineering, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, eb251@msstate.edu, Burak Eksioglu, Fetih Yildirim

MAN Turkiye A.S. is a bus manufacturer with a plant located in Ankara. The complex layout of their facility leads to inefficient management of their plant which in turn leads to planning problems. The aim of this study is to analyze parts manufacturing shop of the plant and identify opportunities. We study the production and distribution operations for the pipes used in the busses manufactured. We develop mathematical models and solution algorithms to solve their problems for a fixed planning horizon.

■ WC37

C-Room 307

Military Applications IV

Contributed Session

Chair: Sandie Grage, Naval Undersea Warfare Center, 1176 Howell Street, Bldg 1259, Newport, RI, 02841, United States, gragesp@npt.nuwc.navy.mil

1 - An Improved Triangulation Method for Electronic Target Location

Hélcio Vieira Junior, Brazilian Air Force, SHIS QI 05, Brasilia, Brazil, junior_hv@yahoo.com.br

The location's estimation of a stationary electronic emitter has several purposes on the field of electronic warfare. This research proposes a modification to the Multiple Sample Correlation Algorithm (MSCA) where some statistical concepts are aggregated to the original method. With our modifications we were able to improve the emitter position fix estimate more than 240% compared to the original MSCA and more than 1.200% compared to the Extended Kalman Filter Methodology.

2 - Allocation of Flight Personnel and Helicopters to Missions in the Canadian Air Forces

Michel Gamache, Professor, Ecole Polytechnique de Montreal, C.P. 6079 Succ. Centre-Ville, Montreal, Qc, H3C 3A7, Canada, michel.gamache@polymtl.ca, Louis-Philippe Bigras, Gilles Savard

The tactical group of the Canadian Air Forces is confronted with diverse scheduling problems during the planning of the missions for a fleet of Griffon CH146 helicopters, among them the construction of the crew schedules and the assignment lines for helicopters. In this paper, we present an integrate formulation where these two problems are solved simultaneously.

3 - Optimizing the Effectiveness of Ballistic Missile Defense Systems

Dhaifalla K. Al-Mutairi, dhaif@stat.kuniv.edu

A stochastic dynamic programming model is developed to determine the optimum size of ballistic missile defense sites that are required to cover the territory of interest as well as the optimum distribution of interceptors at each site against incoming warheads so that the defense performance criteria are optimized. An application of this model is given.

4 - Optimal Planning for Sensor Field Replenishment

Sandie Grage, Naval Undersea Warfare Center, 1176 Howell Street, Bldg 1259, Newport, RI, 02841, United States, gragesp@npt.nuwc.navy.mil, Thomas Wettergren

We describe a method for planning the deployment schedule of a distributed sensor field designed for operation over an extended time interval. Due to uncontrollable events (such as weather systems), replenishment of sensors is used to maintain effectiveness. A linear programming approach is applied to develop an optimization solution to the replenishment scheduling to maximize time-averaged performance. Computer simulations support the optimization results.

■ WC38

C-Room 308

Computer Science-OR Applications to CS

Contributed Session

Chair: David Heimann, Professor, University of Massachusetts Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States, heimann@theworld.com

1 - A Novel Framework for Demand Prediction in Real-time in a Fast Food Restaurant

Abhishek Sharma, Director of Products, MobileFusion, 1207 E. Carson St, Suite 200, Pittsburgh, PA, 15203, United States, abhi@cmu.edu, Craig Coulter

Predicting optimal replenishment of food-items in a fast food restaurant is an open problem in operations management, and has prevented $100B industry from adopting production automation -without a way to control production, automation makes little sense. Solution demands synchronize production, with very near-term demand to serve fresh food. We report a novel unified framework based on AI and stochastic modeling to solve this variant of just-in-time manufacturing control problem.

2 - Applying Operations Research in Management Systems Through Service Oriented Enterprise Architecture

Abelardo Mayoral-Noriega, AMN, Jaime Nuno #89, Hermosillo, So, 83150, Mexico, amayoral@msn.com, Abelardo Mayoral-Fierros

Messages and Services Oriented Enterprise Architecture (EA) facilitate recording of past events, allowing creating more accurate forecasting models to support management decisions. A government management application, among others, is reviewed, in which users require real-time process monitoring and which accounts for multiple procedures and resources (material, working teams, etc.), making the management process dynamic and subject to variability and uncertainty in workflow and resource supply.

3 - Efficient Interconnect Communication Design and Resource Management for Supercomputing Centers

Yiyu Chen, IBM Research Zurich, 4 Sauemerstrasse, Rueschlikon, 8803, Switzerland, yic@zurich.ibm.com, Wolfgang Denzel

Network communication is an emerging run-time factor for applications hosted in supercomputing centers due to the architecture complexity and stochastic traffic patterns. We proposed a general multi-stage model to deploy resources, such as link bandwidth and buffer spaces, to improve communication efficiency and system performance. The proposed solutions of system stability and optimal resource allocation are further substantiated with detailed system simulation and various traffic schemes.

4 - Software Metrics at a Telecommunications Company – A Case Study

David Heimann, Professor, University of Massachusetts Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States, heimann@theworld.com

We explore a metrics program for updating the voicemail product for a telecommunications company. We address the company's culture leading to program adoption, the program structure, program implementation, effects on quality and timeliness, and subsequent events. We discuss facilitating an atmosphere conducive to a metrics program.

■ WC39

C-Room 309

Robust Optimization

Contributed Session

Chair: Panagiotis Angeloudis, Imperial College London, Rm 618, Skempton Building, London, sw7 2bu, United Kingdom, panagiotis.angeloudis01@imperial.ac.uk

1 - Efficient Algorithm for Deviation Robust Optimization under Interval Data Uncertainty

Tiravat Assavapokee, Assistant Professor, University of Houston, 4800 Calhoun Street, Houston, TX, 77204, United States, tiravat.assavapokee@mail.uh.edu, Shabnam Zangeneh, Ronny George

This research presents an algorithm for making deviation robust decisions under interval data uncertainty for two-stage MILP problems. The algorithm incorporates iterative Benders' decomposition algorithm, bi-level programming, approximation algorithms, and priority based methods to efficiently solve the overall optimization problem. All results illustrate impressive performance in computation time of the proposed algorithm.

2 - Uncertainty-aware Design Optimization with the DAKOTA Toolkit

Brian Adams, Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS-1318, Albuquerque, NM, 87185-1318, United States, briadam@sandia.gov

DAKOTA is a freely available Sandia National Laboratories toolkit for optimization, uncertainty quantification, and sensitivity analysis with large-scale computational models. I will survey the DAKOTA framework and its flexibility to combine optimization and uncertainty analysis to perform reliability-based optimization, potentially accelerated by surrogate models. I will apply such hybrid algorithms to uncertainty-aware design of micro-electro-mechanical systems. http://www.cs.sandia.gov/DAKOTA

3 - Robust Optimization: Supply Chain Management Applications

Jorge Vera, Professor, Dept.. Industrial Engineering, Universidad Catolica de Chile, Vicuna Mackenna 4860, Santiago, Chile, jvera@ing.puc.cl

Robust Optimization has emerged as a modeling approach to handle uncertain data where no detailed probabilistic information is available. In this talk we show various robust optimization approaches applied to some supply chain problems in agriculture and forestry management. We also show how we have evaluated the trade off between optimality and robustness as well as the use of Monte Carlo simulation to asses the actual feasibility of solutions.

4 - Robust Optimization Scheduling Techniques Applied to Automated Container Terminals

Panagiotis Angeloudis, Imperial College London, Rm 618, Skempton Building, London, sw7 2bu, United Kingdom, panagiotis.angeloudis01@imperial.ac.uk, Michael Bell

Technologies used in automated container terminals, largely borrowed from other industrial domains, progressed rapidly after their initial implementations by European port operators. They still fail however to cater for the unpredictability of a dynamic port environment, thus rendering scheduling a challenging task. We implement a robust scheduling algorithm that uses intervals for key parameters and looks for solutions that minimize maximum regret with respect to their particular realizations.

■ WC40

C-Room 310

OR and Infectious Disease II

Sponsor: Health Applications Section
Sponsored Session

Chair: Shane Hall, Assistant Professor of Operations Research, Air Force Institute of Technology, AFIT/ENS, Bldg 641, 2950 Hobson Way, WPAFB, OH, 45433, United States, SHANE.HALL@afit.edu

1 - Limiting Extraimmunization in a Childhood Immunization Schedule

Shane Hall, Assistant Professor of Operations Research, Air Force Institute of Technology, AFIT/ENS, Bldg 641, 2950 Hobson Way, WPAFB, OH, 45433, United States, SHANE.HALL@afit.edu, Edward Sewell, Sheldon H. Jacobson

This presentation discusses discrete optimization models for designing childhood immunization vaccine formularies that limit extraimmunization. Such models allow public health policy makers and pediatricians to evaluate the combinatorial explosion of vaccine choices spawned by the development of combination vaccines.

2 - Polio Vaccine Administration in India: A Case study

N. Ravichandran, Professor, Indian Institute of Management, Vastrapur, Ahmedabad, India, nravi@iimahd.ernet.in

Polio Vaccine Administration for small children in India is routinely done in several states with remarkable efficiency. The supply chain involved in this exercise is fairly complicated. The paper documents the innovative practices adopted by a state in administering polio vaccine.

3 - A Fictitious Play Dynamic Model for the Development of Mitigation Strategies for Pandemic Outbreaks

Javier Visbal, Graduate Asistant, Universidad del Norte, Km 5 Via a Puerto Colombia, Barranquilla, Colombia, javierv@uninorte.edu.co, Carlos Paternina-Arboleda, Diana Ramìrez, Edgar Navarro-Lechuga

Limited inventory of vaccine, antiviral drugs and other health resources pose healthcare delivery challenges for transmittable influenza virus with pandemic potential. There are no existing commercial efficient decision tools for developing mitigation strategies on early response, vaccination, prophylaxis, hospitalization, and quarantine actions. A simulation model is presented that mimics propagation of outbreaks under the influence of mitigation strategies using a game-theoretical framework.

4 - Evaluating the Efficacy of Household Control Strategies for TB in Areas of High HIV Prevalence

Georgie Mellor, PhD Student, University of Southampton, School of Mathematics, Highfield, Southampton, SO17 1BJ, United Kingdom, G.R.Mellor@soton.ac.uk, Christine Currie, Russell Cheng, Elizabeth Corbett

We describe a discrete event simulation model of the transmission dynamics of tuberculosis (TB) and HIV disease parameterised to describe the dual epidemics in Harare, Zimbabwe. This model concentrates on modelling within-household and random transmission of TB and provides a way to explore the limits and potential impact of targeting households with a variety of case-finding strategies.

■ WC41

C-Room 3A

Joint Session B&SB/HAS: Systems Biology: From Biology to OR

Sponsor: INFORMS Computing Society/ Bioinformations & Systems Biology, Health Applications Section
Sponsored Session

Chair: Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, TX, United States, aholder@trinity.edu

1 - A Brief Biology Tutorial for Mathematical Programmers Interested in Systems Biology

Kevin Livingstone, Assistant Professor, Trinity University, One Trinity Place, San Antonio, TX, 78212, United States, klivings@trinity.edu, Allen Holder, Eivind Almaas

Systems biology a growing field ripe for collaborations between biologists and mathematical programmers. As in any interdisciplinary effort, one of the critical first steps is developing a common vocabulary between collaborators from different backgrounds. This presentation will provide a brief overview of the biology necessary to understand the questions posed in systems biology, including the central dogma of molecular biology, gene regulation, protein interaction, and metabolic networks.

2 - Why OR Plays a Crucial Role in Systems Biology

Allen Holder, Trinity University Mathematics, One Trinity Place, San Antonio, TX, United States, aholder@trinity.edu, Kevin Livingstone, Timothy Nunamaker, Eivind Almaas

Systems biology is steeped in network optimization because it is natural to model cell behavior in terms of an optimal state. However, many in the area often define constructs in terms of the solution, as if it was unique. Initial investigations show this is flawed, and we will discuss the role of degeneracy and offer an alternative perspective. This aids the current frontier of the discipline that is based in parametric and sensitivity analysis.

3 - Systems Biology of the Cell: A Network Perspective

Eivind Almaas, Microbial Systems Biology Group, Lawrence Livermore Nat'l Lab, 7000 East Ave, L-452, Livermore, CA, 94550, United States, almaas2@llnl.gov

Many complex systems can be represented and analyzed as networks, and examples that have benefited from this approach span the natural sciences. For instance, we now know that systems as disparate as the World Wide Web, scientific collaborations, food webs, protein interactions and metabolism all have common features in their organization. I will discuss how network approaches can elucidate the organization of cellular function, and illustrate with examples of multiple large-scale datasets.

■ WC42

C-Room 3B

Operations Research in Medicine and Health Care II

Contributed Session

Chair: Keith Willoughby, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, kwilloughby@hqc.sk.ca

1 - Reducing Workload Differences for Ambulances While Maintaining Coverage

Hari Rajagopalan, Assistant Professor, Francis Marion University, School of Business, P.O. Box 100547, Florence, SC, 29501, United States, hrajagop@fmarion.edu, Cem Saydam

EMS managers face the difficult task of locating a limited number of ambulances to yield the best service. How busy an ambulance is depends on where it is located and more busy an ambulance is the greater the chance of crew fatigue. We formulate a probabilistic model with the objective to minimize the workload differences while maintaining coverage requirements. We introduce a search algorithm to solve the model and test the model using real data from Mecklenburg County, NC.

2 - Critical Care Transport in British Columbia

Jing Chen, Centre for Operations Excellence, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, jing.chen@coe.ubc.ca, Anjali Awasthi, Steven Shechter, Peter Dodek, Derek Atkins

In British Columbia, the location of advanced medical facilities is in one corner serving 80% of the population while the remaining area is served by regional medical hospitals, covering most needs but without advanced services. The process of transporting patients in urgent need to a more advanced facility, up to 1500 kms away, requires the coordination of four to six different agencies in a rapid and safe series of actions. This talk presents the case study done to improve the process.

3 - Integrating Clinical Operations Information and Demand Forecasting to Predict Hospital Congestion

Abelardo Mayoral-Fierros, Operations Engineer, Fraser Health Authority, 10334 - 152A Street, Suite 300, Surrey, BC, V3R 7P8, Canada, abelardo.mayoral@fraserhealth.ca, Jonathan Patrick, Wendy Lamarre

An integrated care and discharge planning process was implemented at Burnaby Hospital which helps in the identification of a Projected Discharge date for patients. This information is used in combination with a demand forecasting model to provide information on the probability of congestion in the short term. A decision support tool provides information on current and predicted levels of occupancy, enabling management to take preventive action for day-to-day staffing and capacity decisions.

4 - Using Simulation to Test Ideas for Improving Speech Language Pathology Services

Keith Willoughby, Health Quality Council, 241-111 Research Drive, Saskatoon, SK, S7N 3R2, Canada, kwilloughby@hqc.sk.ca, Shauna Hickey, Ben Chan

Speech language programs aim to prevent and correct disorders of language, speech, voice and fluency. A particular health region in Saskatchewan has experienced an increase in the number of pre-school children referred for speech language therapy, resulting in a one-year wait to first appointment. We developed a simulation model to test various change ideas. Some strategies showed considerable promise for improving patient flow and are now being used in actual practice.

■ WC43

S-Grand Ball. A (Lev. 2)

Aviation Applications II

Contributed Session

Chair: Fan Wang, Professor, Sun Yat-Sen University, School of Business, Dep. of Management Science, Guangzhou, 510275, China, fanwang@gmail.com

1 - Modeling the Choice of Airline Itinerary & Fare Product: Implications on Airline Planning Strategies

Emmanuel Carrier, Research Assistant, MIT, 77 Massachusetts Ave, 35-217, Cambridge, MA, 02139, United States, ecarrier@mit.edu

In this paper, we develop a methodology to analyze the choice of an airline itinerary and fare product based solely on booking data. We incorporate the impact of airline pricing and RM on the traveler's choice set by applying fare rules and combining booking with fare class availability data. Characteristics of the traveler and trip were retrieved and used to segment demand and estimate a latent class choice model providing an alternative to the traditional segmentation based on trip purpose.

2 - The Efficiency of Airport Diversification Strategies: An Input Distance Function Approach

Graziano Abrate, University of Eastern Piedmont - Department of Management Studies, Via Perrone, 18, Novara, 28100, NO, Italy, g.abrate@hermesricerche.it, Fabrizio Erbetta

The estimation of an input distance function allows to obtain measures of economies (or diseconomies) of scope which are dual to the cost function, without requiring the assumption of cost minimizing behavior and information on input price data. Moreover, it allows to evaluate technical and allocative inefficiency. We apply this approach using a sample of small and medium-size airports to evaluate the impact on performance of management strategies such as diversification and outsourcing.

3 - Taxi-out Prediction Using Reinforcement Learning Based Stochastic Dynamic Programming Approach

Poornima Balakrishna, Doctoral Student, Systems Engineering and Operations Research, George Mason University, Fairfax, VA, 22030, United States, pbalakri@gmu.edu, Rajesh Ganesan, Lance Sherry

The talk presents a novel reinforcement learning (RL) based stochastic dynamic programming approach for predicting taxi-out times that was tested on data from Detroit International Airport (DTW) and Washington Reagan national (DCA). Initial results show that the average prediction error for more than 80% of the flights is less than 3 min. The research results are useful in Airport Departure Planning.

4 - Improving Airline Schedule Planning at Swift Aviation Group

Arife Colak, Arizona State University, GWC 502l P.O. Box 875906, Tempe, AZ, 85287, United States, arife.colak@asu.edu, Ahmet Keha, Scott Haralson

Swift Aviation Group operates 4 Boeing aircrafts, under the company Team Jet, LLC, that are used for transporting professional sports teams around North America. We deal with the problem of determining a schedule for the aircrafts given the schedules of the teams for the regular season by minimizing the cost incurred by the dead ferries and subleases. We formulated the problem as a network flow problem. Results show significant improvement in the total cost.

5 - Robust Airport Gate Assignment Problem

Fan Wang, Professor, Sun Yat-Sen University, School of Business, Dep. of Management Science, Guangzhou, 510275, China, fanwang@gmail.com, Liang Xu

Robust Airport Gate Assignment (RAGA) problem attempts to build evaluation criteria for the robustness of aircraft-to-gate assignments to handle uncertainty on aircraft schedule. We model the RAGA by two methods; one is a robust graph coloring model by introducing the un-supervised estimation functions while the other is a robust optimization model. Experimental results on the real-life test data from Hong Kong International Airport demonstrate the performance of the RAGA models.

■ WC44

S-Grand Ball. B (Lev. 2)

Teaching with Cases

Sponsor: INFORM-ED

Sponsored Session

Chair: Greg Zaric, Associate Professor, Ivey School of Business, University of Western Ontario, London, ON, Canada, gzaric@ivey.uwo.ca

1 - Teaching with Cases

Greg Zaric, Associate Professor, Ivey School of Business, University of Western Ontario, London, ON, Canada, gzaric@ivey.uwo.ca, Srini Krishnamoorthy

We will teach the case Lansink Appraisals in more or less the same way that we would to MBA and undergraduate business students. To get the most from this session participants should read the case (available for download from Ivey Publishing, http://cases.ivey.uwo.ca/cases/pages/home.aspx, case # 9B00E013) and answer these questions: 1. Critique Hamilton's model; 2. Develop an alternate model; and 3. How should Lansink respond? We will end with a discussion of the case and case teaching.

■ WC45

S-Capitol Hill (Lev. 3)

Models in Financial Engineering

Contributed Session

Chair: J E Beasley, Brunel University, CARISMA, Brunel University, Uxbridge, UB8 3PH, United Kingdom, john.beasley@brunel.ac.uk

1 - Building Efficient Portfolios Using in Multiple Economic Scenarios

Kanshukan Rajaratnam, Student, University of Virginia, P.O. Box 400747, 151 Engineer's Way, Charlottesville, 22904, United States, kanshu@virginia.edu, Peter Beling

Literature describes choosing between consumer credit scorecards in a manner that is efficient with respect to set of conflicting business objectives, such as profit, market share, and losses but in a single economic scenario. We describe how randomized scorecard selection strategies relate to the construction of efficient portfolios, under an assumption that a relationship can be established between economic scenarios and the discriminatory power of scorecards.

2 - A Real Options Approach to Investment Decisions in Competitive, Dynamic Retail Markets

Baabak Ashuri, Graduate Research Assistant, Tennenbaum Institute, School of Industrial and Systems Engineering, Georgia Institute of Technology, Atlanta, GA, 30332, United States, bashuri@isye.gatech.edu, William Rouse, Douglas Bodner

The proliferation of retail outlets means that even slight differences in market location can have a significant impact on profitability. We look at retail market analysis from a theoretical investment perspective to overcome some of the limitations of marketing research. We present an integrated investment model that can be used to explain retailers' behaviors in competitive, dynamic markets. This option-based model shows how small discount retailers invest early in developing markets.

3 - Detection of Momentum Effects Using an Index Out-performance Strategy

J E Beasley, Brunel University, CARISMA, Brunel University, Uxbridge, UB8 3PH, United Kingdom, john.beasley@brunel.ac.uk, N Meade

Concentrating on liquid long-only investments, we investigate momentum using index out-performance portfolio selection (via a modified Sortino ratio) for eleven S&P international equity indices. The probability a stock out-performed its index for a number of weeks, conditional on out-performance during the preceding year, successfully predicts momentum effects. We find evidence of significant momentum profits (including reasonable transaction costs) in seven indices.

■ WC46

S-Ballard (Lev. 3)

Addressing Competition and Uncertainty in Electricity Markets

Sponsor: Energy, Natural Res & the Environment/ Energy

Sponsored Session

Chair: Uday Shanbhag, Dept. of Industrial and Enterprise Systems Engg, UIUC, 216 Transportation Bldg, 104 S Mathews Avenue, Urbana, IL, United States, udaybag@uiuc.edu

1 - On the Solution of Stochastic Nash-cournot Problems in Electricty Markets

Ankur Kulkarni, Industrial and Enterprise Systems Engg, UIUC, Urbana, IL, United States, akulkar3@uiuc.edu, Uday Shanbhag

Uncertainty in demand, fuel prices and generation availability imply that agents are faced by stochastic multi-period optimization problems. Using complementarity theory, we show existence of Nash equilibria under a variety of market assumptions. Through the use of matrix-splitting ideas, a scalable convergent algorithm for solving such problems is provided. Finally, we provide some numerical results to show utililty of such an approach.

2 - Reliability Impacts of Increased Wind Penetration in Electricity Markets

Uday Shanbhag, Dept. of Industrial and Enterprise Systems Engg, UIUC, 216 Transportation Bldg, 104 S Mathews Avenue, Urbana, IL, United States, udaybag@uiuc.edu, Judith Cardell, Di Zhang

As the proportion of wind power in the generation mix increases, existing market designs may prove inadequate. We consider the impacts of reliability on increased wind penetration through the use multiperiod energy and capacity market models. Specifically, uncertainty in wind velocities is captured through stochastic equilibrium formulations. Some preliminary computational results will also be provided.

3 - A Nash-Cournot Model to Assess Market Power in a Time of Use Electricity Market

Emre Celebi, University of Waterloo, Dept. of Management Sciences, Waterloo, ON, N2L3G1, Canada, ecelebi@engmail.uwaterloo.ca, David Fuller

We examine variational inequality formulation of a Nash-Cournot model with linearized DC network constraints in electricity markets with time-of-use pricing. Dantzig-Wolfe decomposition algorithm split the model into subproblems for each player and a master problem that coordinates the communication between the subproblems. We analyze column dropping procedures for improving the performance of the Dantzig-Wolfe decomposition algorithm with further testing on large and realistic models.

■ WC48

S-Fremont (Lev. 3)

Finance Theory and Empirics

Contributed Session

Chair: David Carino, Research Fellow, Russell Investment Group, 909 A Street, Tacoma, WA, 98402, United States, DCarino@russell.com

1 - Turkey, Bulgaria, and European Union: Testing PPP with TAR Method

Nazim Taskin, TAMIU, 5201 University Blvd., WHTC Room 219, Laredo, TX, 78041, United States, nazim_taskin@yahoo.com

The reasons for countries to access to EU are cultural, political and economic. This paper investigates PPP between TR and US, and BG and US, and tries to establish whether TR is more economically compatible with EU. A new version of TAR model allows us to consider both nonstationarity and nonlinearity used in this study. Results show PPP does not hold for BG and TR. Hence, comparing two countries and making comments related to entry into the EU based on exchange rates is not entirely helpful.

2 - The Relationship Between Lead-lag Times and the Time to Expiration Date in Korean Financial Markets

Hyun Kyung Kim, KAIST, #207-43 Cheongryangri2-dong, Dongdaemun-gu, Seoul, Korea, Republic of, khk144@business.kaist.ac.kr, Byung Chun Kim, Seung Oh Nam

This paper examines the KOSPI 200 stock index and the KOSPI 200 stock index futures markets. First, this study aims to resolve the overnight data problem and the heteroscedasticity problem by exploring lead-lag times on a daily basis between these two financial markets. Second, the expiration day effect has only addressed by event studies in the previous literatures. However, this study explores the relationship between the lead-lag times and the remaining time to the expiration date of futures.

3 - Combining Opportunity Cost, Cost of Capital and Project Risk Based Approaches in Project Valuation

Janne Gustafsson, Cheyne Capital Management, Stornoway House, 13 Cleveland Row, London, SW1A 1DH, United Kingdom, janne.gustafsson@cheynecapital.com

A risky project can be valued by discounting project cash flows either (i) at the rate of return of a security that is equivalent in risk to the project (opportunity cost), (ii) at the cost of capital, or (iii) at a rate implied by (a) the risk of the project and (b) the investor's risk attitude. We show how these approaches can be combined together in a single framework, and focus on modelling of various financing alternatives, including mezzanine loans extended by a hedge fund.

4 - Should We Buy or Rent our Home? Estimation by Real Option Approach

Tomoaki Tabata, Associate Professor, Tokyo Fuji University, 1-7-7 Shimoochiai, Shinjuku, Tokyo, Tk, 161-8556, Japan, tabata@fuji.ac.jp, Takashi Namatame

It is a problem that we should buy or rent our home, and many simulations based on various factors have been developed with this problem. In many cases, it is a conclusion that we should buy our home in trems of money. But the flexibility of the decision making in renting home according to the life event is not evaluated. In this study, we evaluate the value of such flexibility by the real option approach.

5 - Price Pressure at Russell Index Reconstitution

David Carino, Research Fellow, Russell Investment Group, 909 A Street, Tacoma, WA, 98402, United States, DCarino@russell.com, Mahesh Pritamani

Although constituent changes in the Russell Indexes can be anticipated long in advance, the impact of speculative trading around reconstitution on the Russell 2000 Index is less than previously reported. We show evidence that the reconstitution effect is diminishing over time, possibly due to the decreased number of index changes in the recent low-volatility years, the changes in index methodology introduced by Russell, and the increase in short positions and active strategies in recent years.

■ WC49

S-Greenwood (Lev. 3)

Joint Revenue Management and Operations Management

Sponsor: Revenue Management & Pricing - Invited/Sponsored

Sponsored Session

Chair: Anshu Jalora, Associate Scientist, PROS Revenue Management, 3100 Main St. Suite 900, Houston, TX, 77002, United States, ajalora@prosrm.com

1 - Revenue Management Planning at Taiwan High Speed Rail

Shaw Ching Chang, Institute for Information Industry, Taipei, Taiwan - ROC, Scchang@iii.org.tw, Kwo Chen Wang, Jason C. H. Chen, Wen-Chyuan Chiang

This paper describes a multi-leg multi-fare yield management model with consideration of leg-OD based inventory control and service classes. The model captures the operating style of Taiwan High Speed Rail Corporation in which the company adopts it as the basis for its yield management system and data mining.

2 - Valuing Product Mix as an Option: Investment, Production and Pricing

Zhongjun Tian, PhD Candidate, Washington University, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63130, United States, tian@wustl.edu, Panos Kouvelis

We study a firm's joint decisions of investment, production and pricing. At the beginning of the time horizon, the firm invests in a capacity which can be used to produce two substitute products of which the total demand evolves in time. At sometime near the end of the horizon, the firm makes commitment decisions on both quality level of and volume of capacity committed to each product. At the end of the horizon, the firm observes the total demand and makes the production and pricing decisions.

3 - Revenue Management Performance Drivers: An Empirical Analysis in the Hotel Industry

Carrie Crystal, Notre Dame, Mendoza School of Business, South Bend, IN, United States, carrie.crystal@mgt.gatech.edu, Mark Ferguson, Jeff Stratman

We developed and administered a survey instrument tailored to the hotel industry to measure both drivers of RM and RM performance. In line with expectations, we found evidence that forecasting and organizational focus positively impact RM performance. On the other hand, the results showed evidence that higher organizational structure scores negatively impact RM performance. We provide a few explanations for this non-intuitive result and proposals for future research.

4 - Integrated Pricing and Distribution Optimization Applied to the Auto Rental Industry

Ivette Arambula, Senior Scientist, Science & Research, PROS, 3100 Main St. #900, Houston, TX, 77002, United States, iarambula@prospricing.com, Aaron Putnam

We describe the problem of determining optimized pricing recommendations to satisfy demand of rental products offered to customers subject to limited availability of resources and considering the option of repositioning the resources at a cost. We model it as a network optimization to maximize profit given the forecasted demand, current inventory and distribution costs. We summarize results of simulations to show the profit lift using the joint optimization versus the pricing optimization alone.

■ WC50

S-Issaquah A & B (Lev. 3)

Topics in Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Darius Walczak, PROS Revenue Management, 3100 Main Street, Suite 900, Houston, TX, 77002, United States, dwalczak@prospricing.com

1 - An Alternative Discrete Choices Model by Customer Preferences
Lijian Chen, Assistant Professor, University of Louisville, Department of Industrial Engineering, Speed School of Engineering, RM312, Louisville, KY, 40292, United States, lijian.chen@louisville.edu

In this paper, we study the problem of modeling the discrete customer choice behavior. We propose a model based on the concept of preference order. Using this model as an input, we propose a stochastic programming model to determine the resource allocation and solve it considerably fast. Simulation results are presented to illustrate the effectiveness of our method, including the comparison with the independent demands resource allocation model.

2 - A Multi-stage Stochastic Programming Model for Revenue Management: Nested Controls and Buy-ups
Burak Buke, PhD Candidate, The University of Texas at Austin, OR/IE Program, 1 University Station C2200, Austin, TX, 78712, United States, bukeb@mail.utexas.edu, H. Ahmet Kuyumcu, Utku Yildirim

In this work, we consider the network capacity control problem of an airline. We propose a multi-stage stochastic programming formulation addressing two important issues: (1) Modeling of nested controls when customers arrive according to a nonhomogeneous Poisson process, (2) Modeling of buy-up behavior for customers. We discuss the possible solution methodologies and demonstrate our results via numerical examples.

3 - Overbooking Control for Network Cargo RM
Mikhail Nediak, Assistant Professor, Queen's School of Business, 143 Union St., Kingston, ON, K7L 3N6, Canada, mnediak@business.queensu.ca, Jeff McGill, Tatsiana Levina, Yuri Levin

We consider a cargo shipping problem on a network of locations connected by flights operated on a fixed periodic schedule. Bookings for cargo shipping between origin-destination pairs are made in advance. However, cargo capacity availability is unknown at the time of booking. The problem is to find the optimal accept/reject policy to maximize the expected present value of profit. We discuss the structural properties of the solution and numerical approximation schemes.

4 - Consumer Behavior in Waiting for Last-minute Discounts
Anton Ovchinnikov, Darden School of Business, University of Virginia, 100 Darden Blvd, Charlottesville, VA, 22903, United States, aovchinnikov@darden.virginia.edu, Joseph Milner

We consider the behavior of customers who strategically decide whether to purchase early at full price or wait for a discount in response to a firm's practice of putting some inventory on sale. We suggest game theoretic and heuristic models of consumer behavior and compare their predictions with wait-or-buy decisions of real people obtained from an on-line simulation. We discuss suboptimalities in these decisions and analyze their implications for the firm's revenue management policy.

■ WC51

S-Kirkland (Lev. 3)

Revenue/Yield Management

Contributed Session

Chair: Lama Moussawi, School of Business, American University of Beirut, Beirut, Lebanon, lama.moussawi@aub.edu.lb

1 - Managing Product Transitions
Ozlem Bilginer, PhD Candidate, Stanford University, 344 Olmsted Road 336, Stanford, CA, 94305, United States, ozlem@stanford.edu, Feryal Erhun

Product launches often result in situations where companies have to manage multiple product generations simultaneously, giving rise to numerous challenges. In this paper, we consider the case of overlapping product lifecycles in the presence of market potential uncertainty, with product price as the decision variable. We model the dynamics between overlapping lifecycle products by accounting for product cannibalization and formulate a two-stage stochastic optimization model for optimal pricing.

2 - Refurbishment of a Hotel as a Real Option Problem
Henning Rasmussen, Professor, University of Western Ontario, Richmond st, London, On, Canada, hrasmuss@uwo.ca

We use real option theory to analyse the refurbishment of an asset, such as a hotel, for which the quality and hence the revenue produced, deteriorates as time passes. The total time interval is divided into a small number of subintervals. The revenue is modelled by a stochastic differential equation and a Bellman equation is derived and solved numerically for each subinterval of time with the costs of refurbishment being given parameters.

3 - Optimization Over Revenue-rate Endogenized Ranges
Michael Pangburn, University of Oregon, 488 Lillis Building, Eugene, OR, 97403, United States, pangburn@uoregon.edu, Shankar Sundaresan

We consider a revenue-optimization problem in which the firm's policy (e.g., inventory setting) not only influences the expected revenue rate, but also the range over which that function applies (i.e., the limits of integration). In our context, the integration limits are implicitly defined by level contours of the revenue function. Using an appropriate problem transformation, we prove concavity for a supporting (sufficient) set of conditions, and investigate the resulting solution structure.

4 - Airline Revenue Management: Network Expansion - Itinerary Decisions
Amir Joshan, PhD Candidate, University Of Auckland, Eng. Science Department, Rm 325, Level 3, 70 Symonds Street, Auckland, CBD, New Zealand, a.joshan@auckland.ac.nz

Here we model a monopolistic market where two airlines have differentiated products and they compete on market shares at the same time as they optimize revenue by taking an appropriate inventory control policy. We show that over a set of possible itineraries there exist only one possible combination of itineraries that both airlines are optimized given the other airline pricing and network strategy and it is a Nash equilibrium over network of flights.

5 - Monopolist Pricing for a Performance Event Under Demand Uncertainty
Craig Sorochuk, University of Western Ontario - Ivey, 1151 Richmond Street N, London, ON, N6A 3K7, Canada, csorochuk@ivey.ca, John Wilson

We provide a Statistics-based, monopolist pricing model for a seller who sets ticket prices and quantities before customer demand is known. It is assumed that customers have reservation prices that follow a known distribution, tickets are homogeneous, there is a marginal cost for each ticket offered, customers arrive in random order, and no resale is possible. The results found using our model are compared with those in the Economics literature.

■ WC52

S-Leschi (Lev. 3)

Approximation and Network Optimization

Sponsor: Optimization/ Combinatorial Optimization
Sponsored Session

Chair: Brian Dean, Clemson University, bcdean@cs.clemson.edu

1 - An O(n log n)-time Approximation Scheme for Steiner Tree in Planar Graphs
Glencora Borradaile, Brown University, glencora@cs.brown.edu

We give an O(n log n)-time approximation scheme for the Steiner tree problem in planar graphs. First we find a low-weight grid-like subgraph called a brick decomposition. We show that there is a near-optimal solution, T, that crosses each face of the brick decomposition a small number of times and use this to design a dynamic program to find T.

2 - A More Compact Polyhedral Formulation for Minimum Cut
Ojas Parekh, Emory University, ojas@mathcs.emory.edu

For a graph (V,E), existing linear formulations for the minimum cut problem require \Theta(|V||E|) variables and constraints. These formulations can be interpreted as a composition of |V|-1 polyhedra for minimum s-t cuts paralleling early algorithmic approaches to finding globally minimum cuts, which relied on |V|-1 calls to a minimum s-t cut algorithm. We present the first formulation to beat this bound, one that uses O(|V|^2) variables and O(|V|^3) constraints. Our formulation directly implies a smaller compact formulation equivalent to the subtour relaxation of the Traveling Salesman Problem. This talk covers research conducted jointly with Robert Carr, Greg Little, Goran Konjevod, and Venkatesh Natarajan.

3 - Approximation Algorithms for k-Hurdle Problems
Brian Dean, Clemson University, bcdean@cs.clemson.edu

The k-hurdle problem is a natural generalization of the classical s-t minimum cut problem where we must select a minimum-cost subset S of the edges of a graph such that every s-t path intersects S at least k times. In this talk we describe a set of approximation algorithms for k-hurdle variants of the NP-hard multiway cut and multicut problems. For the k-hurdle multiway cut problem with r terminals, we give two results, the first being a pseudo-approximation algorithm that outputs a (k-1)-hurdle solution whose cost is at most that of an optimal solution for k hurdles. The second is a 2(1-1/r)-approximation algorithm based on rounding the solution of a linear program that embeds our graph into a simplex. For the k-hurdle multicut problem in an n-vertex graph, we provide an algorithm that, for any constant epsilon > 0, outputs a (1-epsilon)k-hurdle solution of cost at most O(log n) times that of an optimal k-hurdle solution, and we obtain a 2-approximation algorithm for trees.

4 - Iterative Methods in Combinatorial Optimization
Mohit Singh, Carnegie Mellon University, mohits@andrew.cmu.edu

Linear programming has been a successful tool in combinatorial optimization to achieve polynomial time algorithms for problems in P and also to achieve good approximation algorithms for problems which are NP-hard. We demonstrate that iterative methods give a general framework to analyze linear programming formulations of combinatorial optimization problems. We show that iterative methods are well-suited for problems in P and lead to new proofs of integrality of linear programming formulations for various problems in P. This understanding provides us the basic groundwork to address various problems that are NP-hard and to achieve good approximation algorithms. In this talk, we focus on degree bounded network design problems. The most well-studied problem in this class is the Minimum Bounded Degree Spanning Tree problem. We present a polynomial time algorithm that returns a spanning tree of optimal cost and the degree of any vertex in the tree exceeds its degree bound by at most an additive one. This generalizes a result of Furer and Raghavachari to weighted graphs, and thus settles a 15-year-old conjecture of Goemans affirmatively. This is essentially the best possible result for this problem. For degree constrained versions of more general network design problems, we obtain strong bi-criteria approximation algorithms using the iterative method.

■ WC53

S-Medina (Lev. 3)

Military Technology and Security System Assessment

Cluster: Technology Evaluation and Assessment
Invited Session

Chair: Greg Graves, Assistant Professor, U.S. Military Academy, Dept.. of Mathematical Sciences, 646 Swift Road, West Point, NY, 10996, United States, greg.graves@usma.edu

1 - Vulnerability Assessment in Physical Security Systems
Greg Graves, Assistant Professor, U.S. Military Academy, Dept.. of Mathematical Sciences, 646 Swift Road, West Point, NY, 10996, United States, greg.graves@usma.edu

Arrangements of forces and countermeasures to protect military bases or installations are in effect specialized physical security systems. This presentation builds on previously presented research to discuss the identification of vulnerabilities in physical security systems. Capitalizing on a linear programming formulation to determine bounds on the expected utility of an alternative, the interpretation of the dual program provides insight into vulnerabilities present in the system design.

2 - Unmanned Aircraft Systems Assessment for the Military Future
Darryl Ahner, Senior Research Analyst, U.S. Army TRADOC Analysis Center, Naval Postgraduate School, P.O. Box 8695, Monterey, CA, 93940, United States, darryl.ahner@us.army.mil

Unmanned Aircraft Systems (UAS) bring a significant capability to the battlespace across a wide range of missions. This presentation addresses the methodology for identifying these missions, the populating of the number of missions for assessment, the identification of key system characteristics to be considered, and development of the operational analysis tool that determined the trade-offs between multiple proposed UAS systems.

3 - Future Force Warrior (FFW) Experimentation and Analysis
Jon Alt, MAJ, USA, Operations Analyst, TRADOC Analysis Center, Monterey, Naval Postgraduate School, P.O. Box 8695, Monterey, CA, 93943, United States, jonathan.alt@us.army.mil, Nita Miller, Lawrence Shattuck, Tom Lucas

This research supports FFW's evaluation of emerging technology through the use of constructive simulation, leveraging large designs of experiments in a high performance computing environment, and live experimentation, making use of more efficient experimental designs and systematically gathered user feedback. Results will be used to determine which technologies hold the most potential to address needed capability gaps.

■ WC54

S-Queen Anne (Lev. 3)

Queuing Networks

Sponsor: Applied Probability
Sponsored Session

Chair: Ananth Krishnamurthy, Rensselaer Polytechnic Institute, CII 5015, 110 8th Street, Troy, NY, United States, krisha@rpi.edu

1 - Buffer and Server Allocation in General Queueing Networks
Tom van Woensel, Eindhoven University of Technology, P.O. Box 513, Eindhoven, NL, Netherlands, t.v.woensel@tm.tue.nl, Ricky Andriansyah, Frederico Cruz

Optimization of manufacturing systems is the focus of a number of studies. Of interest here is the optimization of the number of buffers and servers, since both of them represent a significant amount of investment in a company. The joint buffer-server optimization is a nonlinear, multiple-objective optimization problem with integer decision variables. Numerical results are presented.

2 - Approximate MVA for Closed Queueing Networks with Multiple-Server Stations and General Service Times
Rajan Suri, Professor, Industrial and Systems Engineering, University of Wisconsin, Madison, Madison, WI, 53726, United States, suri@engr.wisc.edu, Mary Vernon, Sushanta Sahu

Closed Queueing Networks are used in modeling systems such as FMS, CONWIP, health care, and computer systems. Mean Value Analysis (MVA) is often used to compute the performance measures for these models. The Schweitzer-Bard (S-B) approximation improves the computational efficiency of MVA for single-server stations. We provide a simple extension to S-B MVA to enable the analysis of multiple-server stations. We then extend the model for general service time distributions.

3 - Performance of Kanban Control Systems with Advance Demand Information
Ananth Krishnamurthy, Rensselaer Polytechnic Institute, CII 5015, 110 8th Street, Troy, NY, United States, krisha@rpi.edu, Kumar Satyam

Analytical models are developed to analyze the effect of integrating advance demand information with kanban controlled pull systems. Queuing models based on parametric decomposition are used to evaluate the effect demand information lead times and base stock levels on performance measures such as flow times, inventory, and back order levels.

■ WC55

S-Ravenna (Lev. 3)

Advances in Airline Optimization - II

Sponsor: Aviation Applications
Sponsored Session

Chair: Amy Cohn, Assistant Professor, University of Michigan, 2797 IOE Building, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States, amycohn@umich.edu

1 - Managing Integrated Main and Regional Carriers Recovery Decisions
Julian Pachon, Principal O.R. Scientist, Navitaire, Inc., 9130 Jollyville Rd, Suite 100, Austin, TX, 78759, United States, Julian.Pachon@navitaire.com, Stuart Smith

A common regional carrier model is to transport passengers who book directly with the main carrier. Once a flight schedule is determined, all operational decisions are generally done independently. Since disruptions to the schedule affect both the main and regional carriers, independent recovery decisions lead to sub-optimal solutions. We discuss approaches that integrate both main and regional decisions. We describe the integrated recovery problem and present its technological challenges.

2 - Airline Crew Pairing is Solved
Curt Hjorring, Senior Optimization Specialist, Jeppesen, Odinsgatan 9, Gothenburg, SE-411 03, Sweden, curt.hjorring@jeppesen.com

The airline crew pairing has a long history in the OR literature. I will provide an overview of the significant contributions. I now believe that the basic crew pairing problem is solved so well in practice that further algorithmic improvements will provide little impact for production problems. However, there are a number of extensions and integrated problems for which benefits are possible, and algorithmic improvements are needed.

3 - Managing Severe Airspace Flow Programs: The Airlines' Side of the Problem
Khaled Abdelghany, Assistant Professor, Department of Environmental and Civil Engineering, Southern Methodist University, P.O. Box 750335, Dallas, TX, 75275-0335, United States, khaled@engr.smu.edu, Ahmed Abdelghany

We present a heuristic-based approach for minimizing airlines schedule disruptions and operation costs associated with severe airspace flow programs. The approach considers primary decisions made by flight dispatchers such as flight slot substitution and rerouting outside the boundaries of the flow constrained area. Problem formulation, solution approach and preliminary results are presented.

■ WC56

S-Wallingford (Lev. 3)

Energy Issues

Contributed Session

Chair: Susan Cholette, Asst. Professor, SF State College of Business, 1600 Holloway Ave, San Francisco, CA, 94109, United States, cholette@sfsu.edu

1 - Intelligent Search Approach for Spatially Explicit Design of Cost-effective Torrent Control Measures

Jochen Breschan, PhD Student, ETH Zurich, Forstliches Ingenieurwesen, CHN K75.1, Zurich, 8092, Switzerland, breschan@env.ethz.ch

Densely populated areas in mountainous regions have always been facing the problem of risks caused by natural hazards. We address the challenge of how to design a bundle of control measures that maximizes the effectiveness-cost ratio. An intelligent search technique was used to identify spatial patterns of control measures that are near-optimal, considering a set of biophysical constraints. Our approach improves the allocation of public funds and supports planners in decision making.

2 - An Optimization-Simulation Model of a Combined Liquefied Natural Gas and CO2 Value Chain

Jogeir Myklebust, PhD Student, NTNU, Gloeshaugen, Trondheim, 7491, Norway, jogeirm@iot.ntnu.no, Audun Aspelund, Truls Gundersen, Matthias Nowak, Asgeir Tomasgard

We develop a decision support framework for a combined LNG and CO2 value chain based on tabu-search and process simulation. It consists of outer and inner loops. The outer loop searches for the strategic decisions like capacities, technology, and process design, that results in the lowest consequential total costs. Its inner loop iterates with a process simulation tool to find operational decisions and corresponding costs for the intermediate and final strategic solutions.

3 - Valuing Swing Contracts for Load Service Entities

Zhan (James) Pang, PhD Candidate, SE&EM CUHK, R609 M. M. W. Engineering Building, Chinese University of Hong Kong, Hong Kong - ROC, zpang@se.cuhk.edu.hk

This paper addresses the interemporal risk hedging problem of a risk averse load service entity, who is obligated to serve the varying electricity load at a regulated price in exposure to demand volume risk and supply price risk. A swing contract with continuous exercise options is designed for the load service entiry to hedge the price/volume risk. The structural properties of the optimal hedging strategy are characterized and the optimal contracting strategy is exploited.

4 - Greening the Supply Chain: Improving Carbon Emissions in the Distribution of Food and Beverages

Susan Cholette, Asst. Professor, SF State College of Business, 1600 Holloway Ave, San Francisco, CA, 94109, United States, cholette@sfsu.edu, Kumar Venkat

Rising fuel prices and global warming warnings have firms considering emissions reduction strategies. We model emissions from delivering a product from manufacture to end consumers. We consider food and beverage firms because transit and cold storage needs make this sector energy intensive. We select from logistical configurations and determine the best placement of routes and warehouses. Our case studies show that firms can make practical changes to significantly reduce their carbon footprint.

■ WC57

S-Columbia (Lev. 4)

Computer Analysis

Contributed Session

Chair: Soumyo Moitra, IIM Calcutta, Diamond Harbour Road, Joka, Kolkata, 700104, India, sdmoitra@hotmail.com

1 - A Novel Visualization Approach for Association Rules Mining

Enes Eryarsoy, Faculty of Management, Sabanci University, Orhanlı, 34956 Tuzla, Istanbul, Turkey, enes@sabanciuniv.edu, Ayhan Demiriz, Gurdal Ertek, Ahmet Sahinoz, Fatih Cakmak

In this study, we build upon our earlier framework for visualizing association mining results. We extend the framework by displaying binary, categorical and numeric data together with association mining results. We illustrate our approach on a real-life dataset where we gain actionable insights.

2 - Formation of Supply Chain Networks with Heterogeneous Agents

Yang Zhang, The School of Management, Xi'an Jiaotong University, No.28 Xianning West Road, Xi'an, 710049, China, zhangyangnapoleon@gmail.com, Wentian Cui

In this paper, we employ a classical newsvendor model integrated with the mechanism of preferential attachment to study the stability and efficiency of supply chain network. Our contributions mainly include: (1)the proposition of stability and efficiency (2)remarks on the stability and efficiency of typical structures of supply chain network.

3 - Simulations of Evolution of Cooperation Between Enterprises in Cluster based on BA Social Networks

Wen-ping Wang, Jiu Long Hu Campus of Southeast Univ, Room 337, the 3rd Building of Ju Yuan, Jiang Ning District, JiangSu Province, Nan Jing, 211189, China, kathleen_seu@hotmail.com, Qing-li Da, Wei-da Chen

In this paper, the evolutionary rule of the cooperation relationships between the enterprises is studied. We obtained some valuable conclusions, such as different rules of changing strategies influence the correlation between the evolution stabilization value of the average cooperation proportion and its initial value, the evolution stabilization value of the average cooperation proportion isn°Øt influenced by the whiten temptation value in grey payoff matrix.

4 - Application of Control Strategies on a Manufacturing System in a Dynamic Market Environment

Rajesh Krishnamurthy, PhD Candidate, Oklahoma State University, EN 322, School of Industrial Engineering & Mgmt, Stillwater, OK, 74078, United States, rajesh.krishnamurthy@okstate.edu, John Nazemetz, Charlene Yauch

External entities such as customers, competitors, and suppliers create a dynamic environment for a manufacturing system. In this study, simulation model experiments are used to analyze external influences and how they can be managed through control strategies selected from the Lean and Quick Response Manufacturing strategies.

5 - An Optimal Network Security Management Model for E-Commerce

Soumyo Moitra, IIM Calcutta, Diamond Harbour Road, Joka, Kolkata, 700104, India, sdmoitra@hotmail.com

Internet crime is a major risk in e-commerce and organizations deploy a variety of security measures. This paper presents a model to help systems managers decide on the optimal level of network security for their organizations. The model takes into account the impact of heterogeneous hacker behavior and the effectiveness of different security measures to minimize system damages resulting from hacking and the costs of security. Implications for information security policy are discussed.

■ WC58

S-Pike (Lev. 4)

Product Development

Contributed Session

Chair: Anant Mishra, University of Minnesota, 321 19th Ave S, Minneapolis, United States, amishra@csom.umn.edu

1 - Multi Objective Modelling for Determing Alloy Compostion

Jaby Mohammed, Department of Industrial Engineering and Technology, Morehead State University, KY, 40351, j.mohammed@moreheadstate.edu

Multi criterion therory would be used to develop an alloy composition by using a laser manufacturing process. This new manufacuring technique is gaining so much importance because of it versatility in mnaufacturing materials. This presentation would deal in developing a desired alloy composition using multi criterion model.

2 - Facilitating Semantic Interoperability Between Designers and Engineers in a New Car Development

Namkyu Park, Asscociate Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States, namkyu@wayne.edu, Cheolsoon Im

In a new product development, reducing design time has been one of the great challenges. Especially in automotive industry, it is well known there are numerous difficulties in communication between designers and engineers. In this research, using a Bayesian network approach, three parties from a car manufacturer such as designers, engineers, and interface experts are targeted to analyze their communication and knowledge exchange in the context of semantic interoperability.

3 - Firm Level Components Bundling: Integrated and Disintegrated Models

Kunpeng Li, Utica College, 1600 Burrstone Road, Utica, NY, 13502, United States, kli@utica.edu, Dilip Chhajed

The paper models two types of software-hardware-bundling in the computer-based industries. The bundling can be either integrated or disintegrated. Price, quality, and model trade-offs are investigated. Optimal model decisions are concluded in both a monopoly and a duopoly.

4 - Product Release Portfolio Determination

Narayan Raman, DMTS, Alcatel-Lucent, 600-700 Mountain Avenue, Murray Hill, NJ, 07974, United States, narayanraman@alcatel-lucent.com, Salman Shaikh

Firms seek to incorporate customer preferences into their product features and applications portfolio at every new release in order to maximize their revenue and profit potential. This study presents a methodology to determine customer value proposition for individual features, develop customer willingness to pay estimates, and utilize them to prioritize candidate features through an optimum-seeking approach. Extensions to incorporate multiple objectives are also discussed.

5 - An Empirical Analysis of Distributed Organization of Technology Projects

Anant Mishra, University of Minnesota, 321 19th Ave S, Minneapolis, United States, amishra@csom.umn.edu, Kingshuk Sinha

The increasing globalization of technology development work is presenting managers with choices for organizing projects that transcend the boundaries of firms and countries. Based on data collected from 665 projects between January to March 2007, we examine how project organization choice (insourcing, outsourcing, offshoring and offshore-outsourcing) affects the relationship between (i) project characteristics and project performance and (ii) project management style and project performance.

■ WC59

S-Seneca (Lev. 4)

Techology Management II

Contributed Session

Chair: Alp Ertem, Research Assistant, University of Arkansas, Industrial Engineering Dept., 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, alpertem@gmail.com

1 - A Proposal for 3G Mobile Services Adoption: COMPASS Acceptance Model

Lei Tang, Assi. Professor, ESC Rennes School of Business, France, 2 rue Robert d'Arbrissel CS 76522, Rennes, 35065, France, lei.tang@esc-rennes.fr

In this study, we will show that the COMPASS Acceptance Model is suitable for testing 3G mobile services, and may be used to define the weighing factors of their life cycles in cross –cultural context. Data collected from France (Paris) and China (Beijing) among 3G early adopters were tested against the research model. The results strongly support the proposed model in predicting behavior. Several implications will help 3G players to determine marketing strategies and access new mobile services.

2 - Impacts of Nanotechnology on Socio-economic Structures from an Operational Perspective

Orhan Guvenen, Professor/Institute Director, Bilkent University, Ankara, 06800, Turkey, gorhan@bilkent.edu.tr, Murat Hakan Ozturk

In this study, we first provide a brief background information about the evolution of nanoscience and the chaotic impacts of other historical scientific revolutions. Then we start to construct an anticipative analysis of nanotechnology's socioeconomic impacts in the time dynamics. We adopt an operational perspective for that interdisciplinary analysis and we approach the topic from a wide variety of directions like technology management, innovative entrepreneurship and strategic decision making.

3 - Statistical Analysis of Read Rates in RFID Systems

Alp Ertem, Research Assistant, University of Arkansas, Industrial Engineering Dept., 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States, alpertem@gmail.com, Alejandro Mendoza, Nebil Buyurgan

Although there are many aspects of a successful Radio Frequency Identification (RFID) implementation, as yet they have not been studied thoroughly. Read rate in RFID systems is a key performance variable that should be considered during implementation. Factors known to affect the read rate are number of tags in reading zone and distance between tag and antenna. This study investigates the statistical results of three sets of experiments performed controlling these factors.

■ WC60

S-University (Lev. 4)

Technology Life Cycle Management: Road from Intelligence to Commercialization

Sponsor: Technology Management
Sponsored Session

Chair: Tugrul Daim, Associate Professor, Portland State University, P.O. Box 751, Engineering and Technology Management, Portland, OR, 97207, United States, tugrul@etm.pdx.edu

1 - Technology Integration Framework for Early-stage NPD

Neslihan Sener, Portland State University, P.O. Box 751, Portland, OR, United States, neslido@yahoo.com, Tugrul Daim

This paper develops a framework for multi dimensional technology integration analysis at the early stages of product development. As a case, Intel Corporation's product development process is analyzed.

2 - Technology Intelligence Sources: A New Frontier for Technology

Guillermo Rueda, PhD Student, Intel, Hillsboro, OR, 97124, United States, guillermo.rueda@intel.com, Pisek Gerdsri, Tugrul Daim

Abstract: This paper presents an overview of technology intelligence sources used at an increased rate by corporations and governments. The sources include citation and patent analysis. The paper includes cases from emerging technologies demonstrating use of these sources.

3 - Technology Roadmapping Through Intelligence Analysis

Hilary Martin, Intel, Washington County, Hillsboro, OR, 97124, United States, hilary.t.martin@intel.com, Tugrul Daim

Abstract: This study uses text mining to uncover trends in nanotechnology and changes in nanotechnology programs and applications since the first distribution of the National Nanotechnology Initiative (NNI) funds in 2001. Top keywords in current nanotechnology research are analyzed to provide insight into the translation of government funding invested in applied research programs to resulting publications and patents.

4 - University Technology Transfer Efficiency Metrics

Tim Anderson, Associate Professor, Portland State University, P.O. Box 751, Portland, OR, 97207, United States, tima@etm.pdx.edu, Jisun Kim, Tugrul Daim

Abstract: Data Envelopment Analysis (DEA) is used for evaluating the efficiency of 51 universities over four years. An efficiency diagram was developed to represent and explain the patterns of performance change for university technology transfer efficiency (UTTE) which provide more detail about how so-called efficient universities are different from each other and how each university can keep or improve its efficiency.

Wednesday, 3:30pm - 5:00pm

■ WD01

C-Room 602

Supply Chain Competition and Coordination III

Contributed Session

Chair: Ajay Mishra, Associate Professor, SUNY Binghamton, School of Management, Binghamton, NY, 13902, United States, amishra@binghamton.edu

1 - Supply Chain Focus Dependant Safety Stock Placement Problem

Gangaraju Vanteddu, Industrial & Mfg Engineering Department, Wayne State University, 4815 Fourth Street #1073, Detroit, MI, 48202, vgraju@wayne.edu, Ratna Babu Chinnam, Kai Yang

Considering both the safety stock and the lead time reduction costs, we offer some interesting managerial insights in the context of the strategic placement of the safety stocks in a supply chain in the presence of stochastic demand and supply. Our model also facilitates both performance evaluation and optimization for a given set of parameters to achieve the strategic fit between the individual business strategy and the supply chain strategy.

2 - Coordinating a Constrained Channel

Navid Sabbaghi, MIT, 77 Massachusetts Avenue, Room 32D-712, Cambridge, MA, 02139, United States, sabbaghi@mit.edu, Yossi Sheffi, John Tsitsiklis

Linear wholesale-price contracts are considered incapable of coordinating a newsvendor's procurement decision for a 1 supplier/1 newsvendor supply channel. Consequently, more complex contracts have been studied. We show that when a newsvendor is capacity-constrained there is a set of wholesale prices that coordinate his ordering decision. We prove this for multiple-supplier channels and analyze both negotiation and equilibrium settings. We extend our findings to risk-sharing contracts.

3 - Inventory Competition Under Profit Satisficing and/or Maximizing Objectives

Chunming Shi, Assistant Professor, Wilfrid Laurier University, School of Business and Economics, Waterloo, ON, Canada, cshi@wlu.ca

Inventory competition of newsvendors has been studied extensively under the profit maximizing objective. However, profit maximizing objective assume risk neutrality for all newsvendors. In this paper, we study competing newsvendors under profit satisficing and/or maximizing objectives. It is noted that the profit satisficing objective is more practical and it does not assume risk neutrality.

4 - Optimal Capital Investment Decision in Supply Chain with Substitutable Factors of Production

Puneet Mathur, Doctoral Student, Indian Institute of Management Bangalore, Bannerghatta Road, Bangalore, 560076, India, puneetp03@iimb.ernet.in, Janat Shah

Capacity reservation contracts literature by and large implicitly assumes non-substitutability of factors of production to derive optimal capacity investment. We propose a model with substitutable factors using Cobb Douglas production function to derive optimal capital investment for supply chain. We compare performance to show that non-substitutability assumption overemphasizes supplier's underinvestment in capacity, esp in off-shoring context where cost drops substantially for only one factor.

5 - Retailer-manufacturer Coordination for Shelf Space and Marketing Mix Decisions

Ajay Mishra, Associate Professor, SUNY Binghamton, School of Management, Binghamton, NY, 13902, United States, amishra@binghamton.edu, Scott Webster

The retailer and the manufacturer of a product influence its demand in a store through their decisions on price, advertising, shelf space allocation, and slotting fee. We develop a model to analyze the decisions of the manufacturer and the retailer and examine coordination mechanisms.

■ WD02

C-Room 603

Proposed Practices in Closed Loop Supply Chains

Cluster: Closed-Loop Supply Chains and Sustainable Operations
Invited Session

Chair: Mark Ferguson, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, United States, Mark.Ferguson@mgt.gatech.edu

1 - A Revenue Management Approach to Product Recovery

Mark Ferguson, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, United States, Mark.Ferguson@mgt.gatech.edu, Moritz Fleischmann

Products coming off of lease are returned to the OEM's remanufacturing facility where a disposition decision is made to either remanufacture the returned unit or to disassemble it to recover spare parts. The disposition decision contains the basic properties of a traditional revenue management (RM) problem. We exploit this analogy and formulate a RM model of the disposition problem. We show that a RM approach can significantly enhance the value recovered, relative to current practice.

2 - Trade-in Rebates for Price Discrimination or Product Recovery

Gilvan Souza, Associate Professor, University of Maryland, Smith School of Business, College Park, MD, 20742, United States, gsouza@rhsmith.umd.edu, Mark Ferguson, Dan Guide

We study B2B markets such as Internet routers, where an OEM offers trade-in rebates to persuade existing customers to purchase newer generation equipment. This practice exists even in cases where the OEM obtains no value from the older units (e.g., the used equipment is too old to be remanufactured). Reasons for such behavior is to price discriminate existing customers, and to prevent a gray market for used products to develop. We study this problem analytically.

3 - Markets for Remanufactured Products: An Empirical Analysis of Buyer and Seller Characteristics

Ravi Subramanian, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, United States, ravi.subramanian@mgt.gatech.edu, Ramanath Subramanyam

We present an empirical analysis of market characteristics of remanufactured products, including willingness to pay (WTP), buyer expertise, seller reputation, and post-purchase buyer satisfaction, using a dataset of actual purchases of such products.

4 - Analyzing the Effect of Inspection Mechanisms on Investments in Remanufacturing used Products of Uncertain Quality

Andrea Robotis, HEC School of Management, Paris, robotis@hec.fr, Tamer Boyaci, Vedat Verter

We consider a 2-period setting where in Period 1 a monopolist decides the remanufacturability level of a product in addition to the number of products to be collected in Period 2. The quality condition of the collected products is uncertain. The collected products have to be inspected before they are remanufactured. We characterize the optimal investment levels and we show that the effect of uncertainty may or may not be detrimental depending on the inspection mechanism that is used.

■ WD04

C-Room 606

Tutorial: Business Engineering: A Practical Approach to Valuing High-risk High-return Projects Using Real Options

Cluster: Tutorials
Invited Session

1 - Business Engineering: A Practical Approach to Valuing High-risk High-return Projects Using Real Options

Scott Mathews, Assoc. Technical Fellow, The Boeing Company, P.O. Box 3707 MS 42-50, Seattle, WA, 98124, United States, scott.h.mathews@boeing.com, Jim Salmon

Options technology when applied within a corporation for strategic decision-making is called real options. These leading-edge risk and valuation mathematical methods more accurately determine effective investment strategies to reduce risk and shape project value outcome. A new airplane business case is used to illustrate various valuation techniques with modeling and simulation enhancements. Business engineering extends real options into systems engineering for comprehensive project management.

■ WD07

C-Room 609

Reverse Supply Chains

Contributed Session

Chair: Ronald Tibben-Lembke, Associate Professor, Supply Chain Management, University of Nevada, MGRS / 0028, Reno, NV, 89557, United States, rtl@unr.edu

1 - Modeling Government Subsidy Impacts on Recycling Systems

I-Hsuan Hong, Assistant Professor, National Chiao Tung University, 1001 Ta Hsueh Road, Hsinchu, 300, Taiwan - ROC, ihong@mail.nctu.edu.tw, Chin-Fang Wang

Government subsidies to a recycling system may play important roles in driving or curtailing the flows of recycled items. The government may choose the subsidy scheme from different alternatives: subsidizing the upstream or downstream tier per unit of materials handled by them. We investigate the impacts of exogenous subsidies on recycled material flows in a decentralized recycling system where each tier independently acts according to its own interests.

2 - Contract and Strategic Collection Network Design for Reverse Production Systems

Joshua W Pas, Research Assistant, ISyE, Georgia Tech, 765 Ferst Drive NW, Atlanta, GA, 30332, United States, jpas@isye.gatech.edu, Jane C Ammons, Matthew J Realff

Our research addresses three key recycling processor's problems of how to strategically design a collection network, how to be competitive in the collected materials marketplace (high investment), and how to avoid overpaying for materials (collector in regions with different spaces and costs). With incomplete information on collectors' types, suitable contracts are designed to help reduce collectors' defections from the collection network.

3 - Taguchi Loss functions and Supplier Selection

Sharon Ordoobadi, Professor, University of Massachusetts-Dartmouth, 285 Old Westport Rd., N. Dartmouth, MA, 02747, United States, sordoobadi@umassd.edu

A decision model is developed to help decision makers with their outsourcing decisions. The model starts with economic analysis to determine that outsourcing is economically justified. Taguchi loss functions are then used to quantify the intangible costs and benefits of selecting a supplier. The supplier with highest ranking will be selected.

4 - New Findings in Reverse Logistics
Ronald Tibben-Lembke, Associate Professor, Supply Chain Management, University of Nevada, MGRS / 0028, Reno, NV, 89557, United States, rtl@unr.edu, Dale Rogers

Ten years after our first reverse logistics study, we have done a follow-up study. We look at how reverse logistics practices have changed, both in terms of what is being done, and what new best practices have emerged. We look at the size of reverse logistics, the level of product returns in a number of categories, and focus on several specific industries.

■ WD08

C-Room 611

Inventory Management- Information

Contributed Session

Chair: John Kobza, Professor, Texas Tech University Department of Industrial Engineering, Box 43061, Lubbock, TX, 79409, United States, john.kobza@ttu.edu

1 - The Value of Install Base Information in Spare Parts Demand Forecasting
Cerag Pince, PhD Candidate, Erasmus University, Room H09-06, Burg. Oudlaan 50, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, pince@few.eur.nl, Rommert Dekker

Spare parts inventory control models typically assume that demand information is given.The usual way to obtain this info is to apply statistical analysis to historical demand data.However, this does not reflect the anticipated changes in the future nor it is timely in case of slow moving items.The idea brought forward in this paper is to use information on install base to improve forecasting.The information particularly involves changes in phase in/phase out situations.

2 - Life-time Buy Decisions with Multiple Obsolete Parts
James Bradley, Associate Professor, College of William and Mary, Mason School of Business, 118C Tyler Hall, Williamsburg, VA, 23187-8795, United States, james.bradley@mason.wm.edu, Hector Guerrero

Life-cycle mismatch occurs when part life cycles end before the life cycles of products that require the parts. Life-time buys can be used to mitigate part obsolescence, where a quantity of parts is purchased for the remaining product life. We extend prior work on optimal life-time buy quantities for one product with one obsolete part, by deriving analytic solutions, heuristic policies, and bounds for optimal life-time buy quantities when many parts become obsolete over a product's life cycle.

3 - Strategic Safety Stocks in Supply Chains with Demand Forecasts and MRP Planning Logic
Tor Schoenmeyr, MIT, 305 Memorial Drive, Cambridge, MA, 02139, United States, tor_s@mit.edu, Stephen Graves

Under quite general assumptions about the forecasts, the demand process, and the supply chain structure, we show that safety stock placement for systems operating under MRP planning logic is materially equivalent with the corresponding well-studied problem for systems with i.i.d. demand and base stock policies. Hence, we can use existing algorithms to find optimal safety stocks. We find significant benefits from the inclusion of the forecast process in a case study with real data.

4 - The Optimality of State Dependent (s, S) Policy for a Stock Rationing System with Two Demand Classes and Backordering
Jianjun Xu, PhD Candidate, Nanyang Business School, Nanyang Technological University, Nanyang Technological University, 50 Nanyang Avenue, Singapore, 639798, Singapore, xu0001un@ntu.edu.sg, Shaoxiang Chen

We consider Stock Rationing problems for a finite horizon periodic review inventory system with fixed setup cost and backordering, under assumption that there are two stochastic demand classes. We show that a state dependent (s, S) policy is optimal. Numerical study illustrates that the value of rationing increases significantly with the increase of the setup cost, while it is not sensitive to other cost parameters.

5 - Inventory Control for Automated Drug Dispensing Machines: A Service Level Policy
John Kobza, Professor, Texas Tech University Department of Industrial Engineering, Box 43061, Lubbock, TX, 79409, United States, john.kobza@ttu.edu, Steven Myles, Surya Liman, Garrett Heath, Sean Dunagan

The authors present a service level inventory policy for automated drug dispensing machines. Through simulation, it is shown that there could be a significant reduction in pharmaceutical shortages for a case study hospital. A pilot study was also performed to validate the simulation results. The model performed well compared to theoretical predictions and pre-implementation data.

■ WD09

C-Room 612

Project Management II

Contributed Session

Chair: Bruce Pollack-Johnson, Associate Professor of Mathematical Sciences, Villanova University, Department of Mathematical Sciences, 800 Lancaster Avenue, Villanova, PA, 19085, United States, bruce.pollack-johnson@villanova.edu

1 - Reducing I.T. Project Failures with Value-driven Project Leadership
Gezinus Hidding, Associate Professor, Loyola University Chicago, 1 E Pearson, Room 382, Chicago, IL, 60611, United States, ghiddin@luc.edu

I.T. Project failures rates have been high for decades. Various project management techniques have been used and project managers certified to the Project Management Body of Knowledge (PMBOK), but failure rates remain high. Working with 20 seasoned I.T. project managers, we propose a new project management paradigm: Value-Driven Project Leadership (VDPL). VDPL will be presented along with plans for a preliminary empirical study of VDPL's effectiveness in reducing project failure rates.

2 - Managing Risk in Alternative Energy Product Development
Burcu Tan, Teaching Assistant, University of Texas, McCombs Business School, 1 University STA B6000, Austin, TX, 78712-0201, United States, Burcu.Tan@PhDmccombs.utexas.edu, Edward Anderson, Geoffrey Parker

We will explore how to value using modern financial techniques the development of new alternative energy technologies(AETs) given uncertainty. In particular, we propose to adapt the real options methodology to value the potential return from developing AETs using stochastic system dynamics models representing the uncertainty in both the learning curve and the fossil fuel price cycles.

3 - Scheduling Production Directly from Demand
Don Curtis, Greycon, Inc., One Independence Plaza, Suite 720, Birmingham, AL, 35209, dc@greycon.com

Production scheduling for Industries such as paper manufacturing face a combination of product complexity, inconsistent demand, and varying transition costs. We describe a solution that creates a production schedule directly from existing orders, forecast, and inventory policy. The scheduling algorithm seeks to balance the often opposing goals of production efficiency, customer service, and inventory levels.

4 - A Methodology for Determining the Cluster of a New Project When There are Preformed Project Clusters
Aybeniz Yiöt, ASELSAN A.S., ANKARA, Turkey, ayigit@aselsan.com.tr, Ömer Saatçeiölu, Canan Sepil, Yasemin Serin

In order to develop a dynamic project clustering scheme a Project Identification Card (PIC) that defines the projects in a project space is developed. The measurement scale of the PIC is constructed by using the absolute measurement Analytic Hierarchy Process (AHP). The projects are clustered by using the PIC. A Clustering Tabu Search algorithm is generated and used in the sensitivity analyses of the clusters to projects. A methodology for determining the cluster of a new project is developed.

5 - Incorporating Quality Considerations into Project Time/Cost Trade-off Analysis and Decision Making
Bruce Pollack-Johnson, Associate Professor of Mathematical Sciences, Villanova University, Department of Mathematical Sciences, 800 Lancaster Avenue, Villanova, PA, 19085, United States, bruce.pollack-johnson@villanova.edu, Matthew Liberatore

This paper extends the standard time/cost trade-off problem by assuming that different tasks can be performed at different quality levels. We then provide a mathematical programming model for solving this problem, and illustrate with an example. The model can be used to generate quality level curves to illustrate the trade-offs among time, cost, and quality, which can be used to make scheduling decisions that explicitly model and consider quality as well as time and cost.

■ WD10

C-Room 613

Advanced Models in Supply Chain Management

Cluster: Inventory
Invited Session

Chair: Emre Berk, Assistant Professor, Bilkent University, Faculty of Business Administration, Ankara, Turkey, eberk@bilkent.edu.tr

1 - The (Q,r) Model for Perishables with Multiple Outstanding Orders
Emre Berk, Assistant Professor, Bilkent University, Faculty of Business Administration, Ankara, Turkey, eberk@bilkent.edu.tr

We analyze the lost sales (Q,r) model for perishables with constant leadtimes/lifetimes when there may be more than one outstanding order. We employ an embedded MC approach and obtain operating characteristics of inventory system via an effective shelflife distribution. We establish some stochastic properties of the system and present numerical results.

2 - Multi-period Inventory Models with Price Protection
Osman Alp, Bilkent University, Industrial Engineering Department, EA421, Ankara, TR, 06800, Turkey, osmanalp@bilkent.edu.tr, Alper Sen, Nurdan Ahat

In an environment with declining procurement costs and sales prices, the manufacturer offers price protection so that the retailer will maintain adequate inventory. With price protection, the retailer will be reimbursed with a percentage of the procurement cost declines, for the inventory that the retailer ordered within a given price protection period but not yet sold. We study the optimal inventory control policy of the retailer under price protection.

3 - Deciding on the RFID Tagging Level of Inventories
Evsen Korkmaz, Istanbul TechnicalL University, Macka 34367, Istanbul, Turkey, evsenkorkmaz@yahoo.com, Tarkan Tan

In a recent survey of retail chief information officers, it is reported that 55% of respondents plan to implement RFID capabilities in a near future. However, this investment is still very expensive to justify tagging on item-level for all SKUs. Therefore, it is important to decide on the level of RFID tagging for each SKU in the inventory: item, case, pallet, or none. In this talk, we present a model that can be used in making this decision, along with some results and managerial insights.

4 - Retail Inventory Control: The Effect of Store Handling Operations
Alina Curseu, Technische Universiteit Eindhoven/Department of Technology Management, P.O. Box 513, 5600 MB, Eindhoven, Netherlands, a.curseu@tue.nl, Tom van Woensel, Jan Fransoo

We consider a retail inventory problem and explicitly recognize the shelf-stacking at the store level as a critical operational expense. The retailer manages the inventory of multiple items facing stochastic demands and periodically reviews its stock for replenishment. Furthermore, we assume orders may be in multiples of a fixed batch size. We analyze various system operating characteristics and explore opportunities for extending existing inventory control rules with a handling component.

■ WD12

C-Room 615

Forecasting

Contributed Session

Chair: Victor Tang, MIT, c/o Building3 Associates, 55 Deerfield Lane South, Pleasantville, NY, 10570, United States, victang@mit.edu

1 - Method to Remove the Bias of Staffing Error in Contact Center Forecasting
Viroj Buraparate, Manager, Hewlett-Packard Company, 11445 Compaq Center Drive West, Houston, TX, 77345, United States, viroj.buraparate@hp.com, Yikang Li

The authors study the impacts of forecasting and staffing errors to service level in a contact center environment. A methodology to distinguish these two phenomena from each other will be presented. Furthermore, a mathematical model that can be used to minimize the bias of staffing error from influencing future forecasts will be shared together with examples.

2 - Forecasting Next-day Electricity Price by Time Series Model Based on K-nearest Neighbors
Zhi Zhou, Department of Decision Sciences and Engineering Systems, Rensselaer Polytechnic Institute, 110 8th St., CII, Suite 5015, Troy, NY, 12180, United States, zhouz@rpi.edu, Wai Kin Victor Chan, Ting Xie, Haiyuan Wang, Yingjie Zhou

To forecast next-day electricity price is critical to both producers and consumers in deregulated electricity power market. This paper proposes a time series model based on K nearest neighbors, to forecast the next 24 hours electricity spot prices. The results show that performance of the model is similar to Seasonal Holt-Winters in real data set, but is simpler. The relation among block size, search space length and prediction error of forecasting is analyzed to help model parameters selection.

3 - Forecasting Price Indices for Communications Equipment
Gerard Brosnan, Principal, Noblis, 3150 Fairview Park Drive, Falls Church, VA, 22042, United States, gerard.brosnan@noblis.org

The purpose of this paper is to identify pricing trends in the American communications equipment market and to estimate prevailing price indices in the 2007–2016 timeframe. The forecasted data will serve as a proxy for future customer-premises equipment prices paid by U.S. federal agencies under the General Services Administration Networx contract.

4 - Government Guarantee Value Research Based on the Hidden Information
Wang Le, Xi'an Jiaotong University, Box 2308, No.28 West Xianning Road, Xi'an, Shaanxi Province, 710049, China, happywle@gmail.com, Guo Ju E

There is always the information asymmetry in the process of absorbing the non-governmental investors to the infrastructure financing through the government guarantee. Firstly, guarantee can be a signal deliver of the quality of the infrastructure; this is good for the risk control for the lender. Second the guarantee request to the governmental can lead to a inverse-choice because of the different risk preference of the government, this may also arose a time-inconsistent risk.

5 - Ex Ante Evaluation and Improvement of Forecasts and Predictions
Victor Tang, MIT, c/o Building 3 Associates, 55 Deerfield Lane South, Pleasantville, NY, 10570, United States, victang@mit.edu

Forecasts and predictions are evaluated after the fact, when it is impossible to change a decision. We make improvements before the fact. We consider the composite organization, their knowledge, data bases, formal/informal procedures as a measurement system. We use Gage R&R to improve the quality of this entire measurement system, its forecasts, and predictions.

■ WD13

C-Room 616

Integer Programming Applications

Contributed Session

Chair: Ada Barlatt, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, abarlatt@umich.edu

1 - Compatible Branching in Branch-and-price Using Variables from the Disaggregated Problem Formulation
Hernan Wurgaft, SUNY Maritime College, 6 Pennyfield Avenue, Bronx, NY, 10465, hwurgaft@sunymaritime.edu

Compatible branching, which prevents columns that have been set to zero from being regenerated, is usually achieved by fixing sets of variables of a compact formulation of the problem. In this study, we experiment with compatible branching strategies that directly fix sets of variables of the disaggregated problem formulation. Two such strategies applied to the Generalized Assignment Problem separate the solution space by considering the cardinality and capacity utilization of the columns that are active in the relaxed solution at each node. Disaggregated variable branching is combined with compact formulation branching to reach optimality. Xpress-Mosel was used for the branch-and-price implementation and experimentation.

2 - Portfolio Selection Using Linearly Constrained Multiple Objectives
Paul Salasznyk, PhD Candidate, Rensselaer Polytechnic Institute, 110 Eighth Street, CII 5107, Troy, NY, 12180, United States, salasp@rpi.edu, William Wallace

Many organizations have been making efforts to analyze a large set of project proposals in order to choose project portfolios which maximize the performance, meet resource constraints and minimize risk. Integer programs are well suited for solving optimization problems involving the several, often conflicting objectives in the R&D project portfolio selection problem. We apply this solution method to a problem with linearly constrained objectives.

3 - An Overview of the Traveling Salesman Subtour Problem and Related Research
Susan Heath, Assistant Professor, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States, skheath@nps.edu, Aruna Apte

The traveling salesman subtour problem (TSSP) has been applied, in various forms, to a wide variety of problems over the course of more than 25 years. This breadth of use, but infrequent use, has led to several issues. This research provides a structured organization of TSSP-type problems, a survey of related published research articles, and a necessary correction to a lemma in a foundational paper.

4 - Post-Merger Supply Chain Coordination: The Impact of Market Regions and Distribution Configurations
Shenghan Xu, Department of Business, College of Business and Economics, University of Idaho, Moscow, ID 01003, shenghan@uidaho.edu, Iqbal Agha

In this paper we study how the expected synergistic gain upon merger of two companies is impacted by their market region definitions and distribution configurations. These two characteristics, which reflect geographical and/or demographic demarcations, bring uniqueness to each company's supply chain network. We report the findings of an integer-program-based computational study of 112 supply chain merger scenarios of two companies with up to 2410 stores and 34 distribution centers in the continental United States using U.S. Census Bureau 2005 data.

5 - A Divide-and-Conquer Approach to High- and Low- Level Resource Planning

Ada Barlatt, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States, abarlatt@umich.edu, Amy Cohn

We consider a resource allocation problem with tightly- coupled high-and low-level decisions. We show that by decomposing the problem into a series of smaller problems in which the high-level decisions are fixed, we can use a divide-and-conquer approach to greatly improve tractability. An example from automotive stamping is used to demonstrate this approach.

■ WD14

C-Room 617

Network Optimization II

Contributed Session

Chair: Ning Shi, R & D Engineer, IBM China Research Lab, Diamond Building A, 2/F, Zhong Guan Cun Software Park, Beijing, China, shining@cn.ibm.com

1 - Supplier Selection Based on Neural Network

Davood Golmohammadi, PhD, Rutgers University, 703 Bevier Rd, Piscataway, NJ, 08854, United States, dgolmoha@mix.wvu.edu, Haleh Valian

A decision making model was developed to select suppliers using neural networks. This model used historical data for suppliers and their performance to help the vendor supplier selection decision. A set of input functions for supplier selection criteria was defined to create input data for training the model. Both type of criteria, qualitative and quantitative, used in the model so fuzzy techniques were applied to transfer linguistic terms to crisp numbers. Backpropagation (BP) was used for training the Neural Network in this model and parameters of the algorithm adjusted toward a global solution. For the model validation, the suppliers for three products were ranked based on the proposed model and the results compared with the managers' ranking.

2 - Optimal Routing of Inspection Vehicles

Gang Li, The University of Texas at Austin, McCombs School of Business, Austin, TX, United States, gang.li@mail.utexas.edu, Anant Balakrishnan, Juan Morales, Brian Roth

We consider the problem of routing a vehicle to inspect links of a transportation system. Links differ in their inspection times and frequencies and a schedule must ensure that the time between successive inspections of each link does not exceed a specified link-dependent scope. We develop an integer programming model, based on link groups that can be covered within a period, to optimize the vehicle route for different objectives, and explore ways to improve the effectiveness of solution methods.

3 - Assignment Problems in Multi-Sensor Multi-Target Tracking

Dimitri Papageorgiou, Operations Research Analyst, The Raytheon Company, 235 Presidential Way, Woburn, MA, 01801, United States, Dimitri_J_Papageorgiou@raytheon.com

Assignment problems play an integral role in multi-target tracking. When multiple sensors are present, they can often improve tracking performance by sharing detection- and track-related data. These data must first be correlated and associated with one another in a matter of seconds before estimation can take place. We present an overview of these assignment problems and describe the most popular heuristic and exact algorithms for their solution.

4 - Simulation of Stochastic Activity Networks

Drs. B. Dodin, Anderson Graduate School of Management, Univ. of California, Riverside, Riverside CA 92521, bajis.dodin@ucr.edu, A.A. Elimam

Monte Carlo Simulation (MCS) is used to analyze projects modeled as Stochastic Activity Network (SAN). Accuracy of the MCS results depends on the sample size. Sample size must consider the SAN characteristics including: number of activities, their distributions, number of paths, and the SAN structure. This paper investigates the impact of these characteristics on the sample size, and hence the accuracy of the simulated results.

5 - Dynamic Fleet Management Problem with Uncertain Demands and Uncertain Service Times

Ning Shi, R & D Engineer, IBM China Research Lab, Diamond Building A, 2/F, Zhong Guan Cun Software Park, Beijing, China, shining@cn.ibm.com, Raymond Cheung

We are motivated to study the dynamic fleet management problems with uncertain market demands and uncertain service times. We formulate this problem as a multistage dynamic network model with partially dependent random arc capacities and propose a resource-directive decomposition approach to solve it. The approach decomposes the problem into a number of tractable stochastic tree recourse problems. The experimental results demonstrate its efficiency in solving large scale problems.

■ WD15

C-Room 618

Stochastic Optimization/Large Scale Optimization II

Contributed Session

Chair: Michael Chen, PhD Candidate, Northwestern University, 2145 Sheridan Road IEMS, Evanston, IL, 60201, United States, michael-chen@northwestern.edu

1 - The Two-level Decomposition Principle via Dual Central Pricing for Multi-stage Stochastic Programming

Lila Rasekh, HEC Montreal, 3000 Chemin de la Côte-Sainte-Catherine, Montreal, Canada, lila.rasekh@mcgill.ca, Jacques Desrosiers

Multi-stage stochastic programming (MSP) problems often have very large number of scenarios and special structures which are tractable by decomposition. This paper presents a two-level decomposition method for a class of MSP problems. The decomposition is done on the dual of a MSP problem where the goal is to compare the simplex-based column generation technique with that of an interior-point based decomposition and column generation algorithm, namely the Analytic Center Cutting Plane Method.

2 - Scenario Generation for Obtaining Sound Solutions

Arnt-Gunnar Lium, Research Scientist, SINTEF Technology and Society, NO-7465, Trondheim, Norway, Arnt-Gunnar.lium@sintef.no, Michal Kaut

For any optimization problem, the quality of the solution depends heavily on the quality of the input data. In stochastic programming, the input for the models is usually given in the form of scenario trees based on an underlying statistical distribution. We look at examples where the discretization of the underlying distributions gives unstable results that are too optimistic and turn out to be infeasible when tested using the underlying distribution.

3 - An Ergodic Theorem for Bivariate Functions

Michael Casey, RBIO, 407 N. Broadway, Apt 14, Redondo Beach, CA, 90277, United States, msc.sedcontra@gmail.com

A bivariate function can be a mathematical model for a minimax problem where we minimize with respect to the first variable and maximize with respect to the second. When uncertain data for the problem are modeled with random variables, the biavariate function is random and gives rise to a stochastic game. We prove an ergodic theorem for a class of random bivariate functions.

4 - Stochastic Programming via Stochastic Approximation Approach

Guanghui Lan, School of Industrial & Systems Engineering, Georgia Institute of Technology, Atlanta, United States, glan@isye.gatech.edu, Anatoli Juditsky, Alex Shapiro, Akardi Nemirovski

In this talk, we outline the theoretical convergence results for a wighted-average stochastic approximation approach and demonstrate its excellent practical performance through computational experiments, for example, it is 10-30 times faster than the Sampling averaging approximation.

5 - Sparse Grid Method in Scenario Generation for Multistage Stochastic Programming

Michael Chen, PhD Candidate, Northwestern University, 2145 Sheridan Road IEMS, Evanston, IL, 60201, United States, michael-chen@northwestern.edu, Sanjay Mehrotra

We present an innovative deterministic scenario generation method for multistage stochastic problem using sparse grid algorithm. For functions with bounded mixed derivative, such as exponential utility function commonly seen in financial applications, sparse grid algorithm reduces approximation error substantially, and outperforms the popular Quasi Monte Carlo method. We prove that the method is epi-convergent, and we show numerically its fast convergence on a few classical financial examples.

■ WD16

C-Room 619

Dynamic Programming/Control

Contributed Session

Chair: Huseyin Onur Mete, PhD Student - Research Assistant, University of Washington, 6330 NE Radford Dr 3726, Seattle, WA, 98115, Turkey, mete@u.washington.edu

1 - Optimal Control of Stochastic Systems with Memory

Mou-Hsiung Chang, Researcher, US Army Research Office, P. O. Box 12211, Research Triangle Park, NC, 27709, United States, mouhsiung.chang@us.army.mil

This paper treats a finite time horizon optimal control problem in which the controlled state dynamics is governed by a general system of stochastic functional differential equations with a bounded memory. An infinite-dimensional HJB equation is derived using a Bellman-type dynamic programming principle. It is shown that the value function is the unique viscosity solution of the HJB equation.

2 - Optimal Control of a Production Line Under Uncertainty with a Finite Horizon

Blake E. Nicholson, Department of Industrial and Operations Engineering, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States, blaken@umich.edu, Robert L Smith, Marina A. Epelman

We present recent results from our work on the End State problem, in which one attempts to leave a production line in a certain state when it is shutdown at the end of a shift. The problem background is reviewed and results of a recent study of various control alternatives when faced with unreliable machines are presented.

3 - Mean-Variance Criterion for Semi-Markov Decision Processes (SMDPs)

Melike Baykal-Gursoy, Associate Prof., Industrial and Systems Eng. Dept., Rutgers, gursoy@rci.rutgers.edu, Kemal Gursoy

We consider SMDPs with finite state and action spaces and study the expected time-average variability. Under a certain condition, for communicating SMDPs, we construct (randomized) stationary policies that are ϵ-optimal; the policy is optimal and pure for a specific variability function. For general multi-chain SMDPs, by using a state space decomposition approach, similar results are obtained.

4 - A Dynamic Nonlinear Fluid-Based Scheduling Model for a Single Product Tandem Manufacturing Line Considering Variability Transference

Rodrigo Caliz, Pennsylvania State University, Carlos Osorio-Ramirez, Juan Ucros

In this paper the problem of finding the minimum-cost feedback influx rate for a single-product manufacturing line is considered. A continuous-time optimal control model is proposed in order to determine a closed-form feedback control rule for the influx rate of the manufacturing tandem line. Inventory and cycle time dynamics may be modeled as stochastic processes due to the inherent variability related to manufacturing processes. Thus deterministic approximations based on both traffic flow theory and non-stationary queueing models are used in order to incorporate the stochasticity of the system. Simulation experiments are conducted to evaluate the performance of the proposed policy under several processing times distributions as compared to the non-controlled system where each job enters the system at its arrival epoch.

5 - An Index Policy for the Discounted Bandit Problem with Availability Constraints

Kazutoshi Yamazaki, PhD Student, Princeton University, ORFE Dept., Princeton University, Princeton, NJ, 08540, United States, kyamazak@princeton.edu, Savas Dayanik, Warren Powell

We study a generalization of the multi-armed bandit problem where arms are not always available. We prove the non-existence of an optimal index policy and propose the so-called Whittle index policy by formulating the problem as a restless bandit problem. The index policy cannot be dominated uniformly by any other index policy over the entire class of bandit problems considered here, and is numerically shown to be near-optimal.

■ WD17

C-Room 620

Quality and Statistics

Contributed Session

1 - Relationships Among Service Quality, Customer Satisfaction, Behavior Intentions in Fast Food Restaurants

Hong Qin, PhD Student, University of North Texas, ITDS Dept.. P.O. Box 305249, University of North Texas, Denton, TX, 76203-5249, United States, qinh@unt.edu, Victor R Prybutok

A modified SERVPERF model is developed to measures service quality in fast food restaurants, and the relationships among service quality (with the added dimension of recovery), food quality, and price/value, with customer satisfaction and behavioral intentions are examined. Results indicate the better performance of modified service quality instrument which includes recovery construct. The direct and positive relationship between service quality and behavioral intentions is supported.

2 - Selecting the Best Compromise Among Nondominated Points in Dual Response Surface Optimization

In-jun Jeong, ETRI, 161 Gajeong-Dong, Yuseong-Gu, Daejeon, 305-700, Korea, Republic of, ijjeong@etri.re.kr, Kwang-Jae Kim, Dong-hee Lee, Sung-soo Han

In dual response surface optimization, the posterior preference articulation approach first finds all (or most) of the nondominated points in the mean and the standard deviation space without any substantial articulation of the decision maker (DM)'s preference. The DM then chooses the best one from the set of nondominated points a posteriori. This paper proposes a systematic method to help the DM select his/her best compromise when the nondominated points are comprehensively given.

3 - Difference Based Estimation on Semiparametric Additive Model

Lie Wang, University of Pennsylvania, 3730 Walnut Street, 400 Huntsman Hall, Philadelphia, PA, 19104, United States, liewang@wharton.upenn.edu, Tony Cai, Lawrence Brown

Semiparametric models have received great attention recently. In this paper we consider the semiparametric additive regression model, whose response Y has linear relationship with predictors X and nonparametric regression forms with predictors Z. We propose a difference based method, which has been proved to be asymptotic efficiency for the linear part and achieve the optimal minimax rate of convergence for the nonparametric part under much weaker conditions than most of the existing methods.

■ WD19

C-Room 203

Workforce Planning in the Services

Cluster: Workforce Engineering

Invited Session

Chair: Jennifer Ryan, Senior Lecturer, UCD School of Business, Management Subject Area, University College Dublin, Belfield, Dublin, 4, Ireland, Jennifer.Ryan@ucd.ie

1 - Services Supply Chain Modeling

Sean McGarraghy, College Lecturer, UCD School of Business, Management Information Systems, Quinn School of Business, Belfield, Dublin, Du, 4, Ireland, sean.mcgarraghy@ucd.ie, Terry Harrison

A fundamental part of any services supply chain implementation is having a flexible and extensive database of human resource attributes, and methods for acting on them. We describe a data modeling platform for services supply chains. We also map out key data needs to support stochastic optimization of services supply chains, and develop an approach to create the necessary probability distributions from existing data. We describe the implementation of this on an example stochastic attribute.

2 - OnTheMark: An Integrated Workforce Management Solution

Mark S. Squillante, IBM T.J. Watson Research Center, Mathematical Sciences Department, 1101 Kitchawan Road, RT 134/P.O. Box 218, Yorktown Heights, NY, 10598, United States, mss@watson.ibm.com, Ta-Hsin Li, Jianying Hu, Aleksandra Mojsilovic, Ana Radovanovic, Yingdong Lu

Forward-thinking businesses are investing in advanced workforce management (WFM) solutions as a competitive differentiator. We first analyze the requirements for advanced WFM solutions, which combine managerial discipline with sophisticated analytics and IT to produce demand forecast, labor standards, optimally staffed/timely delivered projects and efficiently deployed workers. We will then review analytics and optimization capabilities behind OnTheMark, a novel WFM system developed at IBM.

3 - Workforce Planning Models with Individual Worker Differences

Esma Gel, Assistant Professor, Arizona State University, Department of Industrial Engineering, Tempe, AZ, 85287-5906, United States, esma.gel@asu.edu, Pornsarun Wirojanagud, John Fowler

We discuss formulations and efficient solution methods for workforce planning. In particular, we consider individual worker differences and a variety of decisions such as hiring, firing, cross-training and the use of contingent workers. Our results demonstrate the importance of modeling worker differences as well as the effectiveness of our heuristics.

4 - Weekly Staff Scheduling at USPS Facilities with Workstation Group Restrictions

Jonathan Bard, Professor, The University of Texas, 1 University Station C2200, Mechanical Engineering, Austin, TX, 78712-0292, United States, jbard@mail.utexas.edu, Lin Wan

This talk discusses the weekly adjustment problem for staff scheduling when movement restrictions exist between workstation groups (WSGs). In practice, it is common for employees to be organized into physical or logical groups to match the layout of a facility. A new model is proposed that integrates WSG restrictions with the shift scheduling and task assignment constraints. The model takes the form of a large-scale integer program and is solved with one of two decomposition heuristics.

■ WD20

C-Room 204

DA Arcade IV

Sponsor: Decision Analysis
Sponsored Session

Chair: Murat Hakan Ozturk, PhD Student, Duke University, The Fuqua School of Business, Durham, 27708, United States, mo24@duke.edu

1 - Information Distortion in Decision Support Systems and Respective Alternative Costs

Orhan Guvenen, Professor/Institute Director, Bilkent University, Ankara, 06800, Turkey, gorhan@bilkent.edu.tr, Murat Hakan Ozturk

Information Systems can be considered as the most important decision support tool for the decision makers in business, academia and politics. In this study we are trying to analyze how manipulations in information systems may affect decision-making processes. We will evaluate the respective alternative costs of manipulated information in decision making from the decision analysis perspective.

2 - Decision Analysis Workflow for Upstream Petroleum Industry

Lev Virine, Schlumberger, 600, 322-11 Ave S.W., Calgary, AB, T2R 0C5, Canada, lvirine@slb.com

Consistent and comprehensive decision analysis process was proven to improve performance of oil companies. The proposed decision analysis workflow includes identification of uncertainties related to petroleum reservoirs, costs of wells and facilities, prices and markets. Decisions made on the stages of exploration, appraisal, development, and production are based on analysis of these uncertainties. Actual production performance management helps to improve the quality of new decisions.

■ WD21

C-Room 205

DAS Student Paper Contest Finalists

Sponsor: Decision Analysis
Sponsored Session

Chair: Kimberly Thompson, Harvard School of Public Health, 677 Huntington Ave., 3rd Floor, Boston, MA, 02115, United States, kimt@hsph.harvard.edu

1 - Probability Elicitation, Scoring Rules, and Cooperation Among Forecasters

Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville VA 22906, United States, lichtendahlc@darden.virginia.edu, Robert L. Winkler

We develop the notion of a joint scoring rule (a collection of interdependent scoring rules) and show that proper joint scoring rules can be generated on a project-by-project basis when eliciting probabilities from independent forecasters. These rules mimic the cooperative stakes business shares would naturally induce. We discuss the extent to which dependent forecasters deviate from the truth under slightly revised stakes.

2 - A Knowledge Gradient Policy for Sequential Bayesian Ranking and Selection

Warren Powell, Professor, Princeton University, Engineering Quadrangle, Princeton NJ 08544, United States, powell@princeton.edu, Savas Dayanik, Peter Frazier

We propose a new sequential Bayesian ranking and selection procedure, the knowledge-gradient policy, for determining the best of a discrete set of noisy options subject to a constraint on the number of samples taken. The Bayesian prior is assumed to have a normal distribution with independent components. The knowledge-gradient policy is provably optimal in several cases, has bounded sub-optimality in general, and compares well experimentally with other information-collection algorithms.

3- Estimating the Patient's Price of Privacy in Liver Transplantation (Note this paper was presented Sunday, Nov. 4th in the 4:30 - 6:00 session on Stochastic Models in Health Care)

Burhaneddin Sandikci, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh PA 15217, United States, bus2@pitt.edu, Oguzhan Alagoz, Lisa Maillart, Mark Roberts, Andrew Schaefer

In the United States, ESLD patients join a waiting list for cadaveric liver transplantation. The details of the composition of this list are not publicly available. We consider the benefits associated with creating a more transparent list by studying the organ accept/reject decision as a Markov decision process. We define the concept of the patient's price of privacy to measure the cost of keeping the list private. We also present the results of numerical experiments based on clinical data.

4 - The Value Heuristic in Judgments of Relative Frequency (will not present in this session)

Xianchi Dai, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, xianchi.dai@insead.edu, C. Miguel Brendl, Klaus Wertenbroch

We show that people heuristically infer the relative frequency of a class of stimuli from the relative value of these stimuli. They judge what is more valuable as relatively scarcer. In three studies, we demonstrate the operation of this value heuristic and the resulting judgmental bias in frequency estimates of stimuli with either inherent (photos of attractive human faces in Experiment 1) or experimentally induced, monetary value (pictures of other species in Experiment 2 and displays of abstract letter combinations in Experiment 3). We discuss implications of the heuristic for people's choice behavior in a variety of domains and for their economic intuitions and understanding of market mechanisms.

5- The Optimal Composition of Influenza Vaccines Subject to Random Production Yields (Note this paper was presented Tuesday, Nov. 06th in the 10:00 - 11:30 session on Dynamic Programming Applications)

Soo-Haeng Cho, UCLA Anderson School of Management, 110 Westwood Plaza, Gold Hall, Suite B512, Box 951481, Los Angeles CA 90095, United States, scho@anderson.ucla.edu

We present a dynamic model for the annual flu vaccine composition decision. An optimal threshold policy is derived for this decision. Due to the greater uncertainty in production yields of new vaccines, the optimal thresholds are neither symmetric between retaining and updating the composition nor monotonic over time. We apply our model to past decisions using parameter values estimated from a historical case. Our analysis shows that the optimal policy can significantly improve social welfare.

■ WD22

C-Room 206

Decision Support Systems Applications

Contributed Session

Chair: Henry Amato, Professor, University of Nevada Reno, 1664 N. Virginia St, Reno, NV, 89512, United States, hna@unr.edu

1 - An Optimization Based Decision Support System for Strategic Planning in Different Process Industries

Narain Gupta, Doctoral Student, IIM Ahmedabad, FPMH 05, IIM Campus, Vastrapur, Ahmedabad, Gu, 380015, India, naraingupta@iimahd.ernet.in, Goutam Dutta

We discuss application of an optimization based Decision Support System (DSS) in different process industries including steel, pharmaceutical, polymer and aluminum. The DSS is based on five fundamental elements: Materials, Facilities, Activities, Storage Areas, and Times. This DSS is user friendly and requires little knowledge of optimization techniques. The results demonstrate substantial improvement of profit in all industries.

2 - A Bayesian Decision Support Tool Using Dynamic Decision Networks

Randal Hickman, Instructor, Math Department, United States Military Academy, USMA, D/Math, 646 Swift Road, West Point, NY, 10996, United States, ar2000@usma.edu, Brian Souhan, Randy Boucher, Gerald Kobylski, Todd Retchless, Charles Sulewski

This presentation proposes a dynamic, real-time, decision support tool for the Future Combat System. This is achieved in a Bayesian framework using Dynamic Decision Networks (DDNs). The output of a DDN serves as an analytic tool to a decision maker or as the decision process algorithm for unmanned, autonomous systems. Our model shows the application of DDNs in a network of sensors and autonomous vehicles operating within the Future Combat System framework.

3 - Helping Operations Planning Engineers Plan Short-term Reservoir Flows

Valeria Quevedo, Centre for Operations Excellence, University of British Columbia, 2053 Main Mall - Room 209, Vancouver, BC, Canada, valeria.quevedo@coe.ubc.ca, Taraneh Sowlati, Derek Atkins, Neda Salehirad

The goal of this project is to develop a general-use spreadsheet reservoir planning model. This model will be used by operations planning engineers at BC Hydro to assist them in deciding on operating parameters of reservoirs under various water inflow conditions while ensuring that power supply requirements and other regulatory constrains are met. The model will incorporate the strengths of the existing planning models, and will further have features to accept multiple inflow forecasts.

4 - Local Recurrence Modeling for Quality and Performance Prediction in Multistage Manufacturing Systems

Hui Yang, School of Industrial Engineering and Management, Oklahoma State University, 322 Engineering, Stillwater, OK, 74075, United States, hui.yang@okstate.edu, Satish Bukkapatnam

Much of the complexity in manufacturing systems is known to emerge from the underlying nonlinear stochastic dynamics. Despite high levels of nonstationarity in the system behaviors, the local evolution of the system exhibits recurrence behaviors. This paper presents a local recurrence modeling approach for predicting throughputs in multistage manufacturing assembly lines.

5 - Determining Acceptable Warehouse Performance Using A Neural Network

Henry Amato, Professor, University of Nevada Reno, 1664 N. Virginia St, Reno, NV, 89512, United States, hna@unr.edu

Managers need to have some measure of a warehouse's daily performance. The relationship between daily warehouse transactions and performance is usually complex and non-linear, making it difficult to develop precise mathematical performance models. Fortunately, managers need only know if the day's performance was acceptable in order to determine if investigative action is required. This paper presents a method which uses a neural network model to determine acceptable performance.

■ WD23

C-Room 208

Queueing Models III

Contributed Session

Chair: Shengwei Ding, Post Doctoral Researcher, UC Berkeley, 111 N. Rengstorff Ave, Apt 120, Mountain View, CA, 94043, United States, dingsw@cal.berkeley.edu

1 - Stochastic Modeling of Correlated Parallel Heterogeneous Servers

Raha Akhavan-Tabatabaei, Intel Corporation, 400 N. Coronado St, Apt # 2056, Chandler, AZ, 85224, United States, raha.akhavan-tabatabaei@intel.com, George Shanthikumar, Shengwei Ding

Classical queueing models assume that arrival process and tool breakdown/maintenance are independent. This assumption does not hold in some industry applications and introduces inaccuracy in predicting queue time. We propose a Markov Decision Based model that considers such dependency conditions, verified in a high-volume manufacturing facility. The study provides a theoretic framework as well as promising results for modeling system with dependency between process and tool availability.

2 - Performance Evaluation of Systems with Fluctuating Server Capacity

Jingxiang Luo, Research Associate, University of Calgary, Department of Computer Science, 2500 University Drive, NW., Calgary, AB, T2N1N4, Canada, jxluo@cpsc.ucalgary.ca, Carey Williamson

We study a variant of an M/PH/c/c loss queue, where capacity c fluctuates. For such a system, several situations of traffic and control are studied. Exact and approximate methods to evaluate performance are developed and compared, and factors influencing blocking and dropping behavior are analyzed. Telecommunication application will be addressed.

3 - Stochastic Modeling for Maintenance of Parallel Servers with Dependency

Shengwei Ding, University of California-Berkeley, 111 N. Rengstorff Ave., Apt 120, Mountain View, CA, 94043, United States, dingsw@cal.berkeley.edu, Raha Akhavan-Tabatabaei, George Shanthikumar

Existing queueing models for predicting tool availability assume that failure of parallel machines happen independent of each other. We provide a stochastic model of such systems through incorporating correlations between the number of failed tools and their failure and repair rates. The study provides theoretic framework and promising results for non-heterogeneous parallel servers. The model is verified on a lithography toolset in a high volume manufacturing facility.

■ WD25

C-Room 210

Applications of Statistic and Simulation

Contributed Session

Chair: John Kros, Assistant Professor of Marketing and Supply Chain Management, East Carolina University, 3121 Bate, Greenville, NC, 27858, United States, krosj@ecu.edu

1 - Multi-model G-efficient Response Surface Designs for a Cuboidal Region

You-Jin Park, Samsung Electronics Co., Ltd, Hwaseong, Gyeonggi-Do, Korea, Hwaseong, Korea, Republic of, eugene993@yahoo.com

The choice of a response surface model is an important consideration in using statistical designs of experiments. Usually, the exact form of the response surface model is not known a priori, and experimenters typically assume that a certain model form will be fit. Then a design appropriate for that model form is selected and the experiment is conducted. However, sometimes the initial choice of the response surface model is incorrect. This can result in large prediction variance for the response based on the selected model. We create multi-model experimental designs that have stable prediction variance for a family of candidate response surface models over a cuboidal region by using genetic algorithms and the desirability function optimization method. We then compare the prediction variance stability of multi-model designs with those of the 3-level face centered cube. These multi-model designs have moderately high G-efficiencies for all candidate models that the experimenter may potentially wish to fit, and outperform the face centered cube design for the second-order response surface model. The G-efficiencies are provided for the multi-model designs and the face centered cube.

2 - On the Distribution of the Usual Estimator of Cpk

Noel Artiles-Leon, Professor Department Industrial Engineering, University of Puerto Rico at Mayaguez, University of Puerto Rico at Mayaguez, Industrial Eng. Department. PO.Box 9043, Mayaguez, PR, 00681, Puerto Rico, nartiles@uprm.edu, Clara Novoa

Assessing the variability in the estimation of a process capability is an important issue in SPC. We deduce the distribution of the common estimator of Cpk when the quality characteristic of interest is normally distributed. We follow a statistically simple procedure that is appealing to practitioners, engineers, and students. Our deduction process is based on the folded normal distribution, the distributions of the sample mean and the sample standard deviation, and their independence.

3 - Improvements in the Ad-hoc Multiplicity Adjustment Methods for Correlated Response Variables

Mohammad Quasem, Associate Professor, Howard University, Washington D.C., D.C., 20059, United States, quasem2@HOTMAIL.COM, Mohammad Huque, Atiar Rahman

Often a treatment in an experiment is tested for multiple response variables that are usually correlated. This testing for multiple variables inflates the Type I error rate. A method for reducing this inflation is by adjusting the significance level of each test under the independence assumption. With correlation among test statistics this adjustment is conservative. Ad-hoc modifications have been suggested for correlated variables by Dubey (1985) and others. We review these methods and suggest alternatives that have better control of the Type I error rate and power performance.

4 - A Web-based Simulation Game for Gasoline Supply Chain

Samik Raychaudhuri, Sr. Operations Research Engr, Decisioneering, Inc., 1515 Arapahoe St, Suite 1311, Denver, CO, 80202, United States, samik@freeshell.org

Simulation games are increasingly becoming popular for their use as an interactive learning tool. In this presentation, I will demonstrate a web-based simulation game I have developed, which focuses on the gasoline supply chain. The game lets the teams make order and supply decisions in a multi-echelon gasoline supply-chain, and view the cost implications (inventory, backlog, total) and other effects (e.g., bullwhip).

5 - A Comparison of Two Data Mining Algorithms in the Presence of Missing Data

John Kros, Assistant Professor of Marketing and Supply Chain Management, East Carolina University, 3121 Bate, Greenville, NC, 27858, United States, krosj@ecu.edu, Marvin Brown

Data mining addresses prediction, estimation, and classification. Today data mining is employed analyzing large data sets. Data quality is important in training and testing. Imprecise and/or missing data must be addressed. Various algorithms may be employed when performing the data mining process. This research explores two of these algorithms, s-Sigmoid Neural Networks and Decision Trees, and addresses the associated effects of missing and/or imprecise data.

■ WD26

C-Room 211

Data Mining Techniques for Business Applications

Sponsor: Data Mining (Sponsored)
Sponsored Session

Chair: Nick Street, Associate Professor, University of Iowa, Dept.. of Management Sciences, S232 Pappajohn Business Building, Iowa City, IA, 52242, United States, nick-street@uiowa.edu

1 - Customer Data Reconstruction Methods for Response Modeling
Sungzoon Cho, Professor, Seoul National University, Seoul, Korea, Republic of, zoon@snu.ac.kr, Doug MacLachlan, PilSung Kang

Response modeling is concerned with identifying potential buyers based on customers' demographic and behavioral data. However, there are many more non-responders than responders in the data set, resulting in low accuracy. Here, we investigate various customer data reconstruction methods for handling class imbalance in response modeling. An empirical study using a real customer data set is conducted.

2 - Process Monitoring of Airplane Parametric Data
James Schimert, The Boeing Company, P.O. Box 3707 MC 7L-43, Seattle, WA, 98124, United States, James.Schimert@boeing.com

Airplanes collect volumes of data from sensors on systems including flight control, hydraulic and electrical power. When maintenance messages or flight deck effects occur, the airplane may be grounded. Therefore it is of interest to anticipate these faults before they occur. This talk discusses process monitoring techniques for this purpose, including a variety of practical issues involved in using independent components, setting limits using density estimation, and contribution plots.

3 - An Ensemble Approach to the Netflix Prize
Brian Almquist, Management Sciences Department, The University of Iowa, S204 Pappajohn Business Building, Iowa City, IA, 52241, United States, brian-almquist@uiowa.edu, Nick Street, Xin Ying Qiu

Netflix is offering cash prizes for improvements to their method for predicting customer movie ratings, based on a huge training corpus. We present a machine learning approach to the problem using only a customer's ratings of other movies. We generalize across movies with a knowledge-transfer method based on predictive ensembles.

4 - Choice Prediction with Consideration Set Clustering
Nick Street, Associate Professor, University of Iowa, Dep. of Management Sciences, S232 Pappajohn Business Building, Iowa City, IA, 52242, United States, nick-street@uiowa.edu, Ding Yuan, Gary Russell

We previously developed a heuristic subset clustering method that was used to induce consideration sets, the set of products a customer considers before a purchase. In this work we use the resulting market segmentation as a preprocessing step for choice prediction. The resulting simplified choice models identify easy-to-predict segments.

■ WD27

C-Room 212

Spreadsheets in Education

Sponsor: Spreadsheet Productivity Research
Sponsored Session

Chair: Janet Wagner, Dean of Business, Richard Stockton College of NJ, J-203, P.O. Box 195, Pomona, NJ, 08240, United States, janet.wagner@stockton.edu

1 - The Art of Teaching Cases Using Spreadsheets
Srini Krishnamoorthy, Assistant Professor, Ivey School of Business, skrishnamoorthy@ivey.ca

This talk will focus on methods of integrating spreadsheets for teaching cases. These include techniques for involving students in the process of building and using models for resolving real life business problems. In addition, specific tips will be offered on managing classroom dynamics.

2 - Multimedia and Spreadsheets: Improving Statistics Instruction
Janet Wagner, Dean of Business, Richard Stockton College of NJ, J-203, P.O. Box 195, Pomona, NJ, 08240, United States, janet.wagner@stockton.edu

Originally targeted to an on-line introductory statistics course, a set of home-movies for numerous spreadsheet based examples of statistical analysis were developed. These videos were then used to great acclaim in an on-ground version of the course as well. A few examples and a discussion of multi-media technologies for use in spreadsheet based courses will be discussed.

3 - Teaching the Simplex Algorithm in Matrix Form Using Spreadsheets
Steven Harrod, Assistant Professor, University of Dayton, School of Business Administration, 300 College Park, Dayton, OH, 45469, United States, a2soft@aol.com

Recent spreadsheet products offer matrix functions that allow the formulation of complex matrix equations in an appealing visual manner within spreadsheets. A spreadsheet can be written to demonstrate the matrix equations of the Simplex algorithm, and offer a more technical manual alternative to the traditional handwritten tableau. A spreadsheet demonstration of the matrix equations of the Simplex algorithm is given, as well as tips for student exercises on concepts such as corner points.

■ WD28

C-Room 213

Joint Session Comp. Methods/DM/ICS: Data Mining Applications in Logistics and Scheduling

Sponsor: Joint Cluster DM and ICS: Computational Methods for Data Mining, INFORMS Computing Society
Sponsored Session

Chair: Sigurdur Olafsson, Iowa State University, 2019 Black Engineering, Ames, IA, 50010, United States, olafsson@iastate.edu

1 - Data Mining-based Decision System Framework for Local Pickup and Delivery Problem
Weiwei Chen, Graduate Student, University of Wisconsin-Madison, 3107 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53705, United States, wchen26@wisc.edu, Liang Pi, Leyuan Shi, Erick Wikum, Bex Thomas, Ted Gifford, Greg Jarosinski, Peter Sun

The Local Pickup and Delivery Problem (LPDP) has drawn much attention recently. This paper presents a general Data Mining-Based Decision System (DMBDS) framework to mimic current dispatch processes and generate solutions for LPDPs by learning from historical data. An application in the intermodal freight industry is tested, where the DMBDS provides good solutions which are comparable to the real solutions provided by expert dispatchers, with respect to a set of key performance indicators.

2 - Optimal Instance Selection for Improved Decision Trees
Shuning Wu, Iowa State University, Black Engineering, Ames, IA, 50010, United States, wushuning@gmail.com

In this paper we present a new optimization-based approach for instance selection that uses a genetic algorithm (GA) to select a subset of instances that result in a simple but yet accurate decision trees. The research shows that GA-based instance selection works best for low entropy datasets and it is able to increase the average instances associated with the leaves of the decision trees, thus instance selection can be used as an effective alternative to prune decision trees.

■ WD29

C-Room 214

Modeling Systems & Languages

Contributed Session

Chair: Gertjan de Lange, VP Sales & Marketing, Paragon Decision Technology Inc, 5400 Carillon Point, Kirkland, WA, United States, g.de.lange@aimms.com

1 - Discrete Event System Modeling of Dynamic Demand Responsive Transportation Systems
Daniel Yankov, Doctoral Student, USF, 4202 E Fowler Ave, ENB 118, Tampa, FL, 33620, United States, danyankov@gmail.com, Ali Yalcin

Recent methods for DRT planning are based on closed information loop and aim a higher level of service automation, flexibility and efficiency. Advance in ITC sector, such as Internet, GIS, GPS lead to a highly dynamical and complex operation environment. We model DRT systems as Discrete Event Systems and apply Supervisory Control based on Finite Automata in real time operation planning. A case study is presented where centralized, modular and decentralized control architectures are computed.

2 - Energy-efficient Coverage Using Sensors with Continuously Adjustable Sensing Ranges
Di Wang, Rensselaer Polytechnic Institute, 110, 8th St., CII, Suite 5015, Troy, NY, United States, wangd2@rpi.edu, Zhi Zhou

This paper defines the maximal lifetime with constrained energy problem in sensor networks with continuously adjustable sensing range which has objective of finding maximal total lifetime. We present a suboptimal MIP formulation. Our theoretical results show that the closeness between the suboptimal MIP

formulation and the LP formulation is upper bounded by NT, where T is unit working time. Two greedy heuristics is designed. Lagrangian relaxation method is used to derive theoretical upper bound.

3 - AIMMS, How to Enhance and Improve OR Usability?
Gertjan de Lange, VP Sales & Marketing, Paragon Decision Technology Inc, 5400 Carillon Point, Kirkland, WA, United States, g.de.lange@aimms.com

The AIMMS modeling system allows you to take advantage of using and deploying OR techniques to your needs. The available sophisticated features such as Generated Mathematical Programs, Time Modeling, Web Services and Stochastic Programming complement powerful basic development features in a point & click IDE. The intent in AIMMS is to continuously enhance and improve the user experience, productivity and understanding of optimization modeling in AIMMS. See also: www.aimms.com.

■ WD30

C-Room 2A

Discussion Session: Challenges and Opportunities for QSR Community (II)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

1 - Challenges and Opportunities to QSR Community (II)
Yu Ding, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, 77843, United States, yuding@iemail.tamu.edu

INFORMS Section on Quality, Statistics, and Reliability was founded ten years ago and has grown into one of the most active sections within INFORMS. A panel of discussants will present their views and perspectives on the challenges the QSR community currently faces and the opportunities that QSR may be able to grasp for the next phase of growth. Audiences will be actively involved in the discussion in this session.

■ WD31

C-Room 2B

Discussion Session: QSR-related Curriculum Development (II)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53711, United States, szhou@engr.wisc.edu

1 - QSR-related Curriculum Development (II)
Shiyu Zhou, Assistant Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53711, United States, szhou@engr.wisc.edu

Recent technological innovation and methodological development raise new challenges to the QSR-related curriculum. A panel of discussants will share their experiences and perspectives in teaching the QSR-related courses at both the undergraduate and graduate levels, and exchange with the audience the ideas and information that might be helpful to reshape the QSR curriculum.

■ WD32

C-Room 302

Applied Probability II

Contributed Session

Chair: Hiroshi Toyoizumi, Associate Professor, Waseda University, Nishi-waseda 1-6-1, Shinjuku, Tokyo, 169-8050, Japan, toyoizumi@waseda.jp

1 - Unknown Distribution Characterization
Salvador Romo-Fragoso, Hewlett-Packard Company, 5200 Blue Lagoon Drive, Suite 950, Miami, FL, 33126, United States, salvador.romo@hp.com, Murat Erkoc

When confronted with uncertainty models, decision makers use a series of parametrical well known distributions to characterize lumpy occurrences. However, in large scale operations such approximations may result in significant gaps between what is projected and what is real. We propose a responsive algorithm to reduce these gaps by efficiently updating the shape and the scale of probability distributions representing dynamic phenomena.

2 - Circadian Patterns in Inter-event Statistics: A Simple Model of Human Activity
Dean Malmgren, PhD Candidate, Northwestern University, 2145 Sheridan Rd., Tech. Inst. Room E136, Evanston, IL, 60208, United States, r-malmgren@northwestern.edu

Elucidating the processes underlying human dynamics is of utmost importance in areas ranging from disease spread to employee productivity evaluation. Here, we study the distribution of the time between consecutively sent e-mails—-the interevent time—-as a proxy for human dynamics. We demonstrate that the inter-event time distribution has circadian patterns, and we propose a cascading Poisson model which predicts these observations more accurately than the recently proposed power-law model.

3 - Truels: An Experimental Study
Rashid Aljalahema, University of Arizona, 1127 E. James E. Rogers Way, P.O. Box 210020, Tucson, AZ, 85721, United States, rashid@email.arizona.edu, Ryan Murphy, Neil Bearden

Truels, or three person gunfights, have been studied extensively in game theory. We discuss the general truel problem and some extensions. More importantly, we demonstrate an experimental study where subjects participate in a game simulating several truel scenarios and attempt to determine their strategies and compare those with the optimal strategy.

4 - Evaluation of Social Queue of Wasps Based on Little's Formula
Hiroshi Toyoizumi, Associate Professor, Waseda University, Nishi-waseda 1-6-1, Shinjuku, Tokyo, 169-8050, Japan, toyoizumi@waseda.jp

There is a kind of Wasps that form social queues for nesting. The social queue is based on first-come-first-serve basis, and only the top can be the dominant of the nest who has the breeding opportuinity. Wasps are taking the risk by joining the social queue to obtain the better breeding opportuinity while working for the current dominant. Using Little's formula, we will evalute the expected benefit for those wasps who joins the social queue.

■ WD33

C-Room 303

Transportation VII

Contributed Session

Chair: Alixandra Demers, Doctoral Candidate, North Carolina State University, Dept.. of Civil, Constr Mgmt, & Env Eng, 208 Mann Hall/ 2501 Stinson Road, Raleigh, NC, 27695, United States, ademers@unity.ncsu.edu

1 - A Heuristic Approach for a Deterministic Vendor Managed Inventory Problem
Soumia Ichoua, Assistant Professor, Johnson C. Smith University, Dept. of Computer Science & Engineering, 100, Beatties Ford Road, Charlotte, NC, 228216, United States, soumia.ichoua@fsa.ulaval.ca, Laoucine Kerbache

We consider a deterministic version of the Vendor Managed Inventory Problem. We propose a rolling horizon approach where a schedule is repeatedly constructed over a fixed number of time periods using a tabu search heuristic. The effectiveness of the proposed approach is assessed under different scenarios that are inspired from real-world applications.

2 - An Integer Programming Methodology for Railway Capacity Planning and Scheduling
Pavankumar Murali, Doctoral Student, USC, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089-0193, United States, pmurali@usc.edu, Maged Dessouky, Fernando Ordonez

We propose an IP model that suitably routes trains through a railway network based on the statistical expectation of running times in order to balance the railroad traffic and avoid deadlocks. The primary objectives are to minimize the delay in transporting shipments through a railway network, and to reject a shipment that could potentially overload a network.

3 - Clustering Time Series with Holt-winters Method for Traffic Fatality Data
Haiyuan Wang, Department of Decision Sciences and Engineering Systems, Rensselaer Polytechnic Institute, CII 5015, 110 8th Street, Troy, NY, 12180, United States, wangh4@rpi.edu, Yingjie Zhou, Wai Kin Victor Chan, Zhi Zhou, Ting Xie

A new clustering method for time series data is developed based on optimized seasonal Holt-Winters parameters. It is used to characterize highway fatality data from 1975 to 2005 of the 51 states in the U.S. Clusters are identified based on the parameters for level, trend, and seasonality. The research paper helps to understand the fatality occurrence characteristics in the nation. States in the same cluster can be used as control groups for evaluation of the effectiveness of policy change.

4 - Determining Path Flows in Networks
Alixandra Demers, Doctoral Candidate, North Carolina State University, Dept.. of Civil, Constr Mgmt, & Env Eng, 208 Mann Hall/ 2501 Stinson Road, Raleigh, NC, 27695, United States, ademers@unity.ncsu.edu

Modeling traffic patterns requires path knowledge. Given a system of sensors, one goal is to optimize the information obtained to determine path flows. To explore the impact of data quantity and quality, random networks were generated for testing the proposed math program and two parameters were set for each traffic input variable (link volumes, and link and path utilization coefficients) – percent network coverage and level of noise. Methodology, experiment design, and results are discussed.

■ WD34

C-Room 304

Transportation VIII

Contributed Session

Chair: Yingyan Lou, Graduate Research Assistant, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States, yingyan@ufl.edu

1 - A Method of Estimating Travel Speeds on a Traffic Network Consisting of Different Road Types
Keisuke Inakawa, Assistant Professor, Nanzan University, 27 Seirei-cho, Seto, Ai, 489-0863, Japan, inakawa@nanzan-u.ac.jp, Toshio Nemoto

We consider the problem of estimating a travel speed for each road, based on the data of a road network with distances, a set of origins and destinations, and observed travel times between them. It makes the estimation difficult when the network consists of roads with different speeds, mainly because it is necessary to estimate the routes and speeds simultaneously. In this paper we propose a mathematical method for estimating travel speed, and present a sample application in an ambulance system.

2 - Controlling Freight Forwarder Networks with Multiple Transshipments in Real-time
Stefan Bock, Prof. Dr., University of Wuppertal, Gauflstrafle 20, Wuppertal, 42097, Germany, sbock@winfor.de

Freight forwarders are continuously forced to increase the efficiency of their transportation processes. Consequently, a new real-time approach is proposed. It integrates multimodal transportations and multiple transshipments. By continuously applying sophisticated improvement procedures, incoming requests as well as occurring traffic jams or vehicle breakdowns are efficiently handled. The practicability of the designed real-time approach has been validated by computational experiments.

3 - Saving Based Algorithms for Vehicle Routing Problem with Simultaneous Pickup and Delivery (VRPSPD)
Yuvraj Gajpal, PhD Candidate Management Science McMaster University Hamilton, Ontario, Canada, gajpaly@univmail.cis.mcmaster.ca, Prakash Abad

The saving heuristic of Clarke and Wright (1964) has been successfully used in the capacitated vehicle routing problem (CVRP). Furthermore, the parallel saving heuristic by Altinkemer and Gavish (1991) combines the saving approach with matching based procedure for CVRP. This paper presents the saving heuristic and parallel saving heuristic for VRPSPD. The numerical results show that the performance of proposed heuristics is qualitatively better than the existing insertions based heuristics for the problem.

4 - Optimal Deployment Strategies of Freeway Service Patrols for Incident Management
Yingyan Lou, Graduate Research Assistant, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States, yingyan@ufl.edu, Yafeng Yin, Siriphong Lawphongpanich

This research is to investigate how to deploy freeway service patrols for faster response and reduced clearance time for traffic incidents. A mixed-integer nonlinear programming model is formulated to provide a full spectrum of support for the deployment decision making, including beat design and fleet allocation. As the formulated model is a very large-scale, highly nonlinear and non-convex problem, a heuristic algorithm based on neighborhood searching is proposed to solve it effectively.

■ WD35

C-Room 305

Facility and Roadway Evacuation Modeling

Sponsor: Transportation Science & Logistics
Sponsored Session

Chair: Kevin Taaffe, Assistant Professor, Clemson University, 130 Freeman Hall, Clemson, SC, 29634, United States, taaffe@clemson.edu

1 - The Development of MALTA for Regional Mass Evacuation Simulation Modeling
Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. 2nd St., Tucson, AZ, United States, chiu@email.arizona.edu, Jorge Villalobos, Pitu Mirchandani

The requirement of the large-scale modeling calls for the development of the Multi-Resolution Assignment and Loading of Traffic Activities (MALTA). This talk presents the spatially scalable dynamic traffic assignment (SSDTA) based modeling approach in MALTA that is of particular advantage for large-scale traffic modeling. Modeling approaches and system framework are presented. We will also present one particular example of applying MALTA to a major U.S. metropolitan area.

2 - Comparison of Optimization and Simulation for Hospital Evacuation Planning
Esengul Tayfur, Clemson University, Department of Industrial Engineering, 110 Freeman Hall, Clemson, SC, 29634, United States, etayfur@clemson.edu, Kevin Taaffe

This research considers the allocation of resources for hospital evacuations that allow a pre-planned response, most notably hurricane evacuations. We propose two different approaches: deterministic optimization and simulation-optimization. We present resource requirements for an evacuation while addressing objectives including evacuation cost, evacuation time, or overall operational cost. We test several possible scenarios for both approaches and investigate the differences between them.

3 - A Stochastic Humanitarian Inventory Model of Fixed Lifetime Goods for Disaster Planning
Miguel Jaller, PhD Student, Rensselaer Polytechnic Institute, jallem@rpi.edu, Jose Holgiun-Veras, Satish Ukkusuri

Disasters, whether natural or manmade, impact different regions of the world on a fairly frequent basis, making global emergency relief operations an important subject to study. This paper introduces a cost minimization multi-commodity, multiple supplier, two echelon, multi-period stochastic inventory model for disaster planning of fixed lifetime commodities.

■ WD36

C-Room 306

Transportation IX

Contributed Session

Chair: Evangelos Mitsakis, Associate Researcher, Centre for Research and Technology Hellas - Hellenic Institute of Transport, 6th km Charilaou-Thermi Rd., PO Box 361, Thermi-Thessaloniki 57001, Greece, emit@certh.gr

1 - On the Warm Started Public Transit Route Network Planning Problem
Randy Machemehl, Professor and Director, Center for Trans Research, Dept. of Civil, Architectural, and Environmental Eng, 1 University Station, C1761, ECJ 6.908, The University of Texas at Austin, Austin, TX, 78712, United States, rbm@mail.utexas.edu, Wei Fan, Nicholas Lownes

Designing an operationally and economically efficient bus transit network is critical for the urban area's social, economic and physical infrastructure. In this presentation, some computational insights on the optimal bus transit route network design problem (BTRNDP) are discussed. Genetic algorithms (GA), simulated annealing (SA), and warm started GA and SA are implemented to solve the BTRNDP. Algorithm comparison and computational insights are presented.

2 - Methodological Approach to Optimize Transportation Infrastructure: Braess' Paradox Perspective
Sittipan Sittikariya, Transportation Engineer, DKS Associates, 719 Second Avenue, Suite 1250, Seattle, WA, 98104, United States, sxs@dksassociates.com, Xiaoping Zhang, Mark Yand

This research proposes an alternate methodological approach to address Braess' paradox in the transportation infrastructure planning context using micro-simulation tool VISSIM. Using HOV (High Occupancy Vehicle) Lane and GP

(General Purpose) Lanes on I-5 in the Seattle area as a test corridor, we present the variation in total system travel time of the users with the presence of HOV lane in the system. This approach provides suggestions when the HOV lanes need to be implemented.

3 - Floating Stocks in Intermodal Supply Chains
Eelco VanAsperen, Erasmus University Rotterdam, Burg. Oudlaan 50, Rotterdam, Netherlands, vanasperen@few.eur.nl, Rommert Dekker

Intermodal supply chain terminals can be used for advanced positioning of inventories. In this presentation we present a model to evaluate the cost-effectiveness of such advance positioning in terms of inventory costs, transportation costs and responsiveness. We find that a combination of direct and indirect transport yields the best results. We finally tackle the problem of timing the shipments. The model is applied to a real demonstration case in Western Europe.

4 - Dynamic Traffic Assignment in Network Control and Signalization
Evangelos Mitsakis, Associate Researcher, Centre for Research and Technology Hellas - Hellenic Institute of Transport, 6th km Charilaou-Thermi Rd., P.O. Box 361, Thermi-Thessaloniki, 57001, Greece, emit@certh.gr, Thanasis Ziliaskopoulos

The paper is concerned with a critical review of the current state-of-the-art in transportation network control based on Dynamic Traffic Assignment concepts. The Cell-Transmission-Model is used as the foundation for the definition of a bilevel-programming model, focusing on network control analysis, traffic management and traffic signal coordination with respect to the fundamentals of traffic flow theory.

■ WD37

C-Room 307

E-Business/Commerce

Contributed Session

Chair: Daniel Malter, PhD Student, Robert H. Smith School of Business, University of Maryland at College Park, Van Munching Hall, College Park, MD, 20742, United States, dmalter@rhsmith.umd.edu

1 - Electronic Grocery Shopping: Ten Years After
Virpi Kristiina Tuunainen, Professor, Helsinki School of Economics, POBOX 1210, Helsinki, FI-00101, Finland, virpi.tuunainen@hse.fi, Matti Rossi

In this research we look at the ways of doing Electronic Grocery Shopping (EGS) and analyze some recent successful business models. We seek to understand what has changed in more than ten years of trial and error, and if and how the obstacles of earlier EGS trials have been solved.

2 - Multi-dimensional Credentials Using Veiled Certificates
John H Gerdes, Jr, Associate Professor, University of South Carolina, 112A Carolina Coliseum, Columbia, SC, 29208, United States, jgerdes@sc.edu, Joakim Kalvenes

Traditional certificates provide one dimensional credentials, certifying a single aspect of the individual. Linkage is possible using a common identifier such as social security numbers, but this raises privacy issues. Veiled certificates are introduced to address situations requiring multi-dimensional credentials. We discuss veiled certificate's features compared to existing certificate schemes, how they relate to existing standards, address costs and other implementation issues.

3 - Netflix: Value Creation in an Industry in Flux
Marc Sachon, Associate Professor, IESE Business School, Univ. of Navarra, Av. Pearson 21, Barcelona, 08034, Spain, msachon@iese.edu

We analyze the Netflix business model of online DVD rental and identify its core elements of value creation in environments of atomized demand and product proliferation. We do this against the backdrop of current changes in the movie business and develop a hypothesis about the future structure in this industry and the Netflix model. The work is primarily conceptual.

4 - A Combinatorial Auction Problem for Bandwidth Packing
Ali Amiri, Professor, Oklahoma State University, 210 BUS, OSU, Stillwater, OK, 74078, United States, amiri@okstate.edu

We study a combinatorial auction problem for bandwidth packing in a telecommunications network. The problem involves deciding which bids to accept in order to maximize total revenue subject to bandwidth capacities. Each bid consists of a set of calls with varying bandwidth requirements to route between source-destination pairs. We present a mathematical programming formulation of the problem and discuss an algorithm to solve it.

5 - Experiential Learning in Online Auctions
Daniel Malter, PhD Student, Robert H. Smith School of Business, University of Maryland at College Park, Van Munching Hall, College Park, MD, 20742, United States, dmalter@rhsmith.umd.edu

Bidder experience in online auctions is usually measured by ratings from any won auctions. In this study, unique data allows tracking product-specific experience. The total number of bids that a winner placed across all auctions of that product before winning an auction is used as the measure of experience. Results indicate that total per-item costs to the buyer are significantly lower with greater experience, suggesting that bidders benefit from product-specific experiential learning.

■ WD38

C-Room 308

Constraint Programming

Contributed Session

Chair: Hugo Yoshizaki, Associate Professor, University of Sao Paulo, Dept.. Production Engineering - POLI, Av.Prof. Almeida Prado, Trav. 2, 128, Sao Paulo, SP, 05508-900, Brazil, hugo@usp.br

1 - CP Optimizers: The Next Generation of Constraint Programming Solvers
Laurent Perron, Dr, ILOG SA, 9 rue de Verdun, Gentilly, France, lperron@ilog.fr

Recent achievements in the implementation of automatic search and an improved engine enable a radically different type of constraint programming solvers. Users can now experience a simple model and run paradigm. Model reformulation, improved performance, parallelism, java and .NET interfaces lower the barrier to entry to this optimization technology. All these aspects will be demonstrated in example applications and problems.

2 - Event-time Models in Inventory Systems
Omer Benli, Dr., California State University, Long Beach, Department of Information Systems, 1250 Bellflower Boulevard, Long Beach, CA, 90840-8506, United States, obenli@csulb.edu

Inventory problems have been traditionally modeled either as a periodic review or a continuous review processes. In this paper an alternative approach for deterministic inventory problems, event-time modeling, is proposed. The essence of this approach is how the exogenous events whose times are ﬁxed and the endogenous events whose times of occurrence are decision variables are handled in the same model. Formulation and computational examples using constraint programming are presented.

3 - A Geometric Approach for Quadratic 0-1 Programming
Liu Chunli, Dr, Chinese University of Hong Kong, William M. W. Mong Engineering Building, Room 609, Shatin, Hong Kong - ROC, clliu@se.cuhk.edu.hk, Duan Li, Sun Xiaolin

We derive new lower bounding methods and variable fixation techniques for quadratic 0-1 optimization problems by investigating geometric features of the ellipse contour of a (perturbed) convex quadratic function. These findings further lead to some new optimality conditions for quadratic 0-1 programming. Integrating these novel solution schemes into a proposed solution algorithm of a branch-and-bound type, we obtain promising preliminary computational results.

4 - A New GA for Resource Constraint Project Scheduling Problem
Sepehr Nemati Proon, PhD Student, Mississippi State University, sn157@msstate.edu, Mingzhou Jin

Resource constraint project scheduling problem (RCPSP) has been studied by many researchers in recent years. The problem is classified as an NP-Hard problem. Yet, there is a need for more efficient algorithm, especially in large scale problems, in industry and real world applications. In this paper, we have developed a new Genetic Algorithm which has the focus for solving large scale problems with the objective of minimization of the makespan of the problem. The algorithm tries to solve the problem by rescheduling the activities in that form a sub problem of the main problem. The computational results of the algorithm was quite stasfactory.

5 - Integration of International and Coasting Container Service Using Mathematical Programming
Hugo Yoshizaki, Associate Professor, University of Sao Paulo, Dept.. Production Engineering - POLI, Av.Prof. Almeida Prado, Trav. 2, 128, Sao Paulo, SP, 05508-900, Brazil, hugo@usp.br, Gustavo Costa, Daniel Chebat, Celso Hino

Europe-Brazil container shipping carriers operate international and cabotage services apart. We developed a linear programming model to evaluate the integration of national and international loads, considering competition with land transportation and unbalance aspects. Results were very attractive and provided the company a solid framework to support strategic and operational decisions.

■ WD39

C-Room 309

Stochastic Optimization/Large Scale Optimization III

Contributed Session

Chair: Peter Nieuwesteeg, Senior AIMMS specialist, Paragon Decision Technology, 5400 Carillion Point, Kirkland, WA, 98033, United States, Peter.Nieuwesteeg@aimms.com

1 - A Pseudo-polynomial Heuristic for Discrete-time Moving-target Search and Its Extension

Myung-Ju Park, Department of Industrial Engineering, Seoul National University, San 56-1, Shillim-Dong, Gwanak- Gu, Seoul, 151-742, Korea, Republic of, pmj0684@snu.ac.kr, Sung-Jin Cho, Sung-Pil Hong

We propose a new heuristic for discrete-time moving-target search. The algorithm maximizes an approximate, instead of exact, detection probability computed from the conditional probability that reflects the partial search history. Having a pseudo-polynomial complexity, it can solve, in acceptable time, the instances an order of magnitude larger than those solved by the previous methods. With its extension, we apply this algorithm to the relocation model in practice.

2 - Hydroelectric Stochastic Risk Management Modelling Using CVaR: An SDDP Approach

Niko Iliadis, Systems Engineer, PSR, Plastira street 4, Nea Smyrni, Athens, 171 21, Greece, nikolaos.iliadis@a3.epfl.ch, Mario Pereira, Sergio Granville, Raphael CHABAR

This paper presents a tool for operating and contracting decisions of a hydroelectric system considering stochastic inflows, spot prices, and forward prices. The objective is to maximize expected revenues from spot and forward market trading, under risk aversion indicators such as required Minimum Revenues, Value at Risk and Conditional VaR. A hybrid Stochastic Dynamic Programming / Stochastic Dual Dynamic Programming formulation is adopted to solve this large-scale optimisation problem.

3 - Solving Stochastic Multi-plant Location Problems with Dynamic Dual Decomposition and Benders' Method

Cheng(Marshal) Wang, University of Toronto, 1711-52 Bayswater Avenue, Ottawa, ON, K1Y4K3, Canada, cwang@mie.utoronto.ca, Roy Kwon

We propose a novel method combining Dynamic Dual Decomposition(D3) method and Benders' Decomposition(BD) method to solve the stochastic multi-plant Facility Location Problems(FLP). The integer variables in both stage cause the SIP intractable. Some strategies for accelerating BD in FLP can be implemented in the scenario subproblems which are decomposed by D3 method. Other new developed methods solving Stochastic Uncapacitated FLP and Stochastic Set Packing Problems are reviewed.

4 - A Multi-stage Risk-averse Newsvendor Model with Law-invariant Coherent Measures of Risk

Sungyong Choi, PhD Candidate, Rutgers University, 515 Mt. Prospect Avenue, Apt. 2E, Newark, NJ, 07104, United States, sungyongchoi@gmail.com, Andrzej Ruszczynski

We construct a risk-averse newsvendor model under multi-stage situation. We apply the theory of dynamic multi-stage optimization to our multi-stage model. We prove that a stationary policy is optimal in the model and analyze the effect of risk aversion to the optimal policy with general law-invariant coherent measures of risk. Our theoretical results are confirmed by sample-based optimization.

5 - An Open Approach to Benders Decomposition for Stochastic Models in AIMMS

Peter Nieuwesteeg, Senior AIMMS Specialist, Paragon Decision Technology, 5400 Carillion Point, Kirkland, WA, 98033, United States, Peter.Nieuwesteeg@aimms.com

The stochastic modeling functionality in AIMMS has been extended with the ability to use a nested Benders decomposition algorithm to solve multistage stochastic recourse models. This decomposition method is offered as a user-customizable procedure inside the library for operations on Generated Mathematical Programs (GMP library). The open implementation of the algorithm allows modelers to fine-tune to their specific stochastic model and to use advanced features of the GMP.

■ WD40

C-Room 310

Model Based Strategies for Mitigation of Large Scale Pandemic Outbreaks

Sponsor: Health Applications Section

Sponsored Session

Chair: Tapas K. Das, Professor, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, das@eng.usf.edu

1 - Strategies for Controlling Antiviral Resistance During the Next Influenza Pandemic

Joesph Wu, The University of Hong Kong, 21 Sassoon Road, Pokfulam, Hong Kong, - ROC, joewu@hku.hk

Many countries are stockpiling antivirals (primarily oseltamivir) to mitigate the impact of the next influenza pandemic. Such an unprecedented massive use of antiviral may cause rapid emergence of antiviral resistance, in which case the effectiveness of antiviral stockpiles will be substantially attenuated and billions of dollars invested in antivirals will be virtually wasted. We present strategies that may reduce this threat of antiviral resistance.

2 - A Simulation-based Optimization Framework for Pandemic Impact Mitigation

Tapas K. Das, Professor, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States, das@eng.usf.edu, Alex Savachkin, Diana Prieto, Andres Uribe

At present, scalable mitigation strategies do not exist for pandemic outbreaks that could affect tens of millions of people in many geographically dispersed cities. We present a real-time simulation tool mimicking movements of each individual in large cities during many weeks of pandemic progress and discuss how to generate mitigation strategies at both national and local levels using a simulation based hierarchical stochastic optimization framework.

■ WD41

C-Room 3A

Biotechnology

Contributed Session

Chair: Argon Chen, Professor, National Taiwan University, 1 Roosevelt Rd. Sec. 4, Taipei, 106, Taiwan - ROC, achen@ntu.edu.tw

1 - Non-stationary and Non-homogeneous Pattern Discovery in Multi-channel fMEG Data

Yupo Chan, Professor & Founding Chair, Department of Systems Engineering, University of Arkansas at Little Rock, 2801 South University, Little Rock, AR, 72204-1099, United States, yxchan@ualr.edu, J. Doug Wilson, Curtis Lowery, Xiaowei Wu, Hari Eswaran, Pamela Murphy, TJ Colvin

Much better medical information can be obtained by using multiple streams of data. Recently, we witness the increased use of multiple-channel Electrocardiogram, Electroencephalogram, and Magnetoencephalography (MEG). Here, we analyze the non-stationarity and non-homogeneity in multiple channels of fetal-MEG data, by a model that best describes the interventions. It was concluded that Spatial-temporal analysis is complementary to classic signal-processing techniques in analyzing such data.

2 - Optimal Testing of Digital Microfluidic Biochips: A Multiple Traveling Salesman Problem

Bogdan Pasaniuc, Docotral Student, University of Connecticut, Computer Science Department, Storrs, CT, 06029, United States, bogdan@engr.uconn.edu, Alex Zelikovsky, Robert Garfinkel, Ion Mandoiu

Digital microfluidic biochips are used for performing biochemical analyses by manipulating droplets on a rectangular array of electrodes. Detection of defective electrodes is done by routing droplets along paths covering all electrodes on the chip and checking their arrival at a sink. Using multiple test droplets can reduce test time, but requires coordination to avoid droplet interference. Formulations, exact and heuristic algorithms, theoretical bounds, and computational results are given.

3 - Algorithms for DNA Microarray Optimization

George Popescu, PhD, ACM, 5 Wild Rose Rd, Westport, CT, 06880, United States, george.popescu@acm.org

DNA microarray hybridization is a high-throughput genomic analysis technology. Recent advances in microarray technology – synthesis of variable length oligonucleotide, parallel mask-less synthesis - allow efficient probing of large eukaryote genomes. We propose efficient algorithms for optimal oligonucleotide sequences selection with sequence synthesis and similarity constraints. We discuss algorithms performance and present applications to methylation and splicing microarray analysis.

4 - Clustering Genes According to Predefined Patterns by Controlling False Discovery Rate

Hae-Sang Park, POSTECH, San 31 Hyoja-dong, Pohang, 790-784, Korea, Republic of, shoo359@postech.ac.kr, Jeong-Wha Lee, Chi-Hyuck Jun, Si-Won Yoo

Classifying genes with time-course expression data into one of the predefined patterns is viewed as a multiple hypothesis testing problem. The proposed approach calculates the p-value of test statistic using Monte Carlo method and estimates prior probability and positive false discovery rate of each pattern. Numerical experiments using synthetic data are performed.

5 - A Systematic Approach to Preprocessing One-color Microarray Intensity Readings

Argon Chen, Professor, National Taiwan University, 1 Roosevelt Rd. Sec. 4, Taipei, 106, Taiwan - ROC, achen@ntu.edu.tw

Though many methods have been proposed to extract information from microarray data, data preprocessing determines the quality of the extracted information. This research is to propose a procedure to preprocess the raw intensity readings. The proposed procedure has 3 steps: rectification, normalization and screening. A real case of 24 human blood samples is used to test the proposed approach.

■ WD43

S-Grand Ball. A (Lev. 2)

Aviation Applications III

Contributed Session

Chair: Hung-Pi Cheng, Chang Gung University, No. 3 Lane 47 Dalian 2nd St., Taoyuan, 33043, Taiwan - ROC, hungpi.cheng@msa.hinet.net

1 - Design and Allocation of a New Aircraft Fleet Under Uncertainty

Mark McDonald, Vanderbilt University, VU Station B 351831, Nashville, TN, United States, mark.p.mcdonald@vanderbilt.edu, Sankaran Mahadevan

Airlines must commit large amounts of money to acquire new aircraft, but the network demands are uncertain. Further, knowledge of how the new fleet will be used in the airline network is needed to optimize the design, yet the performance characteristics of the new aircraft are inputs to network optimization problems. We solve problems of simultaneous aircraft conceptual sizing and fleet management under uncertain demands using reliability-based design optimization techniques.

2 - Operational Performance - Delay and Metrics

Marc Rose, Sr OR Analyst, MCR, LLC, 600 Maryland Ave, #700, Washington, DC, 20024, United States, mrose@mcri.com, Gabriela Rohlck, Dave Knorr

An overview of current NAS Delay and some of the metrics the FAA uses to examine system performance. This includes the need to normalize data for proper period-to-period comparisons. This talk will also provide an overview of some diagnostic metrics used to drill into the data to help determine causes. A primary metric presented here is the Delta Performance Metric. This metric provides strong normalization capabilities. Other metrics/causes will be discussed (e.g., weather).

3 - Flight-hour Based Optimization for Aircraft Maintenance Routing

Ilkay Orhan, Research Assistant, Anadolu University, 2 Eylul Campus, School of Civil Aviation, Eskisehir, 26470, Turkey, iorhan@anadolu.edu.tr, Muzaffer Kapanoglu, T.Hikmet Karakoc

In this study, we propose a flight-hour tracking approach for minimizing the cushion time of aircrafts in airlines management. An integer linear model is proposed for short-term maintenance routings of aircrafts. The savings we obtained by using the proposed approach is also reported for a domestic Turkish airline company.

4 - Aviation Power Systems Infrstructure - Prioritization of Facilities

Gabriela Rohlck, OR Analyst, MCR, LLC, 600 Maryland Ave, #700, Washington, DC, 20024, United States, grohlck@mcri.com, Marc Rose

The FAA is composed of numerous facilities, towers, center, TRACONS, etc. They all require electrical power. Some are small others are very large and busy (e.g. Atlanta Airport). When investments are made, there was no simple methodology to assure the capital went first to those who needed it and would have the largest impact. We developed a methodology for assisting power systems prioritize among the facilities that takes into account traffic levels and impact of an outage.

5 - Strike: Its Implications for the Cause of Lost Luggage

Hung-Pi Cheng, Chang Gung University, No. 3 Lane 47 Dalian 2nd St., Taoyuan, 33043, Taiwan - ROC, hungpi.cheng@msa.hinet.net

I investigate the causes of lost luggage, a problem that costs billions of dollars and damages airline service quality. Since the event of a strike of air traffic control personnel of Aeroporti di Roma, I collected in-depth interview data from multiple informants to piece together the causes of a lost bag. I conjecture that lost luggage may result from overload of personnel, and existing institutional practice that affects the risk sensitivity between airlines and handling agents.

■ WD44

S-Grand Ball. B (Lev. 2)

Enhancing Industrial Engineering and Business Undergraduates' Presentation Skills

Sponsor: INFORM-ED

Sponsored Session

Chair: Judith Shaul Norback, Director of Workforce and Academic Communication, GA Tech Stewart School of Industrial & Systems Engineering, 765 Ferst Drive, Atlanta, GA, 30332, United States, judith.norback@isye.gatech.edu

1 - Teaching and Assessing Workforce Presentation Skills in Capstone Design and Intro to Statistics

Judith Shaul Norback, Director of Workforce and Academic Communication, GA Tech Stewart School of Industrial & Systems Engineering, 765 Ferst Drive, Atlanta, GA, 30332, United States, judith.norback@isye.gatech.edu, Paul Griffin, Nicoleta Serban

The following information will be described about Georgia Tech's Stewart School of ISyE's workforce presentation instruction used in Capstone Design and introduction to Statistics: the development of the instruction from interviews of CEOs, managers, and IEs; its integration into the courses; and assessment results. Instructional materials will be shared.

2 - Teaching Business Students to Give Managerial Talks of Analytical Work

Thomas Grossman, University of San Francisco, tagrossman@usfca.edu, Judith Shaul Norback, Jill Hardin, Garlie Forehand

Two models and 11 skills useful for teaching students how to present analytical work to managers will be described. The relevant workforce presentation skills are based on the Workforce Communication Program at Georgia Tech's Stewart School of ISyE. The skills will be described along with preliminary assessment results. Instructional materials will be shared.

3 - Digital Video Technology to Reduce Communication Apprehension in Undergraduate Business Students

Elke Leeds, Asst Professor of MIS, Coles College of Business, Kennesaw State University, 1000 Chastain Rd, Bulding #4 - Rm 234, Kennesaw, GA, 30144, United States, eleeds@kennesaw.edu, Maurer Ruth

Communication apprehension (CA) is a negative factor in oral presentation. We introduce DV to substitute for in-class oral presentation in an undergraduate information systems course as a way of reducing the negative effects of CA. Faculty and student perceptions of the DV treatment suggest use in high enrollment classes.

■ WD45

S-Capitol Hill (Lev. 3)

Financial Engineering

Contributed Session

Chair: Wei Wang, Doctoral Student, University of Washington, Industrial Engineering, BOX 352650, Seattle, WA, 98195, United States, wangwei@u.washington.edu

1 - Minimum Entropy Calibration of a Point Process Model for CDO Pricing

Nitin Saksena, Graduate Student, ORFE Department, Princeton University, Engineering Quadrangle, Princeton, NJ, 08544, United States, nsaksena@princeton.edu, Rene Carmona

We develop a framework to calibrate a point process model to a set of CDO prices. Our approach yields an arbitrage-free point process that minimizes the relative entropy to a prior. We formulate the calibration problem as an infinite-dimensional optimization problem but prove that, in general, it reduces to a more tractable finite-dimensional problem. Our algorithm provides an alternative to base correlation and can be used to price exotic contracts. Numerical work is carried out with CDX data.

2 - American Option Pricing Under Stochastic Volatility: An Efficient Simulation Approach
Suchandan Guha, University of Florida, 1001 SW 16th Ave #111, Gainesville, FL, 32601, United States, sguha@ufl.edu

We present an efficient procedure to evaluate American options with stochastic volatility. American options face the problem of dimensionality in estimating the continuation payoff common in stochastic dynamic programming. A recent approximation method to estimate such payoff is the Least-Squares Simulation, which generates sample paths to perform least squares minimization. Our work presents a novel extension of the LSM algorithm to stochastic volatility.

3 - Asset Allocation for Life Cycle Retirement Portfolios
Harold Schleef, Associate Professor, Lewis & Clark College, 0615 SW Palatine Hill Road, MSC 40, Portland, OR, 97219, United States, schleef@lclark.edu

Life-cycle portfolios, which attempt to reach a portfolio goal by a target year, have become popular in recent years. The problem of spending down the portfolio during the retirement years is usually addressed separately. This study uses Monte Carlo methods to simulate various asset allocation schemes over the entire life cycle, combining both the portfolio building phase and the retirement spending phase.

4 - Test of Information Flow Hypothesis: Evidence from the ICBC IPO
Antonio Wong, Lecturer of Finance, School of Accounting and Finance, Hong Kong Polytechnic University, Hunghom, Kowloon, Hong Kong - ROC, afcpwong@inet.polyu.edu.hk

The Industrial and Commercial Bank of China (ICBC) concurrently issues its initial-public-offering (IPO) shares in Hong Kong and Shanghai. The offering raises 22 billion USD on 27 October 2006 and becomes the world's largest IPO ever. This study examines the post-IPO prices the dually-listed shares and tests the information flow hypothesis.

5 - Capital Growth and the St. Petersburg Game
Christopher Rump, Assistant Professor, Applied Statistics & Operations Research, Bowling Green State University, Bowling Green, OH, 43403, United States, cmrump@bgsu.edu

Daniel Bernoulli developed the notion of logarithmic utility to seek a fair value to resolve the now-famous St. Petersburg Paradox. A fair value yields no capital growth for the gambler and hence no financial incentive to play. We instead examine the game with the objective of maximizing capital growth, utilizing the Kelly-Breiman criterion for portfolio selection in this context.

■ WD46

S-Ballard (Lev. 3)

Energy Trading and Risk Management

Sponsor: Energy, Natural Res & the Environment/ Energy
Sponsored Session

Chair: Georgio Dalakouras, DalakouG@fhlbsf.com

1 - No Arbitrage Approaches for Power Contract Valuation Using Stochastic Programming
Roy Kwon, University of Toronto, Canada, rkwon@mie.utoronto.ca, Gillian M. Chin

We consider a two-phase approach for evaluating custom power contracts using stochastic programming. The first phase determines the portfolio of generating capacity and amount of a risk free asset that would replicate the claims of the contract under self-financing and no arbitrage conditions. A second phase then maximizes expected utility using bounds on capacity generated in the first phase. Numerical results are presented.

2 - Semidefinite Programming Approaches in Valuing Energy Derivatives
Georgios Dalakouras, Visiting Scholar, University of Florida, 303 Weil Hall, Gainesville, FL, United States, gbdalako@ufl.edu, Roy Kwon, Richard Ghazarian

We consider SDP approachces for valuing path dependent energy derivatives. Several SDP formulations will be presented based on a technique for generating the moments of the risk-neutral distributions of energy (e.g. gas) prices.

3 - Specification Testing for a Joint Power-gas Price Model
Ivo Steijn, Southern California Edison, ivo.steijn@sce.com, Richard Ghazarian

The question of whether a given model is suitable for a given data series is not investigated rigorously in many cases. We review a commonly-used model for forward prices - the Schwartz-Smith two-factor model – and develop formal specification tests to see if the model is an adequate representation of Californian power and gas prices. The answer is an unequivocal no. We conclude with recommendations and challenges for further research.

4 - Valuing Thermal Generation Units with Overfire Options and Maintenance Constraints
Wei Zhu, First Choice Power, Dallas, TX, Wei.Zhu@firstchoicepower.com, Chung-Li Tseng

This paper concerns overfire option of a gas turbine that allows the unit to burn more-than-usual amount of fuel to generate power exceeding its normal rated capacity. Exercising the overfire option may help to capitalize on more profits in the marketplaces than otherwise. This option, however, runs with a risk of potentially damaging or overstressing the turbine, which can be corrected by maintenances that are performed in longer times or higher frequency. The tradeoff of using this option is analyzed. The optimal strategy of exercising this option subject to price uncertainties is also studied.

■ WD47

S-Everett (Lev. 3)

Research & Development

Contributed Session

Chair: Kevin Gormley, Senior Simulation Engineer, The MITRE Corporation, 7515 Colshire Dr, McLean, VA, 22102, United States, kgormley@mitre.org

1 - Application of Lean Thinking to Upfront Research and Development Processes
Katrina Appell, University of Michigan, 316 W. Davis Ave, Ann Arbor, MI, 48103, United States, appell@umich.edu

Moving up the value stream from manufacturing to product development lean principles can next be applied to the fuzzy front-end of applied research. The adoption of lean to research allows for the process to be controlled for uncertainty and risk management, while allowing flexibility to create knowledge and develop technology.

2 - An Approximate Dynamic Programming Approach to the R&D Portfolio Problem
Lauren Hannah, Princeton University, 1 Lawrence Dr., Apt. 604, Princeton, NJ, 08540, United States, lhannah@princeton.edu, Warren Powell

Approximate dynamic programming is used in conjunction with knapsack programming to find locally optimal solutions to the research and development portfolio problem. Applications are taken from long-term energy research carried out by Lawrence Livermoore National Laboratory.

3 - Research and Development Planning: Selecting and Scheduling Projects with Approximate Solutions
Kevin Gormley, Senior Simulation Engineer, The MITRE Corporation, 7515 Colshire Dr, McLean, VA, 22102, United States, kgormley@mitre.org, William Scherer

This research investigated how approximate solution methods can solve the research and development (R&D) project selection and scheduling problem. A Markov Decision Process (MDP) model was formulated for the R&D planning tool of technology roadmaps. Approximate solution methods of state aggregation, problem decomposition and heuristics were explored for solving different types of project networks. The methods were demonstrated on a case study of Unmanned Aircraft Systems technologies.

■ WD48

S-Fremont (Lev. 3)

Simulation - Optimization

Contributed Session

Chair: Jamie R. Wieland, Graduate Student, Purdue University, School of Industrial Engineering, 215 N Grant Street, West Lafayette, IN, 47906, United States, jwieland@purdue.edu

1 - A Simulation Optimization Approach to Solve Stochastic Inventory Problems with Autocorrelated Demand
Rafael Diaz, PhD Candidate, Old Dominion University, ECSB - 4700 Elkhorn Avenue - Room 1100, Norfolk, VA, 23529, United States, rdiaz@odu.edu

Most techniques that describe and solve stochastic inventory problems rely upon the assumption of identically and independently distributed (IID) demands. Stochastic inventory models that fail to capture autocorrelated components in the demand lead to serious errors. A simulation optimization technique that considers serially-correlated components is used to generate near-optimal solutions. The effects of this demand pattern on total costs and service levels are examined.

2 - On-line Decision Support Simulation Model for Contingency Planning in Passenger Transportation
Guisselle Garcìa-Llinás, Industrial Engineering Program Coordinator, Universidad del Norte, Km 5 Via a Puerto Colombia, Barranquilla, Colombia, gagarcia@uninorte.edu.co, Carlos Paternina-Arboleda, Francesco Narducci-Marìn

This paper presents an on-line simulation model for passenger transportation planning that aids in decisions related to unscheduled maintenance events and

highway closures due to mud slides or security issues. The simulation model was developed in ARENAÆ with extensive use of VBA tools for optimization purposes. The simulation reactive scheduling model is able to rapidly re-deploy back-up resources (drivers, buses) or re-route buses when a highway closure event takes place.

3 - A Novel Throughput Optimization Framework Using SPSA and AAP

Hatice Ucar, PhD Student, Wayne State University, 4815 Fourth St., Industrial & Mfg. Eng. Bld, Detroit, MI, 48201, United States, hucar@wayne.edu, Ratna Babu Chinnam, Alper Murat

We propose a novel throughput optimization framework where we use the Average Active Period (AAP) method to detect production bottlenecks and the Simultaneous Perturbation Stochastic Approximation (SPSA) method to improve throughput performance subject to some realistic constraints. Our experimental results, using real data from one of Ford's plants, demonstrate that this framework is both effective and efficient in bottleneck detection and throughput maximization.

4 - Gradient Estimation with Optimal Control-variate Weights

Jamie R. Wieland, Graduate Student, Purdue University, School of Industrial Engineering, 215 N Grant Street, West Lafayette, IN, 47906, United States, jwieland@purdue.edu, Bruce W. Schmeiser

We investigate the common conception that the sample variance of the control variate (CV) should be used for estimating the optimal linear CV weight, even in cases where the variance is known. Assuming a bivariate normal model, we quantify the decision of whether to use the sample variance or the known variance. This work is presented in terms of CV, but its application is in the context of gradient estimation, when optimal CV weights are used to estimate gradients.

■ WD49

S-Greenwood (Lev. 3)

Dynamic Pricing and Revenue Management

Sponsor: Revenue Management & Pricing- Invited/Sponsored
Sponsored Session

Chair: Yun Fong Lim, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, SG, 178899, yflim@smu.edu.sg

1 - Revenue Management in Indian Railways

Goutam Dutta, Professor, IIM Ahmedabad, Wing - 3, IIM Campus, Vastrapur, Ahmedabad, Gu, 380015, India, goutam@iimahd.ernet.in

We attempt the revenue management on one of the trains of Indian Railways, by formulating it as a multi-period, network linear programming problem with the flow balance, capacity, demand and routing constraints. We also discuss the issues of generating booking profile and forecasting demand. The model is expected to be tested with the real data of South Eastern Railway, India.

2 - Revenue Management in Aircraft Leasing Business

Qing Ding, Assistant Professor, Singapore Management University, LKC School of Business, 50 Stamford Road #04-01, Singapore, 178899, dingqing@smu.edu.sg, Brian Rodrigues, Kwan Eng Wee

We consider an aircraft leasing business problem. A group of airline companies may either purchase their own aircrafts or rent aircrafts from a leasing company. We study the benefit of risk pooling effect, which may be affected by the number of seats in a single aircraft; On the other hand, may be recoverd by using dynamic pricing to adjust the demands of airline tickets. We also explore the benefit from interaction of decisions among the purchasing, leasing and dynamic pricing.

3 - Dynamic Pricing of Multiple Products in a Segmented Market

Chi-Guhn Lee, cglee@mie.utoronto.ca, Kevin Ferreira

This problem was motivated by a condominium builder who encounters a challenging problem of pricing multiple types of units in a completed building. Potential buyers are attracted to the sales office and the arrival rate is affected by the publically announced prices. The market is segmented and customers have segment-specific reservation price distributions for multiple products. The objective is to price multiple products so that the total revenue from the building should be maximized.

4 - Dynamic Pricing for Hotel Management with Multiple-day Stays

Yun Fong Lim, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, SG, 178899, yflim@smu.edu.sg, Qing Ding, Kum Khiong Yang

We consider a hotel with a single type of rooms. Customers check the rental rate of a room for a multiple-day period. Depending on the availability and rental rate of a room each customer may make a reservation or turn away. The rental rate is updated according to demand and the remaining capacity of the hotel. We propose a model to dynamically determine the rental rate so that the hotel's revenue is maximized.

■ WD51

S-Kirkland (Lev. 3)

Pricing and Revenue Management III

Contributed Session

Chair: Jing Chen, PhD Candidate, Richard Ivey School of Business, the University of Western Ontario, ON60, 1151 Richmond Street, North, London, ON, N6A 3K7, Canada, jchen@ivey.uwo.ca

1 - Capacity Investment and Pricing with Multiple Demand Classes and Production Priorities

Sandra Transchel, Mannheim Business School, Schloss, S 233, Mannheim, Germany, sandra.transchel@bwl.uni-mannheim.de, Stefan Minner, David Pyke

We consider a joint pricing and capacity investment problem. A firm produces a single product for two price-sensitive demand classes with uncertain market potential and different priorities. Our analysis provides structural properties of the optimal pricing and capacity investment decisions that maximize the expected profit. We compare the cases with a single price for both classes to a framework that allows for price-discrimination.

2 - Unique Bid Auctions: Equilibrium Solutions and Experimental Evidence

Hironori Otsubo, PhD Candidate, Department of Economics, University of Arizona, Tucson, AZ, United States, hironori@email.arizona.edu, William Stein, Bora Kim, Amnon Rapoport

In the unique lowest (highest) bid auction, the winner of the prize is the player who submits the lowest (highest) bid, provided that it is unique. We construct the symmetric mixed-strategy equilibrium solutions to the two auctions, and then test them in a sequence of experiments that vary the number of bidders and size of the strategy space. Our results show that the aggregate bids, but only a minority of the individual bidders, are accounted for quite accurately by the equilibrium solutions.

3 - Market Segmentation Using Customer Returns Policy to Enhance the Firm's Profit

Jing Chen, PhD Candidate, Richard Ivey School of Business, the University of Western Ontario, ON60, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, jchen@ivey.uwo.ca, Peter C. Bell

We study a common problem where a firm faces customer returns that are costly, and present a revenue management approach to segmenting the firm's market into two submarkets using customer returns as the market segmentation device. We illustrate how differential pricing in the two market segments can add to the firm's profit.

■ WD52

S-Leschi (Lev. 3)

Intelligent Agents

Contributed Session

Chair: Brent Zenobia, Doctoral Candidate, Portland State University, Engineering and Technology Managment, PO Box 751, Portland, OR, 97207, United States, bcapps@hevanet.com

1 - Design of a FE/HEV Driving Style Advisor

Dingzhou Cao, GRA, Wayne State University, 4815 Fourth Street, Room 1070, Industrial & Mfg. Engineering Dept., Detroit, MI, 48202, United States, dcao@wayne.edu, Ratna Babu Chinnam, Dimitar Filev

An effective way to reduce fuel consumption in vehicles is to induce a change in driver's behavior. If drivers are prepared to change their driving styles/habits, they can complete the same journeys within near similar times, using significantly less fuel. We present a FE/HEV driving style advisor that dynamically estimates the driving environment and driver's driving pattern to in turn help drivers make the necessary behavioral adjustments so that they can achieve improved fuel consumption.

2 - Autonomy and Cohesion in the Decision Process

Ricardo Bonilla, Doctoral Student, Universidad de los Andes, Cra 1Este # 18A-70, Bogotá, Colombia, rbonilla@uniandes.edu.co, Octavio Andres Torres, Roberto Zarama, Juan Fernando Vergez

In this article we approach the problem of modeling a social system using a mixed process. In our proposal agent's autonomy and cohesion play a role in the decision process of a problem. We use a Bayesian network coupled to a multi-

agent system: the first maps how each agent acts based on priors and evidence, the second capture the collective dynamic and interaction among agents. We observe that the evidence used to make decisions is a combination of individual and collective behavior.

3 - A Theory of Consumer Technology Adoption

Brent Zenobia, Doctoral Candidate, Portland State University, Engineering and Technology Managment, P.O. Box 751, Portland, OR, 97207, United States, bcapps@hevanet.com, Charles Weber

Although adoption is one of the oldest topics in the innovation diffusion literature, it remains a reified concept which has seldom been the subject of much theoretical development. This study applies inductive theory-building methods to an empirical case study of alternative transportation mode choice to develop a theoretical framework for consumer technology adoption. Unified Modeling Language diagrams are provided to help guide implementation of this framework in simulated consumer agents.

■ WD53

S-Medina (Lev. 3)

Technological Forecasting of S&E Personnel Requirements

Cluster: Technology Evaluation and Assessment
Invited Session

Chair: Marlin Thomas, Air Force Institute of Technology, AFIT/EN, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433-7765, United States, marlin.thomas@afit.edu

1 - Forecasting Military S&E Personnel Requirements

Marlin Thomas, Air Force Institute of Technology, AFIT/EN, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433-7765, United States, marlin.thomas@afit.edu

The decline in the number of domestic entries into the science and engineering fields continues to grow as a problem of national concern. The shortage of this S&E pool is already felt in government and defense industries where stringent security requirements are necessary for national security. This session will focus on the approaches for predicting and alternative means for dealing with the forthcoming shortfall in the S&E pool.

2 - Sustaining Technological Innovation Under Declining Domestic S&E Enrollment

Martin Wortman, Professor, Dept.. of Industrial & Systems Engineering, 237C Zachry Engineering Center, Texas A&M University, College Station, TX, 77843-3131, United States, wortman@tamu.edu

The United States is increasingly dependent on university research as a source of technological innovation. As the number of students entering domestic science and engineerings declines, university research programs are increasingly at risk. We will examine this risk to technology and innovation and consider approaches to sustaining unversity research productivity in the coming decade.

■ WD54

S-Queen Anne (Lev. 3)

Fork/Join and Assembly Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Ananth Krishnamurthy, Rensselaer Polytechnic Institute, CII 5015, 110 8th Street, Troy, NY, United States, krisha@rpi.edu

1 - Exact Analysis of a Synchronization Station with Three Finite Buffers

Julien Granger, Development associate, Praxair Inc., R&D, 175 E. Park Drive, P.O. Box 44, Tonawanda, NY, 14151-0044, United States, Julien_Granger@praxair.com

We characterize exactly a synchronization station fed by three independent Poisson processes with shut-down levels via a Markov renewal approach. We compare this system with an alternative system comprising two synchronization stations, each with two buffers, organized in a cascading fashion. We show that those two systems are not equivalent. We provide guidelines for arranging the three input processes so that the cascading system represents most accurately the original system.

2 - Analysis of a Generalized Fork/Join Station with Inputs from Multi-server Stations

Nico Vandaele, KU Leuven Campus Kortrijk, Etienne Sabbelaan 53, Kortrijk, WV, 8500, Belgium, nico.vandaele@kuleuven-kortrijk.be, Nico Goossens, Ananth Krishnamurthy

This paper presents an exact analysis of a fork/join station with inputs from stations composed of multiple exponential servers. The queue length process at the input buffers is analyzed in terms of the underlying Markov process. Expressions for the marginal and joint distributions of inter-departure times from the fork/join station are derived from the analysis of the semi-Markov kernel characterizing the departure process.

3 - Integrated Queuing and Gaming Analsis of Stochastic Assembly Systems

Ananth Krishnamurthy, Rensselaer Polytechnic Institute, CII 5015, 110 8th Street, Troy, NY, United States, krisha@rpi.edu, Jong-Shi Pang, Ram Ramakrishnan, Jinye Zhao

This paper presents a stochastic, decentralized assembly system consisting of two suppliers and one assembler, who decide on investments on capacities and inventories subject to a common throughput constraint. Queuing approximations for the relevant performance measures are integrated into the players' optimization problems, resulting in a generalized Nash equilibrium problem. Existence of a solution is established and numerical results are presented.

■ WD55

S-Ravenna (Lev. 3)

Air Traffic Management: Models and Algorithms

Sponsor: Aviation Applications
Sponsored Session

Chair: Hanif Sherali, W. Thomas Rice Chair, Virginia Tech, Dept. of ISE (MC-0118), 250 Durham Hall, Blacksburg, VA, 24061, United States, hanifs@vt.edu

1 - Simple Procedures for Scheduling Random Flight Arrivals

Thomas Vossen, Leeds School of Business, University of Colorado, Boulder, CO, 80309-0419, United States, vossen@colorado.edu

This presentation discusses algorithms for the allocation of airport arrival slots during Ground Delay Programs when there is uncertainty in the flights' arrival times. We introduce procedures and policies for allocating flights to slots, discuss fundamental properties of the resulting allocations, and describe how the resulting methods can be used to evaluate the impact of demand uncertainty.

2 - Algorithms for Managing Sector Congestion

Robert Hoffman, Principal Analyst, Metron Aviation, 131 Elden St., Fulton, MD, 20759, hoffman@metronaviation.com

We present automated algorithms for applying air traffic restrictions that prevent sectors of airspace from becoming overloaded, with the focus being more regional than national. Heuristic approaches are compared with classical optimization approaches. Results show that a hybrid algorithm may work best.

3 - Weather-based Rerouting and Slot-exchange Mechanisms Within an Airspace Planning Model

Michael McCrea, Assistant Professor, United States Military Academy, 155E Gardiner Loop, West Point, NY, 10996, United States, michael.mccrea@usma.edu, Hanif Sherali

We develop and evaluate two significant modeling concepts within the context of an Airspace Planning and Collaborative Decision-Making Model and, thereby, enhance its functionality in support of strategic and tactical level flight assessments. The first is a severe weather-modeling paradigm used to provide rerouting strategies and expected delay information. The second is a slot-exchange modeling concept that involves airline trading offers for arrival slots at an airport affected by a GDP.

4 - Airlines On-time Performance and Airport Gate Policy Modeling

Jasenka Rakas, PhD, University of California at Berkeley, Nextor, 107B McLaughlin Hall, Berkeley, CA, 94720, United States, jrakas@berkeley.edu, Arnaud Boubert, Valentine Calloud

This study develops a methodology for the analysis of airlines on-time performance characteristics. Gate delays are computed by using Performance Data Analysis and Reporting System (PDARS) actual arrival times (plus taxi-in times) and the Official Airline Guide (OAG) scheduled gate arrival times. The proposed model suggests new airport gate policy alternatives as a function of gate delay variations that relate to (i) origin airports, (ii) airline characteristics, (iii) utilized runways and (iv) weather conditions.

■ WD56

S-Wallingford (Lev. 3)

Auctions/Competitive Bidding

Contributed Session

Chair: Ahmet Yucekaya, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, yucekad@auburn.edu

1 - Information Disclosure and Reverse Multi-attribute Auction Performance

Kholekile Gwebu, Assistant Professor, University of New Hampshire, 441 McConnell Hall, Durham, NH, 03824, United States, khole.gwebu@unh.edu, Murali Shanker

The objective of this study is to explain the manner in which information disclosure interventions affect the performance of Reverse Multi-attribute Auctions. To this end, a conceptual model which integrates information asymmetry theory and signaling theory is developed. Thereafter, computer-based experiments, conducted under controlled laboratory conditions, are employed to compare the performance of multi-attribute auctions that make use of different information disclosure policies.

2 - Quantity Support for Multiple-unit Combinatorial Auctions

Riikka-Leena Leskelä, Helsinki University of Technology, Otaniementie 17, Espoo, 02150, Finland, rleskela@cc.hut.fi, Valtteri Ervasti

We have developed a mechanism to support bidding in multiple-unit combinatorial sealed-bid (reverse) auctions. The so called quantity support mechanism provides bidders a shortlist of bids (price-quantity combinations) that make the bidder a provisional winner of the auction. The tool is anonymous. We have run simulations to study the efficiency of the auctions and the resulting total cost to the buyer. The results indicate that the quantity support mechanism improves the efficiency of auctions.

3 - Learning by Losing: An Empirical Study of Bidding Effort Evolvement in Auctions

Xin Wang, Brandeis University, xinwang@brandeis.edu, Ye Hu

Bidding in auctions is an intrinsically complicate decision, especially for individual bidders without extensive knowledge about the mechanism of auctions. In this paper, we examine how the bidding effort (measured by the number of incremental bids) of auction buyers evolves, especially as a result of their accumulating experience. We track the auction participation of a panel of new customers at eBay over time. A time series model is constructed and analyzed. We find that among other factors, losing experience has a significant impact on reducing the bidding effort over time. In addition, results from our analysis indicate that not controlling for individual heterogeneity leads to considerable underestimation of the effect of experience. The findings of this research have significant managerial implications on how auction sellers and websites could facilitate buyer learning and subsequently improve customer satisfaction and retention.

4 - Outperforming the Competition in Multi-unit Sealed Bid Auctions

Ioannis Vetsikas, University of Southampton, IAM Lab, Building #32, Highfield Campus, Southampton, SO17 1BJ, United Kingdom, iv@ecs.soton.ac.uk

We examine the behavior of competing agents in multi-unit auctions; they wish to maximize a weighted difference of their own gain to that of their competitors. We derive symmetric Bayes-Nash equilibria in both mth and (m+1)th price auctions. Subsequently, we use these equilibria to examine the profits of different agents and show that aiming to beat the competition is more effective than pure self interest in any competitive setting. Finally, we examine how the auctioneer's revenue is affected.

5 - A Particle Swarm Decomposition Method for Bidding into Electricity Markets

Ahmet Yucekaya, Auburn University, 207 Dunstan Hall, Auburn, AL, 36849, United States, yucekad@auburn.edu, Jorge Valenzuela

Profit maximization for power companies is highly related to the bidding strategies used. In order to sell electricity at high prices and maximize profit, companies need suitable bidding models that consider power operating constraints and price uncertainty. We present two particle swarm optimization algorithms to determine bid prices and quantities. The first method uses a conventional PSO technique to find solutions. The second method uses a decomposition technique in conjunction with the PSO.

■ WD58

S-Pike (Lev. 4)

Group Decision Making

Contributed Session

Chair: David L. Ford, Professor, University of Texas at Dallas, School of Management, Richardson, TX, 75080, mzad@utdallas.edu

1 - Group Decision Model for Resolution of Water Conflicts: A Participatory Democracy Approach

Danielle Morais, PhD, Federal University od Pernambuco, Rua Conselheiro Portela, 169, apt. 701 - Espinheiro, Recife, PE, 52020-030, Brazil, dcmorais@ufpe.br, Adiel Teixeira Almeida

Increases in total demand of water are developing many conflicts all over the world. In fact, water resources planning are essentially political processes. However, the importance of involving the general public in governmental decision-making has created an abundance of opportunities for a government to transform the relationship with its citizens. This paper presents a group decision model to reach a resolution of water conflicts using a participatory democracy approach.

2 - Aggregation Procedure of Individual Ranking for Group Decision Making

Adiel Teixeira Almeida, Prof, Federal University of Pernambuco, Cx. Postal 7462, Recife, PE, 50630-970, Brazil, aalmeida@ufpe.br, Danielle Morais

An aggregation procedure for group decision making based on the analysis of individual rankings is proposed. The procedure aims of choosing an appropriate alternative, which is the best compromise according to the point of view of all the actors involved in a multicriteria decision problem. The procedure discharge a first group of irrelevant alternatives provided by a filter and concentrates the analysis in the most satisfactory alternatives.

3 - Negotiation – How Can It Be Taught Effectively to Students?

Rajesh Kumar Srivastava, Emeritus Prof.and Research, Somaiya Institute of Management Studies & Research(SIMSR), University of Bombay, Vidyanagar, Vidyavihar, Mumbai, 400 077, India, srivastava@vsnl.net

The article focuses on whether by training negotiation skill of students of Master Business Administration can be improved. A set of new approach was made to prepare the pedagogy based on earlier researches so that it is more contemporary and covers real life business situations which happens in today's scenario . How negotiation techniques can be improved to students? How to assess the impact of training through not on qualitative based approach but more on quantitative basis so that it can be validated?. Objective of the study was to find out whether training can improve negotiation skills of students. Training effect can be assessed if certain criteria like listing, EQ & Negotiation skills test are conducted using questionnaire as in instrument.

4 - The Role of Loss-prospect Value Uncertainty in Organizational Public Goods Dilemmas

Matthew McCarter, University of Illinois, 350 Wohlers Hall, Champaign, IL, 61820, United States, mmccart6@uiuc.edu, Gregory Northcraft

Value uncertainty, entailing loss prospects, may decrease an individual's willingness to give toward the provision of a public good. These negative effects of loss-prospect value uncertainty may also increase with group size. These arguments were tested using the Assurance Dilemma Game. Experimental results support our loss-prospect hypothesis; however, the moderating effect of group size was negative, suggesting social uncertainty, caused by group size, may trump the effect of loss prospects.

■ WD59

S-Seneca (Lev. 4)

Industry Applications

Contributed Session

Chair: Aliza Heching, IBM TJ Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States, ahechi@us.ibm.com

1 - The Inequality-satisfiability Problem

Erick Moreno-Centeno, 4141 Etcheverry Hall, Mail Code 1777, University of California, Berkeley, CA, 94720-1777, emc@ieor.berkeley.edu, Dorit Hochbaum

We define a generalization of the satisfiability problem (SAT), where each clause is an or-list of inequalities in n variables. The inequality satisfiability problem (I-SAT) is to find a point satisfying at least one inequality per clause. We show that I-SAT is NP-hard even with at most two inequalities per clause, but solvable in polynomial time with fixed number of variables and/or clauses. An important manufacturing problem, the mold casting problem, is shown to be a special case of I-SAT.

2 - Minimizing the Maximum Deviation from Assigning Average Workload to the Bottleneck Station

Ghorbanali Mohammadi, PhD, Shahid Bahonar, University of Kerman, Dep. of Industrial Engineering, College of Engineering, Kerman, Iran, gmohammadi@mail.uk.ac.ir

Mixed-Model assembly lines are often used in manufacturing based on just-in-time techniques. The effective utilization of these lines requires that a schedule for assembling the different models be determined. The objective is to minimize the maximum deviation of actual workload to the bottleneck station at any point during the period. Maintaining a constant flow is most important at the bottleneck workstation. The bottleneck station is the station with maximum total work or equivalently average work per cycle. This paper presents a Practical Sequencing Heuristic Procedure (PSHP) to minimize the maximum deviation from assigning workload to the bottleneck station, and easy to use by practitioner. The performance of the method is numerically tested on standard problems. Experimentation demonstrates the relative desirable performance of the presented methodology.

3 - A Simulation-based Framework for Design and Operation of Print Shops with High Product Variety

Sudhendu Rai, Xerox Corporation, MS 128-51E,
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Print shops can be characterized as make-to-order manufacturing systems that exhibit high-product variety. In this talk, we discuss a productivity improvement solution for print shops called LDP Lean Document Production. Salient features of the solution will be explained including the notion of autonomous cells and algorithms for hierarchical scheduling of jobs. Results of implementation of this solution in several different print production environments will also be presented.

4 - Simulating Performance of Warranty Policies

Aliza Heching, IBM TJ Watson Research Center,
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United States, ahechi@us.ibm.com

We present the results of a simulation study of the costs of servicing a warranty policy for a consumer electronics product. The objective is to explore the impact of different decisions regarding the terms and conditions of the policy on key performance indicators such as total cost and consumer satisfaction. We vary assumptions on parameters such as product retirement rate, product failure rate, and repairman dispatching rules to explore their impact on the key performance indicators.

A

Aardal, Karen MA18, MB18, MC18
Abbas, Ali SC20
Adida, Elodie MB50
Afeche, Philipp TD49
Agarwal, Anurag TC52
Agnetis, Alessandro MB12
Ahn, Hyun-Soo MA07, TB49, WB49
Ahn, Sang Hyung MA05
Ahuja, Ravindra MA52
Akcali, Elif WA02
Aksin, Zeynep TB54
Alagoz, Oguzhan SB40
Albin, Susan TA30
Aleman, Dionne MC41
Allon, Gad MA06, MC51, WB51
Almaas, Eivind WB41
Alp, Osman WB10
Alptekinoglu, Aydin TB50
Altner, Doug TC29
Amato, Henry WD22
Amemiya, Yasuo MD25
Andersen, Erling WB29
Anderson, Richard SB21
Aneja, Yash SC16
Angeloudis, Panagiotis WC39
Animesh, Animesh MD17
Anitescu, Mihai SB15
Anupindi, Ravi MC03
Apley, Dan MC31
Argon, Nilay WA19
Armony, Mor SD06
Armstrong, Michael TD37
Askin, Ronald TD19
Ata, Baris MD50
Ayhan, Hayriye TB51
Aytug, Haldun TD17

B

Babaioff, Moshe MC38
Badiru, Adedeji WB37
Bai, Lihui TD36
Baker, Erin SA21, WA46
Baker, Kenneth SD04
Baker, Ted SA58
Balasubramanian, Hari TA41
Ball, Michael SA55, TA55
Ban, Xuegan (Jeff) SA33
Baptiste, Philippe MA12
Barahona, Francisco TC53
Barkan, Christopher SB52
Barlatt, Ada WD13
Barnes, Andrew MA43
Barquin, Julian TC46
Bassamboo, Achal MC51
Batta, Rajan MB36
Baucells, Manel MA21
Bayraksan, Guzin TA15
Bayraktar, Erhan WC36
Beamon, Benita TC08
Bearden, Neil MB23
Beasley, J E WC45
Beil, Damian TB03
Benjaafar, Saif SB03
Bennett, Ashlea MD34
Benton, WC TB60
Berk, Emre WD10
Berman, Oded SA53
Bernstein, Fernando TA03
Best, Michael J. TA45
Bhadra, Dipasis MC55
Bhandari, Atul SC42
Bhattacharyya, Sid TD52
Bhulai, Sandjai SC54, SD54
Bi, Jinbo TA42
Bichescu, Bogdan TD28
Bier, Vicki TC09
Biller, Bahar MA59
Billups, Stephen SC41
Birge, John MD45
Bish, Doug SB51
Bish, Ebru WA59
Blackstone, Tanja MC37
Blair, Montgomery WB50
Boginski, Vladimir TA27
Boile, Maria MB33
Bollapragada, Ramesh SA36
Bonneau, Richard WA41
Bordley, Bob SD21
Boros, Endre MB13, MC05
Borror, Connie MD31
Boyabatli, Onur WB47
Boyce, David SC33
Brandeau, Margaret MB39
Bria, Frank WA49
Briand, Daniel MA37
Brooks, Paul TC26
Bsat, Mohammad WA01
Bukkapatnam, Satish TA25
Bulbul, Kerem SA57
Burer, Samuel MC29
Burke, Jim MA14
Burns, Laird TA08
Butenko, Sergiy MA28
Byers, Reynold TD27

C

Cachon, Gerard MD06, TA07
Cakanyildirim, Metin WB07
Campo-Rambado, Miguel SD58
Carino, David WC48
Carlo, Hector SB35
Carlson, Melanie WA37
Carrillo, Janice TB59, TC58
Carter, Mike TD39
Cetinkaya, Sila WA02
Chang, Seok Ho TD08
Chaovalitwongse, W. Art SB41, MD41
Chao, Xiuli TC07
Chaudhry, Mohan TC54
Chayet, Sergio SA06
Chelst, Kenneth SC44
Chen, Argon WD41
Chen, Chien-Yu WB14
Chen, Frank MA03
Chen, Jing WD51
Chen, Kay-Yut MC23
Chen, Lijian SA35
Chen, Michael TC15, WD15
Chen, Rachel MD02
Chen, Victoria MB26
Chen, Weiping WA59
Chen, Xin TA14
Chen, Yihsu WB46
Chen, Yong SD30, MC30
Chen, Zhi-Long SB12, MC50
Cheng, Clark MD52
Cheng, Hung-Pi WD43
Cheng, Peng WA43
Cheng, Shih-Fen MD16
Chiang, Wen-Chyuan TA32
Chinneck, John TA19, TB19, TC19
Chiu, Yi-Chang TD34
Cholette, Susan WC56
Cho, Soo-Haeng TB20
Choudhary, Vidyanand SD17
Chung, Chia-Shin WC12
Chung, Eric WC21
Cobb, Barry SC21
Cohn, Amy MA39, MD55, WC55
Coldren, Gregory TB55
Colville, Glenn WA50
Comez, Nagihan SA01
Corley, Bill TB38
Côté, Murray TB39
Cowing, Michelle TB42
Creasey, Roy SD48
Crissey, Mary SA26, MB43, MC43
Crossley, William SC14
Cruz, Jose MB08
Cui, Tingting SC53
Cunha, Claudio SA28

D

Daim, Tugrul WC60
Dalakouras, Georgio WD46
Damnjanovic, Ivan TD35, WA35
Damodaran, Purushothaman TD11
Daneke, Greg WA56
Danna, Emilie SB28
Das, Tapas K. TA40, WD40
Dasci, Abdullah MA51
Dayanik, Savas WA54
de Kok, Ton MC10
de Lange, Gertjan WD29
De Reyck, Bert WA39
Dean, Brian WC52
Dean, Matthew WA42
Deane, Jason TA52
Debo, Laurens SB54
Dekker, Rommert MC33
Delaney, James TB31
Dell, Robert SC19
Delmelle, Eric TC35
Demers, Alixandra WD33
Demeulemeester, Erik MD12
DeMiguel, Victor MD14
Deng, Shi-Jie SC46
Denton, Brian SB43
Derby, Steve TA20
Deshmukh, Abhijit WB20
Deshpande, Vinayak SC02
Desmet, Bram WC08
Dewan, Pooja SA52
Dias, Luis WA21
Diecidue, Enrico TC20
Dietz, Dennis WA27
Dillon-Merrill, Robin SC09
Ding, Shengwei WD23
Ding, Yu WC30, WD30
Dinitz, Laura WA23
Dirkse, Steven MD18
Disraelly, Deena MC09
Dobson, Gregory TC39
Dobson, Ian MA46
Dogan, Ibrahim TB08
Dong, Lingxiu SB06
Donohue, Karen SA07, MB07
Down, Douglas MA54, TB51
Drake, Matt WB44
Drezner, Tammy SD53
Drezner, Zvi TA53
Duan, Rong MC26
Dube, Parijat MA50
Dubrawski, Artur TD26

E

Eapen, Gill SB45
Elmaghraby, Wedad SD56
Erat, Sanjiv WA58
Erenay, Fatih Safa TD12
Erhun, Feryal SD02
Erickson, Gary SA38, SB38, SC38, WC04
Erkip, Nesim SB08
Ertem, Alp WC59
Ettl, Markus WC10
Evgeniou, Theodoros SB27

F

Fan, Yueyue SC36
Farias, Vivek TD50
Feinberg, Eugene MA16
Feldman, Ronen MB27
Fenelon, Mary WA18
Feng, Liming WA45
Feng, Qianmei (May) SC30, SD30
Feng, Youyi MB49
Ferguson, Mark WD02
Ferrer, Juan-Carlos SD51
Fontanesi, John TD40
Ford, David L. WD58
Fowler, John TB12
Fragniere, Emmanuel MA25
Freund, Robert MB44
Frey, Dan TC31
Fridgeirsdottir, Kristin TC49
Fried, Jeremy SD47
Fuchs, Erica MB60,TD60
Fulton, Lawrence V. WC16
Furman, Kevin TC05, WA16, WB16

G

Gabraeel, Nagi SA30
Gabriel, Steve TB46
Galati, Matthew TA29, TB29
Galbreth, Michael WC02
Gallien, Jeremie TC03
Gamarnik, David TC51
Ganesan, Vikram WA25
Gan, Xianghua SA32
Gans, Noah SC06
Garcia, Alfredo MC16
Garrow, Laurie SC55
Garud, Raghu SB58
Gaur, Vishal WA06
Gautam, Natarajan TA57
Gaver, Donald TB09
Gavirneni, Srinagesh MA11
Gay, Ralph WD42
Geistauts, George TB57
Gendreau, Michel MB56
Gilat, Dagan MB25, MC25
Ghate, Archis IS-M, IS-T, TD16
Gilbert, Steve SA02
Gilmore, Elisabeth TD56
Glowacka, Karolina WC09
Goel, Ankur WA47, WB58
Goldberg, Noam MD27
Golden, Bruce SB19
Goncalves, Paulo SB23
Goodale, John TC12
Goodchild, Anne MD33
Gopal, Ram MB17
Gorman, Michael MB52
Gormley, Kevin WD47
Goyal, Vineet SA16
Grage, Sandie WC37
Graves, Greg WC53
Griffin, Joshua SB14
Griffin, Paul SD44
Grossman, Thomas MD58
Grushka-Cockayne, Yael WA20
Guan, Yongpei MC15, WB13
Guikema, Seth WB22
Gung, Roger R. WA49
Guo, Xin TC45
Gupta, Alok TB17
Gupta, Ashish MC19, MD19
Gurgur, Cigdem TD48
Gurnani, Haresh WB06
Gutiérrez, Gabriel TB01

H

Hafer, Lou WB18
Haight, Robert MA47
Hall, Nicholas G. SA12, MC50, MD04
Hall, Shane WB40, WC40
Halog, Anthony TB22
Hamaoka, Yutaka WB57
Hampshire, Robert MC54
Hansen, Mark WA55
Hansson, Anders WD36
Hardin, Jill SD19
Harmon, Robert TC38
Harrison, Terry MB59
Harrod, Steven SC52, SD52
Hart, William MB29
Hatch, Nile SA60, TC60
Hatzakis, Emmanuel SA45
Hazen, Gordon TD22
Heching, Aliza WD59
Hedgepeth, Oliver TB27
Heimann, David WC38
Heragu, Sunderesh SC35, SD35, MA35
Herroelen, Willy MB04
Hicks, Illya TD13
Hill, Craig MB01
Hill, Stephen MB34
Hillier, Frederick S. WB04
Hobbs, Benjamin MC46, MD46
Hoffman, David TA48
Holder, Allen MC42, WA44, WC41
Hollis, Stacey MB28
Hooker, John SA18
Horvitz, Eric SB20
Houghtalen, Lori SD49
Howard, Ronald MB20
Hu, Jack SB11, SC11
Hu, Ming TA49
Hua, Stella TB02
Huang, Qiang MD30, TB25
Huang, Zan SC27
Huggins, Eric TC57
Hughes, Richard TC42
Huh, Woonghee Tim TA59, TC10

I

Iyer, Ananth. V. WA03
Iyigun, Cem TB53

J

Jain, Ankit WA48
Jain, Apurva WC03
Jain, Rahul MA50
Jalora, Anshu MB51, WC49
Janakiraman, Ganesh WA07
Jang, Wooseung MA34
Jank, Wolfgang SD27
Jaruphongsa, Wikrom WC07
Jayakrishnan, R. (Jay) WB33
Jayanthi, Shekhar MC59
Jeffery, Mariah TB23
Jenni, Karen SD20
Jennings, Otis MB54
Jeong, Myong K. (MK) TA25, WB26
Jiang, Li TA11
Jin, Judy TC25, TD25
Johnson, Alan SD37, TB37
Johnson, Michael SA04, MA53

K

Kachani, Soulaymane SB50
Kalagnanam, Jayant TA28
Karaesmen, Itir SD50, MD49
Kardes, Erim WC15
Karisch, Stefan SD55, TD55
Katila, Riitta MC60
Katok, Elena SC23, MA23, MD23, TA23
Katriel, Irit TC28
Kavadias, Stylianos MB58
Kaya, Murat SA23
Kemahlioglu-Ziya, Eda WB02
Keskinocak, Pinar WA40
Khan, Aejaz TD02
Khoshsima, Gholamreza TA22
Kim, David TA16
Kim, Ilhyung WB59
Kim, Kwang-Jae SD25
Kim, Seoung Bum SB26, MA26
Kim, Sujin TC56
Kim, Sukgon WC11
Kim, Sunkyo WC23
King, Andy SD58
Kirkwood, Craig MD20
Klabjan, Diego SB55, TC33, WA10, WB55
Klampfl, Erica TD05
Klastorin, Ted SA59
Knott Eck, Cynthia TC22
Kobza, John WD08
Kocaoglu, Dundar WA52, WB60
Koenigsberg, Ernest MA33, MD05
Kohn, Wolf SD16
Ko, Jeonghan SB11, SC11
Kok, Gurhan SB07
Konak, Abdullah MC57
Kong, Nan MD39
Kong, Zhenyu (James) WB30
Koole, Ger MB54
Kopach- Konrad, Renata SA39
Koppius, Otto MD56
Kotha, Suresh SC58
Kouvelis, Panos SB06
Kovach, Jamison WB25
Krishnamurthy, Ananth TD33, WC54, WD54
Krishnan, Vish TC59
Kristjansson, Bjarni SB29
Krokhmal, Paul MB15
Kros, John WD25
Kucukyazici, Beste SB39
Kuhl, Michael SC48
Kulkarni, Ankur MB14
Kumar, Ashok WB09
Kumar, Sanjay SC08
Kumar, Subodha SA17
Kumar, Sunil SC22, SD22
Kunnumkal, Sumit SD34
Kuo, April SA34, SD36
Kurz, Mary Beth TA18
Kusiak, Andrew SC26

L

Lai, Kee-hung SB32
Lakhera, Sanyogita WB32
Lariviere, Martin MB06, MD06
Lasdon, Leon TD04
Lasry, Arielle TB40
Lawphongpanich, Siriphong MD35
Leachman, Rob WB11
LeBlanc, Larry WC27
Lee, C. Christopher WA57
Lee, Chang Hwan WC01
Lee, Chris P. MC40, TC06
Lee, Chung-Yee TA06
Lee, Eva K. SA41, SB13, SD41, MA42, MB40, MC13
Lee, Hsiao-Hui WB31
Lee, Shiwoo TA39
Lei, Lei SB12
Lei, Yong TC25
Leung, Joseph Y.-T. SD12
Levesque, Moren SB60, MD60
Levi, Retsef MD10, TD10
Leyton-Brown, Kevin SC56, MA56, MC56
Lichtendahl, Casey TA21
Lieberman, Warren MD43
Lieckens, Kris TA05
Li, Gang WC14
Li, Ivy MC21
Li, Jing SB31, SD31, MA31, MB31
Li, Lei MA08
Li, Qing TD07
Li, Xiaobai (Bob) MA27
Li, Yanjun SC13
Lim, Gino MA41, TD18
Lim, Yun Fong WC19, WD49
Lin, Chun-Ting SB09
Lin, Pei-Wei WA34
Lin, Wuqin TD51
Linderoth, Jeff SB18, SC18, SD18, TC18
Linetsky, Vadim TB45
Linkov, I. MD21
List, Barry MA38
Liu, Henry TA36
Liu, Hui SB57
Liu, John SD32
Liu, Yifan SD42
Llewellyn, Donna TA44, TB44, TC44, TD44
Lodree, Jr., Emmett TA09
Long, Elisa SB42
Lopez, Francisco MA15
Lortz, Tim WC28
Lou, Yingyan WD34
Lougee-Heimer, Robin SA29
Lovell, David MA55
Lowe, Timothy TD47

M

MacGregor-Smith, Jim SA42
Madahar, Mukul WB27
Maglaras, Costis TC50
Magrogan, Mary MA38
Maillart, Lisa MB41
Mak, Ho-Yin SB53
Mallik, Suman TC27
Malter, Daniel WD37
Malvankar, Monali TD42
Mamer, John SA56
Marquard, Jenna MB21
Martin, Kipp SC29, SD29
Mastrangelo, Christina TD30
Mathews, Scott WD04
Matis, Timothy MB57
McGinnis, Leon TC02
McLay, Laura SD09
Melouk, Sharif MD48

Mete, Huseyin Onur WD16
Mifflin, Robert TD14
Mihm, Jurgen MC58
Miles, Ralph F. MC20
Miller, Andrew TC13
Miller, Luke WB45
Miller-Hooks, Elise MA36
Mills, Steven WB56
Min, Jo WA08
Mirrkoni, Vahab MD38
Mishra, Ajay WD01
Mishra, Anant WC58
Mithas, Sunil MC17
Mitra, Gautam WA15, WB15
Mitsakis, Evangelos WD36
Mittelmann, Hans MB19
Moallemi, Ciamac TA54
Moinzadeh, Kamran SC07
Moitra, Soumyo WC57
Moore, David SC59, SD60
Moore, James SA37, SB37
Moore, Jim TB36
Morrice, Douglas MC11
Morton, Alec WC20
Moussawi, Lama WC51
Mouzon, Gilles WB12
Muharremoglu, Alp TA10
Mukherjee, Avijit TC55
Mukhopadhyay, Samar MD08
Murat, Alper SB33
Muriel, Ana WB05
Murray, Talisa MB05, TB05

N

Nagarajan, Mahesh SC10
Nagi, Rakesh MC53
Nam, Seong Hyun TC01
Narasimhan, Sridhar WB17
Narayanan, Sriram WC06
Natarajan, Hari MD32
Nazzal, Dima TD53
Nelson, Barry L. MA30
Netessine, Serguei MB02, TA07, TB06, TD59
Newman, Alexandra MC47, MD47, TA47
Nieuwesteeg, Peter WD39
Nie, Yu (Marco) WC33
Nigmatulina, Karima TD09
Niranjan, Suman WB08
Norback, Judith Shaul WD44
Nowak, Maciek SB34
Nowrouzi Kashan, Fariba WC35
Ntaimo, Lewis MD15

O

O'Leary, Mike WC32
Olafsson, Sigurdur WD28
Olinick, Eli SC57
Oren, Shmuel TA46
Oum, Tae SD32
Ouyang, Yanfeng TD01
Ozdaglar, Asu SC50
Ozener, Okan SC34
Ozer, Ozalp SA23, MB03
Ozkul, Ahmet WA38
Ozlen, Melih WA12
Ozsen, Leyla MC34, MD53
Ozturk, Murat Hakan WD20

P

Pan, Qisheng TC36
Pan, Rong SB30
Pandza, Krsto TA60
Pang, Zhan (James) MB49
Parker, Rodney SA03
Parlakturk, Ali K. MD59
Parlier, Greg MD37, TA37, TC37
Parnell, Gregory SA20
Pataki, Gabor TA13
Peeta, Srinivas TA34, WB34
Perry, Marcus WA31
Petering, Matthew MC32
Phillips, Cynthia TB18
Phillips, Robert SA49, SB49
Pinter, Janos D. WC29
Pittman, Sam SA47
Pollack-Johnson, Bruce WD09
Popkowski-Leszcyc, Peter SB56, SD38, TA56
Popova, Elmira TD15
Popova, Ivilina SC45
Posner, Marc MC12
Pot, Auke TD54
Powell, Warren SA19, MA22
Primbs, James MC45
Puterman, Martin SC40

Q

Qian, Zhiguang SD26, MD25, TA31, TD31
Qi, Lian MB53
Quadrifoglio, Luca MC36

R

Radovanovic, Ana TC51
Raghavan, Raghu SD57
Rainwater, Chase TA01
Rajgopal, Jayant SD01
Rakas, Jasenka TC43
Ralphs, Ted MA29, MC44, MD44
Raman, Roopa WA17
Ramdas, Kamalini MA58
Ramirez-Marquez, Jose TB26
Ramnarayanan, Renu MA01
Rao, R. Bharat TA42
Rardin, Ronald MC39
Rauf, Mohd Ali WA32
Ravichandran, N. TD32
Ray, Saibal SB02
Raz, Gal MB22, MC22
Reaume, Daniel MB16
Reed, Josh WB54
Rees, Jackie TB52
Reeves, Kingsley WB53
Regenwetter, Michel TB21
Regis de Farias JR., Ismael MA13
Resende, Mauricio G. C. SD28
Reveliotis, Spyros TC48
Ribeiro, Celso TD57
Richard, Jean-Philippe SA13, MD13
Richter, Anke TC40
Robinson, Stephen TB14
Rockafellar, R. Tyrrell MC04
Roels, Guillaume SA50
Romeijn, Edwin MA10
Ronnqvist, Mikael SC47
Rosenberger, Jay SA40
Roth, Aleda SB59, MC07
Roughgarden, Tim TA38
Royset, Johannes TB35
Ruggiero, John SB22
Ru, Jun WB06
Ruiz-Torres, Alex SC01
Ruperez Micola, Augusto SB46
Rusmevichientong, Paat SC49
Ruth, R. Jean WA05
Ryan, Jennifer WD19

S

Saat, Rapik TD23
Saberi, Amin MB38
Saharia, Aditya TC23
Sahin, Ozge TB49, WB49
Saka, Gorkem SD39
Salo, Ahti MA20
Samsa, Michael MD09
Sandikci, Burhaneddin SD40
Sarkar, Sumit SA27
Sauma, Enzo TD46
Saunders, Michael SD14
Savage, Sam SA43, WA51
Savelsbergh, Martin MB35
Savin, Sergei TD41
Saxena, Anureet WA13
Schade, Christian WA60
Schimert, James TA26
Schmidt, Glen TA58
Schmitt, Tom MC08
Schott, Elizabeth MA44
Schultz, Ken SD23
Sebastian, Hans- Jürgen TA02
Seiford, Lawrence SC32, MD22
Sellami, Moncef MC52
Sellmann, Meinolf MD28
Seref, Onur MD41, WA26, WC26
Sethuraman, Jay SC12
Shah, Devavrat TA54
Shahabuddin, Syed MD01
Shanbhag, Uday WC46
Shang, Kevin SD10
Sharda, Ramesh MC19, MD19
Sharkey, Thomas TC16
Sharma, Dushyant TB16
Sharman, Raj SC17
Shechter, Steven MD42
Shen, Max SC05, MD07
Sherali, Hanif WD55
Shi, Jing WA09
Shi, Leyuan TB04
Shi, Ning WD14
Shi, Ruixia MB11
Shmoys, David MA04
Shmueli, Galit SD27
Shortle, John MB55
Siddiqui, Afzal SD46
Sim, Melvyn TB15
Simchi-Levi, David SC04
Simmons Ivy, Julie SA40, SB31, SD31, MA31, MB31
Sitter, Randy TC30
Sivaramakrishnan, Kartik MD29
Smith, J. Cole MA57, WC18
Smith, Jeff MA48
Smith, L Douglas SB36
Smith, Michael D. WC17
Snyder, Lawrence MD07
So, Anthony Man-Cho MC14
Sobel, Matthew TD20
Sohoni, Milind MC02
Sokol, Joel TC41
Solak, Senay TD43
Sommer, Svenja TD58
Son, Young-Jun MB48
Song, Jeannette SA05, SB05
Sosa, Manuel TB58
Sosic, Greys SD03
Sotomayor, Luz TB48
Soyer, Refik SA31
Squillante, Mark S. MD51
Stecke, Kathryn SD08
Steffy, Dan WA11
Stier-Moses, Nicolas SC50
Stoddard, Steven MB37
Stolyar, Alexander TA51
Stonebraker, Jeffrey TC21, TD21
Strauss, Stephen TA43, TB43
Street, Nick WD26
Sundaramoorthi, Durai TB41
Sun, Monic TD38
Susarla, Anjana TC17
Su, Xuanming MA40, MD03
Swann, Julie WA40

T

Taaffe, Kevin WD35
Tang, Kaizhi MD26
Tang, Sammi WB01
Tang, Victor WD12
Tan, Yong SB17, WA04
Tardif, Valerie TB56
Tarr, Peri SC43
Taylor, Christine WB39
Taylor, Terry SD07
Tekin, Eylem WB19
Temel, Melih WA53
Teo, Chung-Piaw SD05, TA06
Terwiesch, Christian MA60, TA04
Thakur, Mayur MA19
Thiele, Aurelie MA49
Thomas, Lyn MA45
Thomas, Marlin WD53
Thompson, Kimberly WD21
Thompson, Matthew SB47
Tibben-Lembke, Ronald WD07
Tocchella, Barbara SB16
Toktay, Beril WB03
Tomlin, Brian MB10
Tong, Chunyang TC32
Toth, Sandor MB47
Toyoizumi, Hiroshi WD32
Tsay, Andy TC11
Tseng, Paul SA15, SC15
Tsilingiris, Panagiotis TA33
Tsung, Fugee SC25
Turkay, Metin MB42
Tyworth, Gene TB33

U

Ukkusuri, Satish TB34, WA33
Uryasev, Stanislav TD45
Uster, Halit MD57

V

Vairaktarakis, George TA12
Valenzuela, Jorge MB46
Van Hentenryck, Pascal TB28
van Houtum, Geert-Jan TB07
van Ryzin, Garrett MC49
Van Wassenhove, Luk TC04
Veeraraghavan, Senthil TB06
Veit, Daniel J. SA46
Vengazhiyil, Roshan MB30, TB25
Verma, Manish WC34
Villalobos, J Rene TB47
von Winterfeldt, Detlof MA09, MC20
Vossen, Thomas WB43
Vulcano, Gustavo TA50

W

Wagner, Janet WD27
Walczak, Darius WC50
Waller, S. Travis TA35, TC34
Wan, Hong SC31
Wang, Chun WC13
Wang, Fan WC43
Wang, Haibo SC28
Wang, Wei WD45
Ward, Amy TD51
Wasil, Edward SB19
Wasserkrug, Segev MB25, MC25
Weber, Bruce SD45, MA17
Weber, Charles SC60
Wein, Lawrence SB04, MB09
Weintraub, Gabriel MA06
Wen, Zaiwen WA14
Werneck, Renato TB32
Wernz, Christian WB20
White, Preston SD48
Wiecek, Margaret M. SA09
Wieland, Jamie R. WD48
Wilhelm, Wilbert TB13
Williams, Clay SD43
Williams, Pamela MC48
Willoughby, Keith WC42
Wu, Owen TC47
Wu, Shengnan WB35

X

Xanthopoulos, Petros WC26
Xia, Cathy H. MD54
Xia, Yusen SA08
Xiao, Wenqiang MA02, TD06
Xue, Mei MB45
Xu, Xiaowei MC01

Y

Yalabik, Baris WB28
Yamashita, Makoto WA29
Yan, Jia MB32
Yen, Joyce WC05
Yi, John WA28
Yih, Yuehwern SC39
Yildirim, Utku SA51
Yin, Yafeng SD33, MC35
Yip, TL MB32
Yoshizaki, Hugo WD38
Yuan, Hong WB38
Yucekaya, Ahmet WD56
Yunes, Tallys MC28

Z

Zabarankin, Michael WB21
Zahavi, Jacob MC27
Zappe, Chris SA44, SB44
Zaric, Greg WC44
Zayas-Castro, Jose SD59
Zeng, Bo SD13
Zenios, Stefanos MD40
Zenobia, Brent WD52
Zhang, Fuqiang SC03, MC06
Zhang, Jiang SA11
Zhang, Jiawei SA10, SB10
Zhang, John TA17
Zhang, Lei MD36, WB48, WC25
Zhang, Rachel MD02
Zhang, Zhe George WB23
Zhao, Hui MD11
Zhao, Xuan TD03
Zhao, Xuying SB01, TB11
Zhao, Yao TB10
Zhao, Zhenying WC22
Zheltova, Ludmila WA22
Zhou, Ruoyi SA25, SB25
Zhou, Sean TC07
Zhou, Shiyu TB30, WA30, WC31, WD31
Zhou, Shu SD11
Zhuang, Jun SA22
Zhu, Joe SB22
Zhu, Yuntao TD29
Ziliaskopoulos, Thanasis WA36, WB36
Zinchenko, Yuriy WB42
Ziya, Serhan SA54, SC51

A

Aardal, Karen MA18
Abad, Andres TD25
Abad, Prakask WD35
Abayomi, Kobi MA26
Abbas, Ali SC20, MB20
Abdelghany, Ahmed SB55, WB55, WC55
Abdelghany, Khaled SB55, WB55, WC55
Abdellaoui, Mohammed TC20
Abhishek, Kumar SC18, MB19
Ablanedo Rosas, Jose Humberto WB11
Aboolian, Robert SA53, TA53
Abraham, Dan TD55
Abraham, Dulcy MA39
Abrahams, Alan TC52
Abrams, Robert SD33
Abramson, Mark SD14
Abrate, Graziano TC46, WC43
Abu Taha, Rimal WB60
Acemoglu, Daron SC50, MA50
Acharya, Ambarish MA01
Acharya, Dharma MD52
Acharya, Ram TB47
Achterberg, Tobias MA29, MB19
Ackerman, Gary MD09
Acuna, Mauricio MB47
Adams, Brian MC48, WC39
Adams, Peter TD56
Adams, Teresa SA36
Adams-Smith, Dennis MC48
Adhitya, Arief SC08
Adida, Elodie MB50
Afeche, Philipp TD49
Aflaki, Sam MD03
Agarwal, Anurag TB52
Agarwal, Manju WA25
Agarwal, Richa TC33
Agarwal, Ritu MD17, WA17
Agarwal, Yogesh SC16
Aggarwal, Rohit SB17
Aggarwal, Vijay WB01
Agha, Iqbal WD13
Agirbas, Gozde WA42
Agnetis, Alessandro MB12
Agrali, Semra MB53
Agrawal, Anupam TB02
Agrawal, Sunil TC01
Agrawal, Vishal SA02
Ahat, Nurdan WD10
Ahghari, Mahvareh WB19
AhmadBeygi, Shervin SC34, SD34, MD55
Ahmed, Shabbir SB18, SD18, MA57, MB18, TA15, TC13
Ahn, Hyunchul WB17
Ahn, Hyun-Soo MA07, TB49, WB49
Ahn, Jae-Hyeon TC22
Ahn, Jaehyeon TD38
Ahn, Sang Hyung MA05
Ahner, Darryl WC53
Ahuja, Ravindra MA52, TC29
Ahumada, Omar TB47
Ai, Jing TA27
Aichbhaumik, Debo TB30
Aiman-Smith, Lynda SA58
AitSahlia, Farid TC45
Ak, Aykagan MB33, WA39
Akamphon, Sappinandana MB16
Akan, Mustafa SB40, SD06, MD50, TD50
Akartunali, Kerem TB13
Akca, Zeliha MA34
Akcali, Elif SB07, TB39, TD42, WA02
Akcay, Yalcin SB03, TB54
Akhavan-Tabatabaei, Raha WD23
Akkan, Can SB16
Aksin, Zeynep SD06
Aktaran-Kalayci, Tuba MD48
Aktekin, Tevfik SA31
Al-azzoni, Issam MA54
Al-Nory, Malak TB01
Alagoz, Oguzhan SB40, SD39, SD40, MB31, MC41, TA39, TA40, WD21
Alali, Baqer WB60
Alam, Mohammad WC23
Albers, Marc MB52
Albin, Susan TD25
Albright, Russell SA26
Alcabin, Monica WB43
Alden, Jeffrey TB43
Alderson, David SC19, TD09
Alejandro, Garcìa delValle TA32
Alenezi, Abdulrahman MC34, TB56
Alexander, James WA40
Alexander, Suraj M. WC16
Alexe, Gabriela SA41
Alexopoulos, Christos SC31, SD44, MD48
Alhourani, Farouq WA56
Ali, Ozden Gur MB42, MC27
Alidaee, Bahram SC28
Alizadeh, Amir H MB32
Alizamir, Saed TA11
Aljalahema, Rashid WD32
Aljuhani, Fouad WB60
Allebach, Jan P. TA27
Allen, Dave SB57
Allen, David SC41
Allgor, Russell TC03
Allon, Gad SC03, SD07, MA06, MC51, TA07
Allon, Gad SB54
Almaas, Eivind WB41, WC41
Almeida, Adiel Teixeira WD58
Almeida, Pedro WA21
Al-Mutairi, Dhaifalla WC37
Almquist, Brian WD26
Alonso-Ayuso, Antonio SC47
Aloysius, John SD21, MA23, MD23
Alper, Engin MA07
Alpers, Andreas MC44
Alphey, Luke SC42
Alphey, Nina SC42
Alpkan, Lutfihak WB57
Alp, Osman WB10, WD10
Alptekinoglu, Aydin SA06, SB07, TA11, TB50, TB59
Alspaugh, Julie TC03
Alt, Jon WC53
Altinakar, Mustafa SC28
Altinkemer, Kemal SA57
Altinoz, Cuneyt SC01
Altner, Doug TC29
Altug, Mehmet Sekip SC06, TB49, TC49
Altus, Stephen TD55
Alvarez, Jose Fernando MB33
Alvarez, Pablo MB09
Amaral, Antonio WC09
Amasaka, Kakuro WA38
Amato, Henry WD22
Amaya, Johanna WA42
Amemiya, Yasuo MD25
Amini, Mehdi MC37
Amiri, Ali WD37
Ammons, Jane C WD07
Anandalingam, Anand WA28
Anand, Gopesh MC07
Anand, Krishnan MC02
Anani, Shadi B. TD35
Anderle, Markus SD27
Andersen, Erling WB29
Andersen, Henrik Reif TC28
Anderson, Chris SA25, MB39
Anderson, Eddie MB11, MC46
Anderson, Edward TC11, WD09
Anderson, Michael WA32
Anderson, Richard SB21
Anderson, Simon SB38
Anderson, Tim WC60
Andrade, Diogo V. MA28
Andradottir, Sigrun SA48, SB48, WA19, WB19, WC19
Andriansyah, Ricky WC54
Aneja, Yash SC16
Angelis, John SB60
Angeloudis, Panagiotis WC39
Angelus, Alexandar WC07
Angst, Corey WA17
Anily, Shoshana SA10, TD10
Animesh, Animesh MD17, WA43
Anis, Aslam MD42
Anitescu, Mihai SB15
Ankenman, Bruce SC31, TD30
Antes, Matt SA21
Anthony, Barbara SA16
Antin, Parker TC41
Anupindi, Ravi MC03
Aperjis, Christina SA56, MB50
Apley, Dan MC31
Appell, Katrina WD47
Apt, Jay TD56
Apte, Aruna WD13
Aral, Sinan MC17
Araman, Victor SA50, SD50, TA50
Arambula, Ivette WC49
Ara, Roberta MD42
Araujo, Madalena WC09
Arcot, Vishnu WB36
Ardekani, Siamak WC34
Argon, Nilay SB40, WA19
Argote, Linda MC60
Arikan, Mazhar SC02
Ariyawansa, K. A. TD29
Arkali, Gokcen MA58
Armagan, Emre TC48
Armbruster, Benjamin SB42, SC53, WC28
Armony, Mor SA54, SD06
Armstrong, Michael TD37
Armutlu, Pelin SC41
Aromi, J. Daniel SD56
Arora, Ashish MB60
Arora, Sanjeev MC14
Arriaga Martinez, Antonio Alejand WB11
Arroyo, Sharon SC14, TD55
Arslan, Dilek TD37
Arslan, Hasan SB50
Arslan, SeÁil TD37
Artiles-Leon, Noel SC30, WD25
Arulselvan, Ashwin SA37, SC37
Arumugam, Ramesh SA35
Asahiro, Yuichi SA16
Asaki, Thomas SD14
Asdemir, Kursad SB56
Asef-Vaziri, Ardavan SD35
Asgharzadeh, Zohreh TD13
Ashley, Mary TC41
Ashuri, Baabak WC45
Aspelund, Audun WC56
Assavapokee, Tiravat SB41, WC39
Asvanunt, Attakrit TB49
Ata, Baris SB40, SD06, MD50, TC50, TD50
Atahan, Pelin SA27
Ataman, Kaan TC26
Atamturk, Alper SC18, WC13
Atasu, Atalay TB03, WB02, WC02
Athanassoglou, Stergios MC12
Atkins, Derek SB01, TC32, WC42, WD22
Atkinson, Michael SC42, MB09
Atlas, Les TA33
Attema, Arthur E. TD20
Au, Tom MC26, MD26
Auer, Robert TD37
Auzenne, A. Michele MA44
Özgün, Meysun TD37
Avis, David MC47
Aviv, Yossi SC51, TB06
Avni, Tayfun (Ty) SD43
Avramidis, Athanassios TD54
Awasthi, Anjali TC32, TD01, WC42
Awaysheh, Amrou TB57
Axsater, Sven SA11
Aydin, Goker SC11, MB10, MD49, TB49
Aydinliyim, Tolga SB03, TA12
Ayer, Turgay SD39

Ayhan, Hayriye TB51, WA19, WB19, WC19
Ayodhiramanujan, Karthik TD33
Aytug, Haldun TD17
Azadivar, Farhad TC42
Azar, Yossi MD38
Azadivar, Justin MA07
Azaron, Amir MD01
Azizoölu, Meral WA11

B

Ba, Sulin TA17
Babaioff, Moshe MA56
Babayigit, Cihan TD46
Babich, Volodymyr MB10, TB45, TC07
Babineau, Timothy WA40
Bach, Francis MC29
Bachman, Tovey TB37
Bacon, Lynd SA38
Badinelli, Ralph TD27
Badiru, Adedeji WB37, WC09
Bae, Suk-Joo WC12
Baek, Jung Woo WC15
Baek, Seung H. TD11, WB26
Baek, Seungkee TA22
Baerlocher, Natalie SC41
Bahsoon, Rami SD43
Bai, Lihui TD36
Bai, Xinxin MD27
Bai, Xue MC54
Bai, Yanqin SD15
Bailey, Angela TA41
Bailey, John MC25
Bailey, Joseph MC57
Bailey, Matthew SA22
Baiman, Stanley SD07
Baiou, Mourad TC53
Bair, Aaron TC42
Bakal, Ismail MA10
Baker, Elisha TB57
Baker, Erin SA21, WA46, WB46
Baker, Kenneth SD04
Baker, Ted SA58
Baker, Tim WA50
Bakir, Niyazi MC08
Bakshi, Nitin SC06, SD08
Balaban, Carey WB35
Balakrishnan, Anant MD32, WC14, WD14
Balakrishnan, Jaydeep TD53
Balakrishnan, N. MA30
Balakrishna, Poornima TC25, WC43
Balas, Egon WA13
Balash, Peter MD46
Balasubramanian, Hari MD39, TA41, TB12, TD41
Balasubramanian, Sridhar MC07, WC06
Balasundaram, Balabhaskar SD13, TC41, TD13
Balcik, Burcu TC08
Balcioglu, Baris WB19
Baldwin, Carliss MC58
Baldwin, Rusty TA57
Baliga, Nitin WA41
Ball, Michael SA55, SD55, MD49, TA55, TC43, TC49, WA55
Ban, Jeff TD34
Ban, Xuegan (Jeff) MD35, TA35
Banal-Estanol, Albert SA46
Banciu, Mihai MA30, MA51
Bandyopadhyay, Shubho TD17
Bandyopadhyay, Tridib SA17
Banerjee, Amarnath SB09
Banerjee, Ritesh TA41, TD41
Bang, Youngsok TC22
Bansal, Matulya TC50
Bansal, Nikhil SC12
Bansback, Nick MD42
Baptiste, Philippe MA12
Bar, Hena TA43, TB43
Bar-On, Isa SD42
Barahona, Francisco TC53
Barajas, Leandro SA30
Barcelo, Jaume MD32
Bard, Jonathan MA34, MC11, TB41, TD19, WD19
Barden, Jeff SC58
Bardhan, Indranil MA58
Bardossy, Gisela SD57
Bare, Bruce SA47
Barkan, Christopher SB52, MC08, TD23, WC36
Barker, Kash TD23
Barlatt, Ada TD05, WD13
Barnes, Andrew MA43
Barnes, Brenda WA49
Barnes, Earl TD43
Barnes, J. Wesley TC29, TD15
Barnhart, Cynthia MA22, MC56, MD55
Baron, Opher MA07
Barquin, Julian TC46
Barrett, Anthony MC21
Bartholdi, John WA19, WC19
Barton, Paul TC48, WB16
Bassamboo, Achal SA54, SB54, SC36, SD49, MC02, MC51, MD07, TD51, WB51
Bassok, Yehuda SA07, MB11
Bastin, Fabian MB14, TC34
Basu, Sandip SC58
Batta, Rajan SD09, MB36, MC53, TA53, TD33, WA53
Batun, Sakine TA41, TD37
Baucells, Manel MA21
Bauer, Joanna SA57
Baumann, Oliver SC60
Bay, Stephen SD27
Bayati, Mohsen MD51
Bayen, Alexandre TA55, TD34
Bayiz, Murat SA59
Baykal, Adnan SC17
Baykal- Gursoy, Melike WD16
Bayrak, Halil SA22
Bayraksan, Guzin SB18, MD15
Bayraktar, Engin WC36
Bayraktar, Erhan WA54
Baysal, Evren TD48
Baz, Mustafa SA13
Beamon, Benita TC08
Bean, James TA16
Bearden, Neil MB23, WD32
Beasley, J E WC45
Beaumont, Nicholas WA57
Beck, Chris SA18, TB28
Becker, Adrian MA43, TC52
Becker, Bill MB23
Becker, Niels MA51
Bedford, Virginia WB35
Bedingfield, John WC09
Bedolla, Hector SA36
Beeman, Gordon WC21
Behan, Deborah TB41
Beier, Eric WC15
Beigman, Eyal MA06
Beil, Damian SC34, SD34, MB10, MD02
Bekiou, Georgia SC40
Bekker, Rene WB23
Beliën, Jeroen TD42
Beling, Peter WC45
Bell, Brad SD29
Bell, Evan MC52
Bell, Gordon SA25
Bell, Michael WC39
Bell, Peter C. SA36, WD51
Bellido, Rafael MB46
Belloni, Alexandre TB29, WC25
Belobaba, Peter MD55
Belotti, Pietro TC13, TD14, WA16, WC14
Ben-Akiva, Moshe WB33
Ben-Gal, Irad MC27, TA30
Ben-Israel, Adi TB53
Benaroch, Michel SD43
Bendavid, Eran SB42
Benecke, Bernard SD41, WB35
Bengtsson, Jens WA01
Benjaafar, Saif SA07, SB03, TB10, TB54
Benkard, C Lanier MA06
Benli, Omer WD38
Bennett, Ashlea MD34
Bennett, Kristin P. SD15
Benneyan, James MD22, WA25
Benson, Hande Y. MB19, WB39
Bensoussan, Alain TA59, TB16, WB07
Benton, WC TB60
Berg, Bjorn TA41
Berger-Wolf, Tanya TC41
Berger, Rosemary MA34, MD44, WB05
Bergman, Dan MA26, WA46
Berk, Emre WB10, WD10
Berkenpas, Mike SA21
Berliner, Michael MC43, TA43
Berling, Peter TD08
Berman, Oded SA53, SD53, MA07, MA53, TA53
Bernknopf, Richard WA23
Bernstein, Fernando TA03
Berry, Jonathan TB18
Bertsekas, Dimitri SC54
Bertsimas, Dimitris SA40, SA45, TA42, TA55, TC06
Besanko, David MA06
Besbes, Omar MD50, TA49
Best, Michael J. TA45
Bethea, David SD14
Bewernitz, Mike WC26
Bhadra, Dipasis MC55, WB43
Bhadury, Joy SD53
Bhandari, Amit MD45
Bhandari, Atul SD40, MC40, TA57
Bhanot, Gyan SA41
Bharadwaj, Anandhi TC17
Bhardwaj, Pradeep WC03
Bhargava, Hemant SD33, TB59
Bhaskaran, Sreekumar SA02, WB58
Bhatnagar, Rohit TC03
Bhattacharjya, Debarun SC21
Bhattacharya, Abhik SD59
Bhattacharya, Arka WB53
Bhattacharya, Kamal MA19
Bhattacharya, Shantanu TC58
Bhattacharyya, Sid TD17
Bhulai, Sandjai SC54
Bichescu, Bogdan TD28
Bichler, Martin MB56
Bickel, Eric MB20, TA21
Bidanda, Bopaya TB08, WA09, WB35
Biegel, Justin MC57
Biegler, Lorenz TC13, WA16
Bienstock, Daniel TA13, TB16
Bier, Vicki SA22, SC09, MD20
Bigras, Louis-Philippe WC37
Bijvank, Marco SB57, WC08
Bilgiç, Taner WB20
Bilgin, Selin WA11
Bilginer, Ozlem WC51
Biller, Bahar SA03, MA59
Biller, Stephan SA30
Billups, Stephen SC41
Bilsel, Ufuk MA08
Bimpikis, Kostas MA50
Bingham, Derek TC30, TD31
Birch, Jeffrey TD25
Birge, John SB06, MA22, MA59, MB41, MC03, MD45, TC15
Bischak, Diane SD23
Bisgaard, Soren MC31
Bish, Doug SB51
Bish, Ebru SB51, WB49
Bisi, Arnab WB07
Bitran, Gabriel SD51
Bjarnadottir, Margret SA40, TC06
Bjorkvoll, Thor WC22
Björndal, Mette TC56
Blackburn, Joseph WC02
Blackstone, Tanja MC37
Blair, Andrew J. WB60
Blair, Montgomery WB50
Blais, Curt TB52
Blake, John SB39
Blatt, Alan TA53
Bleichrodt, Han TC20, TD20
Bliek, Christian SC18
Blomberg, Jeanette MC25
Blomberg, Jodi MC43
Blum, Rick MB57
Blumrosen, Liad TA38
Blumsack, Seth TA46
Bock, Stefan WD34
Bodily, Sam SD21
Bodner, Douglas WC45
Boewe, Sabrina WA60
Boginski, Vladimir TA27
Boguszak, Matej TC41
Bohorquez, Juan Camilo TB57
Boile, Maria MB33, MD33
Bolia, Nomesh SD42
Bollapragada, Ramesh SA36

Bollapragada, Srinivas MA43, TA43, TC27
Bolton, Gary SA23, TA23
Bompard, Ettore F. TC46
Bomsdorf, Felix TA05
Bonami, Pierre TC13, WA16
Bonilla, Ricardo WD52
Bonneau, Richard WA41
Bookbinder, James H. SD34
Booker, Graham TD23
Bora, Selim SB12
Borchers, Brian WA29
Bordley, Bob SD08, SD21, MB16, TA20, WA21
Bordoloi, Sanjeev TC27, WA42
Borener, Sherry WB43
Borgs, Christian MB38
Borkar, Vivek SD54
Boros, Endre SB12, MB13, MC05
Borradaile, Glencora WC52
Borrego, Deirdre SB43
Borror, Connie TB31
Bortfeld, Thomas SB39, SD05
Bosch, Bob WA44
Boston, Kevin SB47
Boubert, Arnaud WD55
Boucher, Randy W22
Bouffard, Francois MD46
Bougnol, Marie-Laure SB22, TB22
Bountourelis, Theologos TC48
Bourez, Guillaume MB52
Bouzdine-Chameeva, Tatiana TD01
Boyabatli, Onur MA03, WA59, WB47
Boyaci, Tamer TA03, TB54, TD03, WB02, WC03, WD02
Boyce, David SC33
Boyd, Andrew WA49
Boyd, Andy MC49
Boyd, Stephen WB29
Boyko, Nikita WC26
Boyles, Stephen WB33
Boyles, Steven TC34
Boylu, Fidan TD17
Bozer, Yavuz SB35
Bozkaya, Burcin SB16
Bracker, Kevin WB48
Bradley, James SA02, WD08
Bradlow, Eric SC02
Braithwaite, R. Scott SC42
Brandeau, Margaret SB42, MB39, MC40, TD09
Brandt, Lisa SC59
Bras, Bert TC02
Braun, Michael SB27
Bravata, Dena TD09
Brayman, Vladimir SD16
Brendl, C. Miguel WD21
Brennan, Alan MD42
Breschan, Jochen WC56
Bresesti, Paola TD46
Brewis, Stephen J TA05
Bria, Frank MB45, WA49
Brice, Pierre TB26
Bricker, Dennis L. MB08
Briers, Robert MA47
Brigantic, Robert SB37, SD41, TA52, TB09
Briggs, D. SA47, IS-M
Briggs, Tony TC60
Brinat, Hernani MC32
Brinkhoff, Andreas MC23
Brinkman, Candy MC37
Briskorn, Dirk TD57
Brockett, Patrick TA27
Brodsky, Alexander TB01
Broekmeulen, Rob WA06, WA08
Brönmo, Geir SA36
Brooks, Paul SD31, MC44, TC26
Brosch, Rainer TD48
Brosnan, Gerard WD12
Brothers, Alan WC21
Brown, David TA14, WB15
Brown, Geoffrey TC54
Brown, Gerald TB09
Brown, Kenneth N. MD01
Brown, Lawrance WA32, WD17
Brown, Marvin WD25
Browning, Tyson SD43, MC58
Bruce, Peter SA24
Brumbelow, Kelly TD23
Brunet, Pierre-Yves TC07
Brynyjolfsson, Erik MC17
Bsat, Mohammad WA01
Bucci, Michael SD28, TB56
Buchbinder, Niv MD10
Buede, Dennis WA37
Bui, Loc TA51
Bukchin, Yossi TA12
Buke, Burak TA15, WC50
Bukkapatnam, Satish TA25, WA30, WD22
Bulbul, Kerem SA57
Bulut, Zumbul IS- T
Bunn, Derek SD46, MA20
Buraparate, Viroj TD28, WA27, WD12
Burer, Samuel SC41, MC29, TD47
Burgess, Robert SA08
Burk, Robin SA20, TB52
Burk, Roger Chapman SA20
Burke, James SD37
Burke, Jim MA14
Burmeister, Katrin WA60
Burns, Laird TA08
Burnside, Elizabeth SB40, SD39, MB31, TA40
Burtraw, Dallas WB46
Bussieck, Michael SB29, WA18
Bustillos, Brenda TB34
Busygin, Stanislav WC26
Butenko, Sergiy SA42, TC41, TD13, WA26
Butler, Renee TA09
Buyukkaramikli, Cagdas WB10
Buyuktahtakin, Esra TD18
Buyurgan, Nebil WC59
Byers, Reynold TD27
Byrd, Richard MA14

C

Caballero, Isabel TC41
Caboussat, Alexandre TC14
Cabrales, Sergio WB22
Cachon, Gerard MB02, MB06, TD06
Cadenillas, Abel TB48
Caglar, Toros SA31
Cai, Gangshu TC38
Cai, Linning WB12
Cai, Ning SA45, TC45
Cai, Tony WD17
Cai, Xiaoqiang SC12, MC12, TA06
Cakanyildirim, Metin TA59, TD32, WB07
Cakmak, Fatih WC57
Calamai, Paul SA09
Caldentey, Rene SB06, SC49, SD50, WA47, WB54
Caliskan, Cenk TC29
Caliz, Rodrigo WD16
Calloud, Valentine WD55
Camdereli, Almula MA11, MC06
Camm, Jeff TB43
Campbell, Ann MC34
Campbell, Dennis TD59
Campbell, James SD41
Campo-Rambado, Miguel SD58
Campos-Nañez, Enrique MC16
Cantor, Murray SD43
Cao, Dingzhou WD52
Cao, Linh IS- M
Capar, Ismail TA01
Caramanis, Constantine TB15
Cardell, Judith WC46
Cardoen, Brecht TD42
Carino, David WC48
Carley, Kathleen WA37, WB35
Carlile, Paul TC60
Carlo, Hector SB35
Carlson, Jean TD09
Carlson, Melanie WA37
Carlsson, John SC53
Carlyle, Matt TB09
Carmona, Rene WD45
Carnes, Tim TD10
Caro, Felipe SB07, SC49, MD47, WA28
Carol, Prahinski TB60
Carr, Gregory WB43
Carr, Robert TB18
Carr, Scott MA25
Carreras, Ben MA46
Carrier, Emmanuel WC43
Carrillo, Janice TB59
Carswell, Lori MC21
Carter, Mike SA39, TD39
Carty, Steven SD47
Casas, Irene MB36, MC53, TC35
Casey, Michael WD15
Cashbaugh, David MC37
Caskey, Kevin SC11
Castanier, Bruno WB31
Castillo, Christopher WC32
Castillo, Ignacio SC38
Castillo, Mario TD48, WA23, WB22
Castro-Neto, Manoel TA25
Catalan, Jaime MD47
Cates, Dewaynna WA01
Caudillo, Luz MA08
Cavalier, Tom TA32
Cavallaro, John MD40
Cavdaroglu, Burak MB42
Cazzol, Maria Vittoria TD46
Cederlund, Jerry MB01
Ceglarek, Darek WB30
Celebi, Emre WC46
Centeno, Efraim TC46
Centeno, Grisselle MC36
Cerda, Ximena TC05, WC22
Cerekci, Abdullah SB09
Cerisola, Santiago MB46
Cerrito, Patricia SA26, IS- T, WC16
Ceryan, Oben SB01
Cesar, Asunur WA17
Ceselli, Alberto MB31
Cetinkaya, Sila SB08, WA02, WA03
Ceyhan, Mehmet IS- T
Cha, Ji-eun TD38
Cha, Kyungduck SB13, MA42
Cha, Meeyoung SB41
Chaar, Wassim WA50
Chabar, Raphael WD39
Chaffe-Stengel, Priscilla WB56
Chahar, Kiran SD51, IS- M
Chakraborty, Santanu SA39, SC31
Chakravarty, Amiya MD11
Chalermkraivuth, Kete MA43
Chambers, Chester MA59
Chan, Ben TB39, WC42
Chan, Ping Shing MA30
Chan, Timothy SA05, SB39, SD05
Chan, Wai Kin Victor WD12, WD33
Chan, Wyean TD54
Chan, Yupo WD41
Chand, Suresh MA31
Chandaver, Nahush SA56
Chandra, Wenny WA31
Chandrasekaran, Aravind TD28
Chang, Chih-Wang TC53
Chang, Gang-Len WA34, WC33
Chang, Juneho MC32
Chang, Kuohao SC31
Chang, Kyunam SD57
Chang, Mou-Hsiung WD16
Chang, Seok Ho TD08
Chang, Seokcheol WA10
Chang, Shaw Ching WC49
Chang, Shing TC25
Chang, Soo Y. SB16, MC32
Chang, Woojin SB45
Chang, Yih-Long WB08
Chang, Yu-Heng TD43
Chang, Yung-Chia MB28
Chao, Raul WA58
Chao, Xiuli MA03, TC07

Chaovalitwongse, W. Art SA41, SB41, MD41, TC41
Chapman, Jarrett TA09
Chari, Manoj MD44
Charnsethikul, Peerayuth TC53
Chaudhry, Mohan TC54
Chauhan, Satyaveer Singh TD01
Chauhan, Satyaveer TB42
Chayanupatkul, Apichat MD33
Chayes, Jennifer MB38
Chayet, Sergio SA06
Chebat, Daniel WD38
Chellappa, Ramnath SD17, TB17
Chellathurai, Thamayanthi TA45
Chelst, Kenneth SC44, TC22
Chen, Argon WD41
Chen, Bintong WC01
Chen, Binyuan MD15
Chen, Chialin WB58
Chen, Chien-Hung SC42, WB35
Chen, Chien-Yu WB14
Chen, Chin-Sheng TD11
Chen, Ching-Yu TD01
Chen, Dipeng SD46
Chen, Fangruo TD06
Chen, Feng SA07
Chen, Frank MA03
Chen, Hao-Wei TA11
Chen, Hong TB51
Chen, Hongyi WA52
Chen, Hui MC34
Chen, Hung-Nan TD12
Chen, Jason C. H. WC49
Chen, Jessica TD40
Chen, Jia SD26
Chen, Jia-Ying WA48
Chen, Jie SC46
Chen, Jing WD51
Chen, Jing WC42
Chen, K. MD13
Chen, Karen TD26
Chen, Kay-Yut SA23, MB07, MC23, MD03
Chen, Li SC07, TC10
Chen, Lichun SC36
Chen, Lijian SA35, WC50
Chen, Li-Ming MA10
Chen, Liwen SA08
Chen, Lucy Gongtao MA11
Chen, Michael TC15, WD15
Chen, Ming MB49
Chen, Nan SC48, MD45, WA45
Chen, Nan MD31
Chen, Ning MA56
Chen, Pei-Chi SB16
Chen, Pei-Yu MA17, WC06
Chen, Rachel MD02, TB59
Chen, Richard SC34, SD34
Chen, Shaoxiang WD08
Chen, Si SB19, SD57
Chen, Victoria MA26, MB26, TB41, WA46
Chen, Wei-da WC02, WC57
Chen, Weiping WA59
Chen, Weiwei WD28
Chen, Wen WB08
Chen, Wenqing TB15
Chen, Wun-Hwa WA28
Chen, Xiang-Feng SB06
Chen, Xin SB03, SC10, MC50, TA14
Chen, Xing TC43
Chen, Yao-Hsuan TC41
Chen, Ye TB52
Chen, Yi-chun WA31
Chen, Yihsu WB46
Chen, Ying-Ju SD02, TD49
Chen, Yi-Su SA01
Chen, Yixin TA42
Chen, Yiyu TA57
Chen, Yiyu WC38
Chen, Yong SD30, MC30, TD13
Chen, YuanYuan TC17
Chen, Yuwen TB59
Chen, Yuxin SD11
Chen, Zhifeng SD13
Chen, Zhi-Long SB12, SD12, MB49, MC50
Chen, Zhixiang TD11
Chen-Ritzo, Ching-hua WA03
Cheng, Chih-Fen SA05
Cheng, Chun-Hung TD53
Cheng, Clark MC52, MD52
Cheng, Feng WC10
Cheng, Hung-Pi WD43
Cheng, Ming WB35
Cheng, Peng WA43
Cheng, Russell WC40
Cheng, Shih-Fen MD16, TD16
Cheong, M.P. SB46
Chernozhukov, Victor WC25
Chertow, Glenn SB40
Chesworth, Bert MB39
Cheung, Ki Ling TD07
Cheung, Kwok WA56
Cheung, Raymond WD14
Chew, Ek Peng SA01, TB01
Chew, Song WA11
Chhajed, Dilip WC58
Chhatwal, Jagpreet SB40, SD39, MB31, TA40, IS- T
Chi, Chih-Lin TA42
Chiam, Tze Chao SC39
Chiang, Ai-Hsuan WA28
Chiang, David WA48, WC28
Chiang, Wen-Chyuan TA32, TD53, WC49
Chih, Mingchang TC42
Chilton, Lawrence SB37, TA52
Chimani, Markus MC18
Chimka, Justin SB31
Chin, Gillian M. WD46
Chinchuluun, Altannar WC26
Chinnam, Ratna Babu SB33, MD27, TB08, WD01, WD48, WD52
Chinneck, John MC13
Chiou, Suh-Wen MA51
Chipman, Hugh TC30
Chiravalle, Vince TD31
Chirkova, Rada TD13
Chiu, George T. C. TA27
Chiu, Yi-Chang SD36, TB34, TD34, WA34, WD35
Chng, K.C. TC09
Cho, Hang-Min WC12
Cho, Hyun W. WB26
Cho, Hyun-Woo TD11
Cho, Jung Jin TD13
Cho, Minho SA49
Cho, Min-Jeong WB60
Cho, Nam Suk MD48
Cho, Nayoung MD53
Cho, Soo-Haeng MB03, TB20, WD21
Cho, Sung-Jin WD39
Cho, Sungzoon SB26, WD26
Cho, Younchol MB48
Chockalingam, Arun TB16
Chod, Jiri MD59
Choi, Byung Chul WB60
Choi, Changhui SC41
Choi, David MB45
Choi, Hyon MD42
Choi, Jaewon MA41
Choi, Min MA05
Choi, Minnseok WB17
Choi, Min-Rak WA57
Choi, Sang Hyun WB26
Choi, Sungyong WD39
Choi, Winston MD27
Cholette, Susan WC56
Chon, Haewon WA46
Choo, Adrian MD23
Choo, Shawn TC33
Chopra, Sunil SC36, SD49, MC02, MD07
Chou, Ching-Ya WA08
Chou, Chun-An TC41
Chou, Yon WA28
Choudhary, Vidyanand SD17
Choudhu, Shabbir SB33
Choueiki, Hisham TD56
Chow, Andy H F WC34
Chrissis, James W. SC37
Christophel, Philipp WC13
Chu, Leon SD03, MD02, TC10
Chuang, Jen-Hsiang WA40
Chuenparsitporn, Phakphoom WB60
Chung, Casey WC07
Chung, Chia-Shin WC12
Chung, Eric WC21
Chung, Kwanghun TC13
Church, Richard MA47
Churchill, Andrew SA55, TC43, WA55
Ciarallo, Frank W. WB08
Ciarleglio, Michael TC29
Cicek, Nermin WA11
Cil, Eren MB06, TB54
Cillo, Alessandra MA21
Cimren, Emrah IS- M
Cinicioglu, Esma Nur SC21
Cipriano, Lauren SB39, MB39, TB40
Cirillo, Cinzia TC34
Claerhout, Diederik SD01
Clark, Kenneth MB43
Clarke, John-Paul TB32, TD43
Clarke, Leon WA46
Clarkson, Douglas TA26
Cleary, Pat WB27
Clemen, Robert SB21
Cobb, Barry SC21
Coene, Sofie TB32
Cohen, Dov TD26
Cohen, Morris TA07, TB07
Cohn, Amy SC34, SD34, SD55, MA39, MD55, TD05, WD13
Coit, David SC30, SD30, WA56
Colak, Arife WC43
Colak, Selcuk TB52
Colby, Darin WB60
Coldren, Gregory TB55
Coleman, Paul SC42
Coll, Joan MA01
Collins, Phil SD37
Collopy, Paul TD43
Colosimo, Bianca TD25
Colvin, TJ WD41
Comeau, Jules MB47
Comez, Nagihan TB11
Commander, Clayton SA37, SC37
Condon, Anne SC56
Conejo, Antonio J. SD46, MB46, TB46
Conerly, Michael MD27
Conitzer, Vincent MA56, TB38
Conley, James WA39
Connors, Daniel MC25
Conrad, Stephen MD09
Consoli, Sergio MB28
Contractor, Noshir WB14
Cook, Jason MB57
Cook, William MC18, MD13
Corbett, Charles SA06, SA59, MA40, WB03
Corbett, Elizabeth WC40
Cordeau, Leo TC54
Cordone, Roberto MB31
Corley, Bill SB26, MA15, MB26, TB38
Cornejo, Oscar TB01
Corominas, Albert WC11
Correa, Jose SC50
Corsi, Tom TA08
Corsten, Daniel SC02, WA06
Cortes, Cristian SD35
Cosares, Steven WB14
Costa, Gustavo WD38
Costantini, Kevin SC48
Coté, Marie-Claude MC28
Côté, Murray TB39
Cotteleer, Mark MC17
Coughlan, Anne TD06
Coulter, Craig WC38
Cowan, Kelly MD01
Cowing, Michelle TB42
Cox, Andrew MD09
Crainic, Teodor Gabriel SA34, MB56, TB33, TC36, WC33
Crama, Pascale WA39
Cramer, Evin SC14
Cranwell, Robert MA37
Creasey, Roy SD48
Creedon, Jeremiah WB43
Crino, Scott TA37
Crissey, Mary SA26, MB43
Croson, David TC32, IS- M
Crossley, William SC14
Cruz, Frederico WC54
Cruz, Jose MB08, WA12
Crystal, Carrie WC49
Cui, Kai TC01

Cui, Tingting SC53, TC16
Cui, Tony Haitao SA07
Cui, Wenbin MB47
Cui, Wentian WC57
Cunha, Claudio SA28
Cure, Laila MB31
Currie, Christine WC40
Curseu, Alina WD10
Curtis, Don WD09
Curtright, Aimee SA21
Cutar, Adriana WB60
Czerniak, Jeffrey SB37
Czerwinski, David TA42
Czerwinski, Mark MD52
Czerwinski, Mary MC19

D

D'Amours, Sophie SC47
d'Aspremont, Alexandre MC29, MD14, TD14
Da, Qingli WC02
Da, Qing-li WC57
Dabrowski, Paul WB46
Dada, Maqbool WC03
Dag, Berrak IS- T
Dahleh, Munther SC50
Dai, Jim TC51, TC54
Dai, Xianchi WD21
Dai, Yue SC01
Daim, Tugrul SB25, WC60
Dalakouras, Georgios WD46
Dalgin, Gul S. SA41
Dalla Pozza, Ilaria TD38
Dallery, Yves SD06, WB23
Dalton, Chris MC21, TA24
Damay, Jean WC33
Damnjanovic, Ivan TD35
Damodaran, Purushothaman TD11
Dana, James MD50
Daneke, Greg WA56
Danna, Emilie SB28, MC13
Darabi, Houshang WC09
Darby-Dowman, Kenneth MB28
Das, Sanchoy WB01
Das, Sanmay TD52
Das, Tapas K. SA46, SD41, TA40, TD46, WD40
Dasci, Abdullah MA51
DasGupta, Bhaskar TC41
Dasgupta, Tirthankar TB25
Dash, Rajdeep MC56
Dash, Sanjeeb MD13
Daskin, Mark SB53, SC36, MA22, MD07, TB56
Dasu, Sriram SB01, TD51
Davenport, Andrew TA28
David, Esther TA56
Davidson, Cliff MB60
Davies, Jane MA58
Davies, Ruth SD48
Davila, Alejandro MA44
Davino-Ramaya, Carrie TB42
Davis, Fred SD21
Davis, Lauren MB28, TA09
Davis, Ron WC35
Davis-Blake, Alison TC11
Davis-Stober, Clintin TB21
Dawande, Milind SC13, MB12, TA28, TB11
Dayanik, Savas TB48, WA54, WD16, WD21
Day, Robert MB56
De Almeida, David MB52
De Frene, Eline MD12
De Giovanni, Pietro TB02
De Grano, Melanie MD39
de Kok, Ton SD10, TB32, MC10, WB10
de la Torre, Sebastian TB46
de Lange, Gertjan MC24, WD29
De Loera, Jes's MA18
De Meyer, Arnoud TB02
De Reyck, Bert SA59, WA20, WA39
De Silva, Dakshina TA56
de Sousa, Amaro SC57
de Vericourt, Francis SC03, MA40, TB41
de Villiers, Francois WB56
de Weck, Olivier WB39
Dean, Brian WC52
Dean, Matthew WA42
Deane, Jason TA52, TB52
Dearing, P.M. TA53
Deason, Paul TC37
Debely, Joelle MA25
Deblaere, Filip MD12
Debo, Laurens SA06, SB54, SD50, MB06, TB11
Dechter, Avi MC59
Dechter, Rina MC28, TC28
Deck, Cary MA23
Deckro, Richard SC37
DeCroix, Gregory SB08
Dedene, Guido WA32
Dedrick, Jason MD32
Deeds, David SA60, SB60
Degraeve, Zeger WA20, WA39
DeGrange, Walt TB37
Deguchi, Takuya TB27
DeGuzman, Michael SD39
DeKay, Frederick SD32
Dekker, Rommert MC33, TD08, WD08, WD36
Delage, Erick SC05
Delaney, James TB31
DeLaurentis, Po-Ching MA39
DeLisi, Charles SA41
Dellana, Scott SC01
Delmelle, Eric TC35
deMatta, Renato SA01
Demeester, Lieven TC02
Demers, Alixandra WD33
Demeulemeester, Erik MD12, TD42
DeMiguel, Victor MB50, MD14, TA50
Demirci, Mehmet C SD39
Demirel, Suleyman WA03
Demiriz, Ayhan WC57
Demirkan, Haluk SA25
Demirkan, Irem SA60, SB60
Dempsey, James MC41
Denardo, Eric MA16
Dencker, John C. SC58
Denegre, Scott SB13
Deng, Geng TC19
Deng, Mingcherng SD02
Deng, Shi-Jie SC46
Deng, Xinwei SD26
Denhard, David SC37
Denizel, Meltem TD08
Dennis, Jr., John SD14
Denton, Brian MB41, MD39, TA41, TD41
Denzel, Wolfgang WC38
Deo, Sarang MA40, WC03
Derby, Steve TA20
Derigs, Ulrich TA05
Desa, Geoffrey SA58
Desai, Jitamitra TD16
Desai, Sumeet SB36
Deshmukh, Abhijit MD57, WB20
Deshpande, Vinayak SC02, WA03
Desmet, Bram WC08
Desphande, Vinayak SA11, SB43
Desrosiers, Jacques WD15
Dessouky, Maged SA36, SD53, MB36, TD09, WD33
Destro-Borgen, Molly TA41
Detemple, Jerome WB45
Devalkar, Sripad MC03
Devapriya, Priyantha TA18, WC11
Dewan, Pooja MA52
Dewan, Sanjeev MA17
Dexter, Franklin SD31, MD40, TD42
Dey, Santanu SD05, MD13, WA13
Deza, Antoine SD15
DeZwarte, Carol TB37
Dhanasobhon, Samita MA17
Dhawan, Atul TD28
Dhumal, Parag WB08
Di Francesco, Massimo TB33
Di Giacomo, Laura WB20
Diaby, Moustapha SA16
Diamond, Herbert TB42
Dias, Luis MC21, TD22, WA21
Diaz, Rafael WD48
Diecidue, Enrico TC20
Diehl, Kathleen SA42
Dieker, Ton TC51
Dietrich, Brenda SC32
Dietz, Dennis WA27
Dillon-Merrill, Robin SC09, MB08
Dimitrakopoulos, Roussos MC47
Dimitrov, Stanko SC57
Ding, Hongwei MA01
Ding, Li WA19
Ding, Qing SB06, TD49, WD49
Ding, Shengwei WD23
Ding, Yu TA31, TC25, TD13, WA30, WC30, WD30
Dinitz, Laura WA23
Dirkse, Steven SB29, SC24, MD18, WA18, WB18
Disraelly, Deena MC09
Diwekar, Urmila TB48
Dobson, Gregory SA59, TC39, TD39, WB31
Dobson, Lan MA46
Dobzinski, Sharar TA38
Dodek, Peter WC42
Dodin, B. WD14
Doebbeling, Bradley SC39
Dogan, Gokhan MA23
Dogan, Ibrahim TB08
Dogru, Mustafa TB10
Dolinskaya, Irina S. TD37
Dong, Jin SD26, MA01, MD27, TB27
Dong, Jing TB34, WB36
Dong, Lingxiu SB06, SB11, MA02
Dong, Thomas MD44
Donndelinger, Joseph A. SA38
Donnell, Michael SB37
Donohue, George MB55
Donohue, Karen SA07, TB54
Donoso, Macarena TC53
Donovan, Geoffrey SD47
Dooley, Kevin SA01, WB08
Doraszelski, Ulrich MA06
Dorociak, Robin WB60
Doro, Lisa TC42
Down, Douglas G. WB19
Down, Douglas SA54, MA54
Downey, Douglas SB20
Downward, Tony MC46
Doyle, John TD09
Drake, Matt SD44, TB57, WB44
Drev, Matej MB60
Drew, John TA19
Drew, Shane SB48
Drexler, Jonathan WB43
Drezner, Tammy SA53
Drezner, Zvi SA53, MC53
Driscoll, Patrick SA20
Droge, Cornelia MC17
Dror, Moshe SA10, SB03
Druehl, Cheryl MB03
Drury, Colin SD09
Drzymalski, Julie MD08
D'Souza, Gypsyamber WB42
D'souza, Rosskyn TC52
D'Souza, Warren SA40, WB42
Du, Donglei MA30
Du, Lili WA33
Duan, Peng SB55
Duan, Rong MC26
Dube, Parijat MA50, MD54
Dubosson, Magali MA25
Dubrawski, Artur TD26
Duenyas, Izak SB01, MD59
Duggasani, Amar R. SA51
Dugundji, Elenna MC36, MD36
Duke, John MB37
Dulá, Jose SB22, TB22
Dumais, Susan SB20
Dumrongsiri, Aussadavut WC03
Dunagan, Sean WD08
Durango-Cohen, Elizabeth MD11
Durango-Cohen, Pablo WA35
Duran, Serhan SB51, TC08
Duriseti, Ram MA41
Duthie, Jennifer TA35, TD35

Dutta, Goutam TD42, WD22, WD49
Duvvuri, Sri SC38
Dybvig, Alan SC38
Dyer, James TB20

E

Eapen, Gill SB45
Easton, Fred TC12
Easwaran, Gopalakrishnan WA02
Ebrahimi, Nader SA31
Ebrahiminejad, Mehdi TA22
Eck, Brian MC48
Eckhause, Jeremy WA22
Eckstein, Jonathan TB18
Edirisinghe, Chanaka SA45, MD45
Ee, Mong Shan WA22
Eesley, Chuck SD60
Eesley, Dale SA58
Ehrlichman, Samuel SB48
Ehrman, Chaim M. WC35
Eichinger, Alissa TB23
Eiselt, H.A. SD53
Eisenstein, Donald WA19, WC19
Eitel, Dave TB39
Ekici, Ali TB12, WA40
Eksioglu, Burak MB34, TA01, WC36
Eksioglu, Sandra Duni SD36, MA01
El Ghaoui, Laurent MC29
El Ouardighi, Fouad MC01
Elahi, Ehsan TB54
Elazmeh, William TC39
Elble, Joseph TD18
Elefteriadou, Lily SC37
Elhafsi, Mohsen TB10
Elhedhli, Samir TA29, TD56
Eliman, A.A. WD14
Elkins, Tim WA22
Elmaghraby, Wedad SC23, SD56, MB23
El-Nashar, Ahmed TD53
Elrod, Terry TA56
Elsayed, Elsayed SB30, MC30
Elwany, Alaa SA30
Emanuele, Jonathan TA39
Emmerich, Wolfgang SD43
Enders, Johannes MA46
Enders, Paul WA47
Enders, Robert TB53
Endicott-Popovsky, Barbara SC17
Engau, Alexander WA14
Engelbrecht-Wiggans, Richard SC23
Engineer, Faramroze TC35, WA40
Enkemann, Steven TA40
Enriquez, James TB23
Entriken, Robert TD46
Epe, Alexa MC18
Epelman, Marina A. SC57, MB41, TD16, WD16
Epstein, Rafael MD47, WA47
Erat, Sanjiv WA58
Erbetta, Fabrizio WC43
Ercetin, Ozgur SA57
Erden, Zeynep TC60
Erdogan, Sevgi TB34
Erenay, Fatih Safa SB40, TD12
Erenguc, Selcuk TB59
Erera, Alan SA35, SB34, SC34, MB33, MC34, MD34
Ergun, Ozlem SB34, SC34, SD49, MA36, TB12, TC29, TC33, WA39
Erhun, Feryal SD02, MB07, TB03, TC08, WA59, WC51
Erickson, Gary WC04
Erkin, Zeynep WA09
Erkip, Nesim SB08, WB10
Erkoc, Murat TA11, WD32
Erlebach, Thomas MB12
Erlwein, Christina WB15
Ersoz, Suleyman WA11
Ertek, Gurdal WC57
Ertem, Alp WC59
Ervasti, Valtteri WD56
Ervin, Fred SC55
Erway, Jennifer TC14
Eryarsoy, Enes WC57
Erzurumlu, Sinan WA58
Eschenbach, Ted TB57
Eschrich, Steven TA40
Escudero, Laureano SC47
Esenduran, Gokce WB02
Esensoy, Ali Vahit TD39
Espinoza, Daniel TA47
Espiritu, Jose WA56
Esserman, Laura TC21
Estellita Lins, Marcos TB22
Eswaran, Hari WD41
Etesami, Omid MB38
Ettl, Markus WC10
Evans, Diane TA19
Evans, Gerald MA35
Even, Andrew SB33
Evgeniou, Theodoros SB27
Eynan, Amit SB11
Eze, Felix MD26

F

Fabian, Csaba WA15
Fabrikant, Alex MD38
Fabri, Peter MB31
Fagerholt, Kjetil MC32
Faissol, Daniel SD40
Fajardo, David TA34
Fan, Huiyuan MA26, WA46
Fan, Miao MB08
Fan, Ming SA49
Fan, Neng MD41
Fan, Wei WC34, WD36
Fan, Ya-Ju SA41
Fan, Ying TB60
Fan, Yueyue SC36, SD33, MD36, TA36, TC36
Fang, Haw-ren TC14
Fang, Liping SA01
Fang, Shu-Cherng WC29
Farahat, Amr SC50
Farias, Vivek MD50, TD50
Farion, Ken TC39
Farra, Gabe MD52
Fathi, Yahya TB05, TD13
Faulin, Javier TA32
Faulkenberg, Stacey L. SB09
Fayed, Asser SC60
Fearing, Douglas TA55
Federgruen, Awi SC03, SD07, MB10, TD03
Fei, Jun MA16
Feinberg, Eugene MA16
Feldman, Ronen MB27
Feldman, Zohar MB25
Felli, James TD21
Fenelon, Mary MC13, WA18
Feng, Annabelle SA08, WB07
Feng, Baichun SD51
Feng, Hanhua MA54
Feng, Haolin SA11
Feng, Liming WA45
Feng, Qianmei (May) SC30
Feng, Youyi MB49, TC07
Ferguson, Jennifer TD36
Ferguson, Mark SA02, TC59, WB03, WC49, WD02
Ferreira, Kevin WD49
Ferreira, Placid MD30
Ferrell, William TA18, WC11
Ferrer, Juan-Carlos SD51
Ferris, Michael SD18, MD35, TC19
Fifarek, Brian MB60
Figliozzi, Miguel SB34
Figueiredo, Paulo SB23
Filev, Dimitar WD52
Fischbeck, Paul MA53
Fisher, Meredith MA53
Fixson, Sebastian TB50, TD60
Flanigan, Marie TA53
Fleischer, Lisa SC12
Fleischhacker, Adam TC38
Fleischmann, Moritz W02
Fleming, Lee MA60, TB58
Fleten, Stein-Erik SD46
Flood, Derek WC27
Florian, Michael WA36
Fodstad, Marte TA01, TC56
Fogliatto, Flavio WC25
Fontanesi, John TD40
Ford, Andrew TC46
Ford, Justin MA37
Forehand, Garlie WD44
Foreman, John TC03
Forman, Chris MB60, MD17
Forrester, Richard SC16
Forsgren, Anders SD14
Foster, Michael SD42
Fotopoulos, Stergios TC48
Foulk, Victor SC29
Fourer, Robert SA29, SC24, SC29, SD29, MC44
Foutz, Natasha SD27
Fowler, John SA35, SC01, TA41, TB12, WB11, WC11, WD19
Fradkin, Yakov TD05
Fragniere, Emmanuel MA25
France, Stephen WA38
Francis, Peter WA19
Franden, Michael TD24
Frangioni, Antonio TB29
Frank, Paul SC14
Frankenfield, David SC39
Fransoo, Jan WA06, WD10
Fraley, Chris TB27
Frazier, Peter TB48, WD21
Frederick, Shane TC20
Frei, Frances TD59
Freiesleben, Johannes WC28
Frejinger, Emma WB33
French, John SC40
Fresnedo, Roman TD55
Freund, Robert MB44
Fricker, Ronald (Ron) TB09
Fridgeirsdottir, Kristin TA50, TC49
Fried, Jeremy SD47
Friesz, Terry SB15, SD25, SD51, TA08
Frincke, Deborah SC17
Frisk, Mikael SC47
Froehling, Magnus TB53
Frommer, Joshua SC14
Fry, Michael SB35
Fry, Mike TD28
Fu, Michael SA19, SA48, SB27, SB48
Fu, Qi TA06
Fu, Xiaowen SD32
Fuchs, Erica TC60
Fuchs, Regina SC08
Fujisawa, Kaori MD33
Fujisawa, Katsuki WA29
Fukasawa, Ricardo MC18, MD13
Fukuda, Mituhiro WA29
Fukunaga, Alex TD54
Fukushima, Masao TB14
Fuller, David TB46, WC46
Fuller, J. David TD56
Fulton, Lawrence V. WC16
Fung, Glenn TA42
Furman, Jeffrey L. SC60
Furman, Kevin SD19
Furmans, Kai TD33
Furrer, Clint MA37
Furuta, Takehiro MC53, TA53
Fussell, Susan WC21
Fylstra, Daniel TC24, WA51

G

Gabraeel, Nagi SA30
Gabriel, Steve TB46, WB46
Gai, Jing TC54
Gaimon, Cheryl SD60, MB58, MD60, WA58
Gajpal, Yuvraj WD34
Galanis, Eleni MD42
Galati, Matthew TA29
Galbreth, Michael WC02, WC27
Galenko, Alexander SC45
Gallego, Guillermo TA49, TC49
Gallien, Jeremie TC03
Gal-Or, Esther MA51
Gamache, Michel WC37
Gamarnik, David TA54
Gamvros, Ioannis SA05
Gan, Chee-Peng TA48
Gan, Xianghua SA32
Ganesan, Rajesh TC25, WC43
Ganesan, Shridar SA41
Ganesan, Vikram WA25
Ganguly, Sandipan TD14

Ganji, Moein SA55
Gans, Noah SC06, SD06, MB25
Gao, Fei MA03
Gao, Hongman SC28
Gao, Huina MD49
Gao, Long TB10, TD01
Gao, Song WB33
Garces, Edwin WB60
Garcia, Alfredo MC16
Garcia, Hugo WC32
Garcia-Bertrand, Raquel TB46
Garcìa-Llinás, Guisselle WD48
Garcia-Ortega, Justo TA32
Gardner, David J. WB09
Gardner, Lauren TA35
Garfinkel, Robert MB17, WD41
Garg, Miti WA01
Garman, Stephanie WA57
Garrity, Robert MC53
Garrow, Laurie TB55
Garud, Raghu SB58
Gass, Saul I. SC32
Gates, Buhrman TB52
Gaukler, Gary MC06
Gaupp, Marty MC47
Gaur, Vishal SB07, SC02, WA06
Gautam, Natarajan SB31, TA57, WB23
Gauthier, Stephen TD32
Gaver, Donald TA37, TC09
Gavirneni, Srinagesh SD11, MA11, MB07, MC11, TA23, WB06, WB08
Gazelle, Scott SB39
Ge, Deng TB01
Ge, Dongdong SB53
Gebraeel, Nagi SC31
Geiger, Christopher TA09
Geismar, Neil SB12, TA28
Geistauts, George TB57
Gel, Esma TB12, WD19
Gellrich, Mario WB56
Gemici, Banu MD16
Genc, Talat SA56, MD46
Gendreau, Michel SA34, SB19, MB56, WC33
Gendron, Bernard MC28, MD28, TB29
Geng, Qin SB02
Geng, Rui WA43
Gentry, Sommer E. SA40, TC06
George, Ronny WC39
Gerchak, Yigal SB03
Gerdes, Jr, John H WD37
Gerding, Enrico MC56
Gerdsri, Pisek WA52, WC60
Gerrard, Ross MA47
Gershwin, Stanley B. TD08
Geunes, Joseph MA10, MB53, MC50, TA01, TC16
Ghacibeh, Georges WC26
Ghandehari, Mostafa WC34
Ghate, Archis TB05, TD16, WC28
Ghazarian, Richard WD46
Ghim, Cheol-Min WB41
Ghose, Anindya SC38, MD17
Ghosh, Arpita MA56
Ghosh, D.K. TD42
Ghotbi, Sina SA38
Giachetti, Ronald TC27
Gibson, Matthew TC57
Giesen, Ricardo SC34
Gifford, Ted WD28
Gift, Tom MA40
Gilat, Dagan MB25
Gilbert, Robin C MB42
Gilbert, Steve SA02, SA08
Gill, Philip SD14, TC14, WA14
Gill, Ryan WC16
Gilland, Wendell MB10
Gillen, David SA55
Gillison, Maura WB42
Gilmore, Elisabeth TD56
Gilpin, Andrew SA15, SB15, MA56
Gino, Francesca MD23
Ginsburg, Hilla TA30
Girotra, Karan MA60, TB06
Glance, Natalie MC23
Glasser, John WA40
Glasserman, Paul MD45, WA45
Glässer, Uwe MA48
Glazebrook, Kevin TA37, WA19
Glen, Andrew TA19
Glover, Fred MA28
Glowacka, Karolina WC09
Glynn, Peter MD51
Gneiting, Tilmann TA21
Goel, Ankur WA47, WB58
Goel, Piyush SB31
Goel, Sanjay SC17
Goerger, Niki TB52
Goic, Marcel MD47
Goings, Janet WA05
Gokce, Elif Ilke TA29, TB13
Gokpinar, Bilal WB58
Golaszewski, Rich WB43
Goldbach, Michael MB51
Goldberg, Andrew TB32
Goldberg, Noam MD27
Goldenberg, Jacob MB27
Golden, Bruce SB19, MD32, WA40
Golden, Linda TA27
Goldfarb, Donald WA14
Goldner, Dan WB43
Goldsman, David SA48, SC31, SC44, SD44, MD48, TD40
Goldstein, James SD43
Golias, Michail MB33
Golmohammadi, Davood SA45, SB41, WD14
Golovnya, Mikhail MD24
Gomes, Carla MD28
Goncalves, Paulo SB23
Gonen, Rica IS- M
Gong, Jing TB29, WB35
Gong, Lixin TA26
Gong, Liying WA35
Gong, Qiang SD13
Gong, Yan SA58
Gong, Yeming TA10
Gongireddy, Shravanth SD13
Goodale, John TC12
Goodchild, Anne SB52, MD33, WB55
Goossens, Nico WD54
Gopal, Anandasivam TC17
Gopalakrishnan, Mohan TA41
Gopal, Ram SB17, MA27, MB17
Gopalappa, Chaitra TA40
Gordon, Jonathan MB27
Gorman, Michael SB52, MC52
Gormley, Kevin WD47
Gortner, Ross SC33
Gosavi, Abhijit TD38, TD52
Goswami, Manisha TC45
Gotoh, Jun-ya MC45
Goul, Michael SA25
Goulding, Christian WA54
Goundan, Pranava SC16, SD05
Gouveia, Luis SA28, SC57, SD57
Govan, Anjela SA26
Govetto, Sophie TC02
Govil, Vaibhav SC52
Goyal, Manu MC02, MD59, TD59
Goyal, Vineet SA16
Goycoolea, Marcos SA47, MC18, TA47
Gozun, Brian TD23
Grabbe, Shon TC55
Grady, Nancy TD26
Grage, Sandie WC37
Graham, Michael WB43
Graham, Thea MC55
Granados, Nelson TB17
Grande, Darby IS- T
Granger, Julien WD54
Granot, Daniel TD03
Granot, Frieda MC05, TD03
Grant, Michael TA43, TB43, WB29
Grant, Paul MC43, MD37
Granville, Sergio WD39
Grasas, Alex SB07
Grauer, Robert R. TA45
Graves, Greg WC53
Graves, Stephen TB11, WD08
Gray, Genetha SB14, MC48
Gray, John SB59
Grechuk, Bogdan WB2
Green, Linda MC40, TD41
Green, Robert MA15
Gregg, Melissa TA41
Greif, Chen SD14
Greistorfer, Peter SB28
Gresh, Donna MC25
Greulich, Francis MB47
Gribkovskaia, Irina TA32
Griffin, Joshua SB14, SD14, TC14
Griffin, Paul SD40, MA40, MB50, MC50, WB40, WD44
Griffith, Bartley WA40
Grobler, Jacomine SD01
Groenendaal, Huybert MA24, TD48
Groenevelt, Harry SD49, MC02
Groer, Chris SB19
Groessler, Andreas SB23
Grönkvist, Mattias MB52
Grossmann, Ignacio TC13, WA16, WC13
Grossman, Thomas WD44
Groznik, Ana WB06
Gruber, March SC58
Gruenert, Tore TA02
Grunden, Naida SC59
Grushka-Cockayne, Yael SA59, TD22, WA20
Gu, Qian WB60
Gu, Qun WC12
Gu, Wenjun TC27
Gu, Zonghao SB13, MC13, WA18
Guan, Xiaohong WA43
Guan, Yongpei MA13
Guardiola, Ivan MB57, IS- M
Guardiola, Luis SA10, SB10
Guarracino, Mario R. WA26
Gue, Kevin SA34, SC35
Guerra, Andres WB16
Guerrero, Hector SA02, WD08
Guha, Suchandan WD45
Guide, Jr., V. Daniel R. TD02
Guide, Dan WD02
Guidry, Caroline TC02
Guignard, Monique SA13, SC47
Guikema, Seth TA52, TD23, WB22
Gul, Serhat TA41
Guldemond, T.A. WA12
Guler, Kemal MB56, TB54
Gülez, Taner TD37
Gumus, Mehmet WB49
Gunasekaran, Senthil TC32
Gunday, Gurhan WB57
Gundersen, Elisabeth TA33
Gundersen, Truls WC56
Guner, Ali Riza SB33
Guner, Ali SB33
Gunes, Evrim Didem TB42
Gung, Roger R. WA49
Gunluk, Oktay MD13
Gunn, Eldon SA47, SB47
Guo, Andy WA48
Guo, Huairui SB30
Guo, Jessica SC33
Guo, Mingyu MA56
Guo, Pengfei SD02
Guo, Zhiling WB48
Gupta, Alok TB17
Gupta, Anupam SA16
Gupta, Ashish MC19
Gupta, Diwakar TA11
Gupta, Kapil MA41
Gupta, Maya MB28
Gupta, Narain WD22
Gupta, Sudheer SB38
Gupta, Varun SC12
Gurbuz, Mustafa Cagri SB01
Gurgur, Cigdem TD48
Gurkan, Gul SC46
Gurkan, Korhan TB50
Gurler, Ulku WB10
Gurnani, Haresh TA03, TA11
Gursoy, Kemal TD29, WD16
Gurvich, Itai SB54, SD07, MB25, TA07, WB54
Gusikhin, Oleg TD05
Gustafsson, Janne WC48
Gutierrez, Alfonso TA39

Gutièrrez, Gabriel TB01
Gutierrez, Genaro TB11, WA47
Gutierrez, Marco A TC08
Guvenc, Gulbanu WA09
Guvenen, Orhan WC59, WD20
Guyse, Jeffery SA53
Guzelsoy, Menal SA13, SD18, MA29
Guzmán, Luceny WA42
Gwebu, Kholekile WD56

H

Haddad, Bashar WC09
Hadzic, Tarik MD28, TC28
Haessler, Robert TC32
Hafer, Lou MA29, WB18
Hagberg, Aric WB14
Hager, William MA14
Hagstrom, Jane SD33
Hagtvedt, Reidar WB40
Hahn, Warren TB20
Haight, Robert MA47
Haimes, Yacov TC23, TD23
Hajiaghayi, Mohammad Taghi MC38
Haji, Maryam WC09
Haksoz, Cagri MA03
Hall, Nicholas G. SA12, SD12, MC12, MC50, MD04
Hall, Randolph SA22, MD33, WC15
Hall, Shane SA16, SA40, WC40
Halman, Nir TD15
Halog, Ph.D., Anthony TB22
Hamann, Jeff SB47
Hamaoka, Yutaka WB57
Hamdouch, Younes MC35
Hamil, Jonathan T. SC37
Hamlin, David B. WB37
Hämmäinen, Heikki MA44
Hammer, Peter MB13
Hampshire, Robert MC54, MD54
Han, Ingoo WB17
Han, Jiawei MD26
Han, Junghee SD57
Han, Lee D. TA25
Han, Shu MC59
Han, Song WB38
Han, Sung-soo WD17
Han, Yoo-Jin TB08
Han, Yunetech SB16
Hanany, Eran TA12
Handley, Sean TB60
Handschin, Edmund MC18
Hang, Darren TD55
Hann, Il-Horn MC58
Hanna, Arthur MC42
Hanna, Rosine WA52
Hannah, Lauren WD47
Hanowsky, Michael MA55
Hans, Erwin TA32
Hansen, Mark TC43, MA55,
Hanson, Donald MD46
Hanson, Jesper MB52
Hao, Jing MA27
Haphuriwat, Naraphorn SC09
Harahush, Shawn MA24
Haralson, Scott WC43
Harback, Katherine(Kate) MC55
Harchol-Balter, Mor SC12, TA57
Hardgrave, Bill MC39
Hardin, Jill SD19, WD44
Hardin, Michael MD27
Hargreaves, Jeremy TA46
Harjunkoski, Liro WB12
Harker, Kemp SC55
Harmon, Robert MD01, TC38
Harney, Robert TB09
Harper, Steven WB14
Harrington, Michael WA40
Harrison, Terry MB59, WC28, WD19
Harrod, Steven SB52, SD52, TB29, WD27
Harsha, Pavithra MC56
Hart, Gary SB15
Hart, Thomas P. TB23
Hart, William MB29, TB18
Hartley, Dean TC37
Hartman, Bruce C. SB03
Hartman, Gregory SB37
Hartman, Joseph MD34, TD18
Hartvigsen, David WB13
Haruvy, Ernan SB56, SC23
Hasan, Imran SB39
Hasan, Shahab WB43
Hasenbein, John TA15, TA51, TC54
Hasija, Sameer TD59
Hassan, Ahmed WB55
Hasselberg, Erik MB52
Hassell, Harrison WC16
Hatch, Nile SA60, SD60, TB60
Hatfield, David WA37
Haug, Peter SC01
Haugland, Dag SA57
Haviv, Moshe SA10
Hazen, Daniel SD37
Hazen, Gordon TC21, TD22
Hazen, Megan MB28
He, Miao MC41
He, Polly Biyu MD40
He, Xiao-Zheng MC35
He, Xiuli SD11, TB11
He, Yang TD56
He, Yuanjie SA11, MD08
He, Yu-Tong MA54
Healey, Christopher SA48
Heath, Garrett WD08
Heath, Jeffrey SB27
Heath, Susan MC11, TC40, WD13
Heching, Aliza TD59, WD59
Hedgepeth, Oliver TB27
Heese, Seb SA02, SD01, MC06, WB06
Heidelbaugh, Clark MB37
Heier, Jessica MA36, WA39
Heimann, David WC38
Heinimann, Hans Rudolf WB56
Heitz, Christoph MA25, WA06
Hellemo, Lars TC48
Helton, Cary SC52
Henderson, Dale WC18
Henderson, James TA08
Henderson, Shane SB48, MA39
Hendricks, Kevin MB02
Hengartner, Nick TC30
Henk, Russell SD36
Henrie, Morgan TB27
Henrion, Max SB24
Henry, Miguel SC47
Heragu, Sunderesh SC35, MA35
Herbots, Jade MD12
Herbranson, Travis SC37
Herer, Yale MC10
Hernández, Salvador SA33
Hernandez-Ramirez, Paola A. SC30
Herndon Ford, Kelley TD26
Herring, Ryan TD34
Herrmann, Jeffrey W. SD31, MA31, MD58
Herroelen, Willy MB04, MD12
Hers, Sebastiaan TA46
Hertz, Alain MD28
Hespanha, Joao TB35
Hess, Stephen TD15
Hesterberg, Tim TB27
Hesterly, William WB32
Hewitt, Mike MC34
Heyde, Chris TB45
Heynoski, Katherine WB28
Hezi, Mor MD58
Hibiki, Norio MC45
Hickey, Shauna WC42
Hickman, Mark SD36, MC36
Hickman, Randal WD22
Hicks, Illya SA42, SD13, TD13
Hicks, Katherine A TB40
Hidding, Gezinus WD09
Hietala, Vince MA37
Higdon, Dave TC30
Higle, Julia L. SA51
Hild, Matthias SC23
Hildrum, Kirsten SC12
Hill, Craig SA08, MB01
Hill, Shawndra SB05
Hill, Stephen MB34
Hill, Tom SA60
Hillier, Frederick S. WB04
Hillier, Mark S. WB04
Hino, Celso MC32, WD38
Hinrichs, Curt SA24
Hirose, Hideo TB27
Hirsch, Michael SA37
Hitt, Lorin MC07, WB59
Hjorring, Curt WC55
Hlouskova, Jaroslava TA45
Ho, Sin MB28
Ho, Teck-Hua SA07
Hoad, Kathryn SD48
Hobbs, Benjamin TA46, WB46
Hochbaum, Dorit MB13, WD59
Hoda, Samid SB15, WB12
Hodge, Lee TD21
Hoffman, David TA48
Hoffman, Karla MB55
Hoffman, Robert WD55
Hogan, Brendan MC55
Hogg, Tad MC23
Hohmann, Samuel TB26
Holdeman, Eric MC09
Holder, Allen SD19, MC42, WA44, WC41
Holender, Michael WB37
Holenstein, Thomas TA38
Holgiun-Veras, Jose TD36, WD35
Hollis, Stacey MB28
Holtfreter, Robert MD26
Holz, Franziska TB46
Homem-de-Mello, Tito SA50, SB48
Hommes, Qi WA05
Hong, I-Hsuan WD07
Hong, Jeff SA48, SC31, SC48, WA28
Hong, Seockjin SC11, MA01, TA22
Hong, Soondo SB35
Hong, Sung-Pil WD39
Hong, Yoon WA37
Honhon, Dorothee SA03, SC49
Honma, Yudai IS- T
Hooker, John MC28, MD28, TC28, WB12
Hooper, Duane WB27
Hopp, Wallace MC22, MC60, MD07, WB58
Hora, Manpreet MC59
Horsburgh, Stuart TA60
Horvitz, Eric SB20
Hosking, Jon SC38
Hosseini, Shaudi WA40
Houck, Chris WA32
Hough, Patricia TC52
Houghtalen, Lori SD49
Howard, Ronald MB20
Howle, Victoria TC52
Hsu, Vernon Ning SB12
Hu, Guiping TB08
Hu, Jack SB11, SC11
Hu, Jianli MA11
Hu, Jianying WD19
Hu, Jian-qiang WB39
Hu, Jiaqiao SA48
Hu, Jing SD15
Hu, Ming MB49, TB49
Hu, Shanshan MC46, TB03
Hu, Xinmin MC46
Hu, Xinxin SA02
Hu, Ye WD56
Hua, Stella SC01, TB02
Huang, Chikong TC53
Huang, Dan SA49
Huang, Huei-Chuen MC48, TD01
Huang, Hueng-Ming MA45
Huang, Kai WB10
Huang, Kenneth TD60
Huang, Ke-Wei SD02
Huang, Min TC21
Huang, Paul WA51
Huang, Ping Heidi SC13
Huang, Pu WC10
Huang, Qiang MD30, TA30, TB25
Huang, Rongbing SA43, SB53, MA51
Huang, Shan SC33
Huang, Simin WB12
Huang, Sui SD15
Huang, Tingliang TB10
Huang, Wenzhen WB30
Huang, Xiao SD03
Huang, Xiaolei TA42
Huang, Xin TB11
Huang, Xuan MC31
Huang, Yongxi TA36
Huang, Zan SC27
Huberman, Bernardo MC19,

MC23, MC58, MD03
Huchzermeier, Arnd TD48
Huckman, Robert MA58
Huggins, Eric TC57
Hughes, Danny WA22
Hughes, Ed MD24, MD44
Hughes, Richard TC42
Huh, Jaeyung SB45
Huh, Woonghee Tim SB50, SD50, MA10, TA59, TC10, WA07, WB49
Hui, Ng Szu WC25
Hulett, Maria de Lourde TD11
Hum, Marcus TC03
Hung, Cheng-Huang SB16
Hung, Hui-Chih SA12
Hung, Kuo-Ting TA59
Hung, Ying TB31
Hunsaker, Brady SA13, MB18
Hunter, George WB43
Hunting, Marcel WA14
Huo, Xiaoming SC46
Huque, Mohammad WD25
Hur, Mansik WC08
Hurink, Johann MB12, WA12
Huschka, Todd MD39, TA41
Hutson, Kevin WC14
Hutton, David SB42, MB39, TD09
Huzurbazar, Aparna MA37
Hvattum, Lars SA28
Hwang, Hark-Chin WC07
Hwang, Jerry SB43
Hwang, Seong-Seob SB26
Hyde, Anthony MA44
Hyde, Valerie SD27

I

Ichoua, Soumia WD33
Ieong, Samuel MC56
Ierapetritou, Marianthi WB16
Iida, Tetsuo WC01
Iliadis, Niko WD39
Iliescu, Dan TB55
Illes, Tibor SC15
Illig, Anthony SB37
Ilvonen, Karita TC39
Im, Cheolsoon WC58
Imbeah, William WB22
Immorlica, Nicole MA56, MB38
Inakawa, Keisuke WD34
Inaltekin, Hazer SA45
Ingalls, Ricki MC48
Insuwan, Phantipa TB38
Ionova, Irina SB43
Ipeirotis, Panos SC38
Iravani, Seyed MA34, MD07, TC07, WB58
Irony, Telba TD21
Isen, Alice MB07
Islegen, Ozge WB03
Iyengar, Vijay SC43
Iyer, Ananth. V. SB43, WA03
Iyigun, Cem TB53
Izraelevitz, David WB14

J

Jabali, Ola TB32
Jacobs, Patricia TA37, TC09
Jacobs, Timothy L. SD55
Jacobson, Sheldon H. SA16, SA40, SD09, MB36, WB40, WC40
Jacquez, Ricardo MA44
Jafari, Mohsen SA45, SB41
Jaillet, Patrick SC34, WB33
Jain, Aditya MC02, WA07
Jain, Ankit MD54, WA48
Jain, Ankur WB42
Jain, Apurva SC07, WC03
Jain, Kamal MB38, MD38
Jain, Rahul MA50
Jain, Sanjay SA58
Jaller, Miguel WD35
Jalora, Anshu MB51
James, Tabitha MA28
Jammernegg, Werner SA08
Janakiraman, Ganesh TA59, TC10, WA07
Jandhyala, Krishna TC48
Jang, Dong Won MC33
Jang, Wooseung MA34
Jang, Yunho SA42
Janjarassuk, Udom MC15
Jank, Wolfgang SB27, SD27, MD25, TA56
Janssen, Renè TD37, WB37
Jarosinski, Greg WD28
Jarrah, Ahmad MA34
Jaruphongsa, Wikrom WC07
Javidi, Tara MA50
Jayanthi, Shekhar MC59
Jayaraman, Raja WA25
Jayaraman, Vaidy WA50
Jayaswal, Sachin MB51
Jeddi Babak WA43
Jeffcoat, David SA37, MB15
Jefferson, Thomas TD14
Jeffery, Mariah TB23
Jenni, Karen SA21, SD20, MD20
Jennings, Nicholas MC56, TA56
Jennings, Otis MC54, TB41, TD51
Jennings, P. Devereaux SB58
Jensen, Bo MA15, WB29
Jensen, Willis TD25
Jeon, Soo Min MC33
Jeong, In-Jae WC12
Jeong, In-jun WD17
Jeong, Myong K. (MK) TA25, TD11, WB26
Jeong, Sangwon MC32
Jeong, Young S. TA25
Jerath, Kinshuk SA50
Jernigan, Stephanie MC52
Jessup, Eric MD33
Jetter, Antonie SB25, TD60
Jewkes, Elizabeth MB51
Jha, Krishna MA52, TC29
Jha, Sanjeev IS- T
Ji, Xiaoyun MA52
Jia, Zheng TD02
Jiang, Houyuan MC51
Jiang, Li MB11, TA11
Jiang, Lixiang TC27, WC17
Jiang, Wei MC26, TB26
Jiang, Wei SB26
Jiang, Xiaoyue MA30
Jie, Pan TB01
Jimenez, Bertha WB60
Jin, Judy TA25, TC31, TD25
Jin, Mingzhou WA42, WD38
Jin, Nong TA30
Jin, Ran MD31
Jin, Yanhong WB38
Jin, Yue WA02
Jing, Bing SD11
Jirutitijaroen, Panida TA15
Jittamai, Phongchai MB28
Joglekar, Nitin SB23, MA58, WA58
Johari, Ramesh SA56, SC50, MA06, MB50, MC46, TC50
Johar, Monica SA17, SC27
John, Richard S. MA09
Johnson, Alan TB37
Johnson, Andrew SC35, MD22
Johnson, Ellis MD13, TD43
Johnson, Michael SA04, MA53, TB42, WC21
Johnson, Neil TB57
Johnson, Sharon SD42
Johnston, Lenrick WB11
Johnston, Vicki TC37
Joines, Jeffrey SD28
Jojic, Nebojsa SB20
Jones, Alex K. SA13
Jones, James TD26
Jones, Philip TD47
Jones, Thomas MC37
Jones, William MD19
Jordan, Jeremy TC57
Jorgensen, Steffen SB38
Joro, Tarja SD45
Jose, Victor Richmond TA21
Joshan, Amir WC51
Jouini, Oualid SD06, WB23
Ju E, Guo WD12
Judd, Kenneth SC15
Juditsky, Anatoli WD15
Jukic, Nenad SC06
Jun, Chi-Hyuck WB25, WD41
Juneja, Sandeep SD49
Jung, Da Hun MC33
Jung, Jeesang TC23
Jung, Kyung-ha MA44

K

Kachani, Soulaymane SB50, SB50, MA49, TB49
Kachhawa, Jitendra MA43
Kadam, Ashay MA03
Kaefer, Frederick MC57
Kagan, Evgeni MC27
Kahn, Charles E. SD39, TA40
Kahn, Charles MB31
Kahraman, Pinar SC41, MB42
Kahruman, Sera SA42
Kaisar, Evangelos TA33
Kaiser, Daniel MC10
Kalafatas, Georgios TA34, TB34, TD34
Kalagnanam, Jayant TA28
Kale, Satyen MC14
Kalkanci, Basak MB07, MD03, TB03
Kallrath, Josef WA16
Kalvenes, Joakim WD37
Kalyanaraman, Shivkumar WA33
Kämäräinen, Vesa TC39
Kamarthi, Sagar TA25
Kamath, Manjunath TD33, WC23
Kamien, Morton WA39
Kaminsky, Phil MA07, WB49
Kammerdiner, Alla WC26
Kampas, Frank J. MD44
Kampas, Frank TA01, WC29
Kanchanapiboon, Atipol WB01
Kandasamy, Hariharan WA23
Kandyba, Maria MC18
Kane, Michael SA40, TA42
Kang, Keumseok SA57
Kang, Laura MB55
Kang, Lulu TC31
Kang, PilSung WD26
Kang, Sungmin MA05
Kang, Tao WA49
Kantavichai, Rapeepan IS- M
Kao, Gio SA16
Kapanoglu, Muzaffer WD43
Kaplan, Haim TB32
Kaplan, Ozge MB26
Kapoor, Ashish SB20
Kapoor, Avinash TC38
Kapur, Kailash SC30, MC30, TC31
Kapuscinski, Roman MC03, MD59, TB03, WA03, WC10
Kapuscinski, Roman
Karaer, Ozgen WA59
Karaesmen, Fikri TB54
Karaesmen, Itir SB49, SC51, MD49, TC49
Karakayali, Ibrahim WA02
Karakoc, T.Hikmet WD43
Karangelos, Efthymios MD46
Kardes, Erim SA22, WC15
Karhade, Prasanna TC17
Karimi, Iftekhar SC08
Karisch, Stefan SD55
Karjalainen, Katri TB02
Karlin, Anna MC38
Karmarkar, Uday MA25, MB45, TC47
Karnik, Aditya WA11
Karnik, Viraj MD52
Karoonsoontawong, Ampol SA33
Karunakar, Madhav TC42
Karwan, Mark MB36
Kasturi, Radhika SC17
Kataria, Gaurav WC06
Katila, Riitta MC60
Katok, Elena SA07, SC23, MA23, TA23
Katona, Zsolt SB38
Katriel, Irit TC28
Katsaros, Vangelis WA09

Katz, Susan SA58
Katz-Navon, Tal SD59
Kauffman, Robert SC43, TB17
Kaufman, David SC40, MB41
Kaut, Michal WD15
Kavadias, Stylianos MB58, TB58, TC59, TD58, WA58
Kavakli, Halil SC41
Kawprasert, Athaphon MC08
Kay, Michael SD28, TB56
Kaya, Guven SA34
Kaya, Latife Genc MC28, WB12
Kaya, Murat SA23
Kayis, Enis SD02
Kaymaz, Pinar MB46
Kazaz, Burak SC06, TD47
Kc, Diwas MC40
Ke, Wei SC51, MC51, TA49
Keane, Jack MB05
Kearney, Trevor MD24
Kee, Ernie TD15
Keeney, Ralph SB21, MA09, MB20, MD20
Keerthi, S. Sathiya TC26, TD29
Keha, Ahmet TD14, WB13, WC43
Keha, Ahmet TB12
Keisler, Jeffrey SA21
Keith, David SA21
Kekre, Sunder SA06, MC03, TB11, TC47
Kelle, Peter SA09
Kellerer, Hans SA12
Kelley, Matthew WB35
Kelly, Jim MC37
Kemahlioglu-Ziya, Eda SA10, WB02
Kemppainen, Katariina TB02
Kennedy, Deanna M. IS- M
Kenney, Melissa SB21
Kennington, Jeffery SC57
Keppo, Jussi SD46, TB16
Kerbache, Laoucine WD33
Kerdoncuff, Pierre TB53
Kerivin, Herve WC13
Kesavan, Saravanan SB07
Keskin, Burcu MC34
Keskinocak, Pinar MA07, MB50, MC07, MC50, MC51, TB12, TC08, WA39, WA40, WB05, WB40
Kessler, Larry TD21
Kettunen, Janne MA20, WA20
Ketzenberg, Michael MC01, WA02
Kewcharoenwong, Panitan TB13
Kewley, LTC Robert TB52
Keyfauver, Carroll SD37
Keysan, Gizem TC35
Khan, Aejaz TD02
Khan, Sinan MB39
Kharoufeh, Jeffrey TA57
Khavaev, Alexei SB43
Khazeni, Nayer MB39
Khoshsima, Gholamreza TA22
Khot, Pradeep TB57
Khouja, Moutaz SB01, WB57
Kianfar, Kiavash TD13
Kieliszewski, Cheryl MC25
Kiesmuller, Gudrun WA08
Kilic, Kemal WB57
Kilinc Karzan, Fatma SD18, TA28
Kim, Amy TC43
Kim, Bara TC54
Kim, Bora WD51
Kim, Bowon MA05, WB58, WC01
Kim, Byoungsoo WB17
Kim, Byung Chun WC48
Kim, Byung-In SB16, SD25, MC32
Kim, Chiwon WA10
Kim, David TA16, TB05
Kim, Deok-Hwan SD25
Kim, Dohoon WC15
Kim, Eung-Gu WB25
Kim, Eun-Seok SD12
Kim, Hag-Min WB17
Kim, Hyun Kyung WC48
Kim, Ilhyung WB59
Kim, Janghoon MA46
Kim, Jisun WC60
Kim, Jongjoo WB58
Kim, Joong-In SC01
Kim, Jung-Kyung TB51
Kim, Jungwuk WC12
Kim, Kap Hwan MC33
Kim, Kwang-Jae SD25, WB26, WD17
Kim, Kwangsoo SD25
Kim, Kyoung-Kuk WA45
Kim, Minsun IS- M
Kim, Moon SA42
Kim, Namhun MB48
Kim, Sang-Hyun TA07, TB07
Kim, Seokjin SB53
Kim, Seon Ki WC28
Kim, Seong-Hee SA48, SC31
Kim, Seoung Bum SB26, SD26, MA26, TB26, TB41, WA46
Kim, Seung-Hwan SC01
Kim, Soora WB46
Kim, Soo-young TD38
Kim, Sujin MC31, TC56
Kim, Sukgon WC11
Kim, Sunggon WC23
Kim, Sung-Hee MA53
Kim, Sungsu WB11
Kim, Sunkyo WC23
Kim, Taebok SC11, MA01, TA22
Kim, Taeho SD25
Kim, Woo Chang SC45, WB45
Kim, Youn Sung TC27
Kim, Youngjin SD57
Kim, Youngwook SD57
Kim, Yusik MA54
Kimbrel, Tracy MD10
Kimbrough, Steve SB46
Kimes, Sheryl SD23
King, Alan SB29, WA51
King, Cynthia (Cindy) MD19
Kintner, Hallie MB16, WA05
Kirby, Maurice MD05
Kirchain, Randolph MB16
Kirkizlar, H. Eser SD40, WA19, WC19
Kirkizoöglu, Zeynep SD35, MA35, TD37
Kirmani, S.N.U.A. SA31
Kirsch, Andy SD47
Kischka, Peter SA08
Kjerrström, Jens MB52
Klabjan, Diego SA19, MD55, TC33, TD15, WA10
Klampfl, Erica TD05
Klassen, Robert D. TB57
Klastorin, Ted SA59
Klein, Cerry MA34
Kleinberg, Robert MA56, MC38
Kleindorfer, Paul SD08, TD59, WB47
Kleine, Andreas TA22
Kleinmuntz, Don MA09
Kleywegt, Anton J. SA50, SB50, SD49
Kliewer, Kyle TA48
Klimas, Josh MB37
Klingebiel, Ronald WB59
Klinger, Tim SC43
Kloess, Artemis SA38
Klosterhalfen, Steffen MC10
Kluberg, Jonathan SB50
Knights, Peter TA47
Knorr, Dave WD43
Knott Eck, Cynthia TC22, WC17
Knott, A.M. SD58
Ko, Jeonghan SB11
Ko, Young Myoung WB23
Kobayashi, Kazuhiro WA29
Kobylski, Gerald WA37, WD22
Kobza, John SD09, WD08
Koc, Ali MD15, TD15
Koca, Eylem MB03
Kocabiyikoglu, Ayse MA49
Kocaoglu, Dundar WA52
Koch, Bruce TC23
Kochenberger, Gary SC28, MC37
Koehler, Gary TD17, WB48
Koenigsberg, Ernest MA33
Koenigsberg, Oded SA06
Koeppe, Matthias MA18
Kohli, Rajiv MB01, WA17
Kohn, Wolf SD16
Kojima, Masakazu WA29
Kok, Gurhan SD10, TD06
Kok, Leendert TA32
Koksalan, Murat SA09, TB12
Kolda, Tamara SB14
Kolfal, Bora TC07
Kolodziej, Marek WA46
Kolotoglu, Elif SA42
Konak, Abdullah MC57
Kong, Chung Yin SB39
Kong, Kyungsoo SD57
Kong, Lingchen SA15
Kong, Nan MC15
Kong, Zhenyu (James) WB30
Konieczka, Jay TC41
Konsynski, Benn SD17
Kontogiorgis, Spyros TB23
Koo, Jeongin MC32
Koole, Ger MA54, TD54, WB23, WC08
Koontz, Stephen WB47
Kopach- Konrad, Renata SB39
Kopardekar, Dr. Parimal TC55
Koppius, Otto MD56, MD56
Koren, Yoram SB01
Korhonen, Pekka TB12
Korkmaz, Evsen WD10
Korpeoglu, Evren TB54
Korsvik, Jarl E. MC32
Kort, Peter M. SB38
Koslowsky, Sam TA27
Kosmopoulou, Georgia TA56
Kossik, Rick TA24
Kostami, Vasiliki TD51
Kostanovskaya, Anna WA60
Kostreva, Michael WA23
Kotha, Suresh SA58, SC58, MC60
Kou, Steven SA45, TB45, TC45
Kouvelis, Panos SA06, SA11, SA23, SB06, MA59, MB10, TD49, WB01, WC49
Kovach, Jamison WB25
Kovalerchuk, Boris MD26
Koyuncu, Nurcin MB48
Krackhardt, David TB42
Krahe, Chris MD09
Krahl, Dave TB24
Kraiselburd, Santiago WA06
Kramer, Joseph SC43
Kranenburg, Bram TB07
Krasik, Vladimir SA50
Krasnakevich, John R. WB37
Krasnodebski, Michal TC52
Krasnokutskaya, Elena MB03
Krass, Dmitry SA09, SA53, SD53, TA53
Kremer, Mirko MB23, TA23
Kretser, Michael TB37
Krishnamoorthy, Bala SC41
Krishnamoorthy, Srini WC44, WD27
Krishnamurthy, Ananth TB01, TD33, WC54, WD54
Krishnamurthy, Rajesh WC57
Krishnan, Harish SA03, SB02
Krishnan, Jayanth TD59
Krishnan, M. S. MC17, WC06
Krishnan, Ramayya SC06, SC27, MC54, WC06
Krishnan, Trichy SD38
Krishnan, Vish MA58, TC59
Kristal, M. Murat SB59
Kristjansson, Bjarni SB29, MB24, WA18
Krnjajic, Milovan TD26
Krob, Daniel MA12
Krokhmal, Paul MB15, MC29, WB21
Kros, John WD25
Krueger, Dana WB25
Kryder, J. Christian SA40
Kubat, Peter SB57
Kucherenko, Sergei TD14
Kucik, Paul SA20
Kucukyavuz, Simge MA57, MC44
Kucukyazici, Beste SD40
Kuhl, Michael SC48
Kuhn, Dr. Kenneth TC55
Kuhn, George MD37
Kuji, Katsuo WA38
Kulkarni, Ankur MB14, WC46
Kulkarni, Vidyadhar TD07, WB07
Kulshrestha, Chinmaya TC38
Kulturel-Konak, Sadan MC57

Kumakura, Hiroshi WA38
Kumar, Akhilesh MD27
Kumar, Arvind MA52
Kumar, Ashok MD30, WB09
Kumar, Deepak WB36
Kumar, Mahesh TC38
Kumar, Nanda SA17
Kumar, Rajeev MB17
Kumar, Ritesh SB45
Kumar, Subodha SC13
Kumar, Sunil MA06, TD49, TD51
Kumar, Tarun SD47
Kumar, Vineet SC06
Kumara, Soundar MB26, TC27
Kumaraswamy, Krishna SD27
Kumiega, Andy MD58
Kunapuli, Gautam SD15
Kundakcioglu, Erhun TC16, WA26
Kunnumkal, Sumit SD34, MD49, TA50
Kunreuther, Howard SD08
Kuntz, Ludwig TC42
Kuo, April SA34, WB36
Kuo, Chia-Wei TB49
Kuo, Way MC30, MD30
Kuo, Yan-Fu TA27
Kurt, Murat MB41
Kurt, Murat TC57
Kuruvilla, Abey WC16
Kurz, Mary Beth TA18, TB12
Kusiak, Andrew SC26
Kutanoglu, Erhan WB30
Kuteev Moreira, Paulo TB42
Kuttuva, Praveen TC32
Kuyumcu, H. Ahmet SA51, WC50
Kuzu, Kaan SA54
Kvam, Paul TD30
Kwak, Doh-Soon WB26
Kwak, Jin Kyung MA11
Kwak, Wooram SB16
Kwinn, Michael TD32
Kwon, Bongju SD57
Kwon, Changhyun SB15, SD25, SD51
Kwon, Dharma TB20
Kwon, Hee-Boong WA57
Kwon, Roy WB45, WD39, WD46
Kyrca, Ömer TD37

L

La Poutre, Han SA46
Labandeira, Xavier WB46
Labe, Russ MB05, TA43
Labiosa, Bill SB21
Labov, Simon TD26
Ladanyi, Laszlo SD13, MA29, TC13
LaGanga, Linda WB12
Lagoudakis, Michail TB12
Laguna, Manuel MC37
Lai, Guoming MB06
Lai, Yung Cheng SB52
Lake, Joe MA48
Lakhera, Sanyogita WB32
Lam, Marco MB34
Lamarche, Carlos TA56
Lamarre, Wendy WC42
Lambrechts, Olivier MD12
Lammoglia, Nelson L. SA56
Lan, Guanghui MC14, WD15
Lan, Yingjie TC49
Landers, Erin SB22
Langer, Mark MA42
Langer, Nishtha WC06
Langseth, Helge SC21
Lanuti, Michael SB39
La-Ornual, Dolchai TC20
Laporte, Gilbert SA28, MC32, TA32
Lariviere, Martin SD06, MB06, MC22
Larson, Kate SC56
Larson, Richard SC42
Lartigue Debian, Andres WC20
Lasdon, Leon TC04, WC16
Lasry, Arielle TB40
Laszlo, Michael MA27
Latorre, Jesus M. MB46
LaTourrette, Tom SC09
Lau, Chun-Ming TD53
Lau, Hoong Chuin MD16
Laundy, Richard TC18
Laval, Jorge MC35
Lave, Lester TD56
Lavi, Ron MC38
Lavrik, Ilya MD52
Lawe, Stephen SC33
Lawless, William MD57
Lawley, Mark SA39, SB39, SC31, MA39, TA40
Lawphongpanich, Siriphong SA33, MC35, MD35, WD34
Lawrence, Barry TC32
Lawrence, Earl MD25
Lawrence, Stephen WB12
Lawson, Bryan WB35
Le, Loan MB55
Le, Tung MD32
Le, Wang WD12
Lea, Djuana SB37
Leachman, Rob TB33, WB11
LeBlanc, Larry WC27
Leblanc, Michael TA26
Lebreton, Baptiste WC02
L'Ecuyer, Pierre MB14, TD54
Leder, Kevin IS-T
Ledolter, Johannes SA25, TD42
Lee, Adrian SD09, MB36
Lee, Bruce WB35
Lee, C. Christopher WA57
Lee, Chang Hwan WC01
Lee, Chang Won MA05, MB01
Lee, Chi Min TC27
Lee, Chi-Guhn SB51, WD49
Lee, Chris P. SB40, TD41
Lee, Chulung SA01
Lee, Chung-Shing WA57
Lee, Chung-Yee MD16, SB12, TA06
Lee, CW MA05
Lee, Donald MA40, TD41
Lee, Dong-hee WD17
Lee, Dong-joon WA37
Lee, Earl Rusty MD09, TB29, WB35
Lee, Eva K. SA41, SB13, SC42, SD31, SD39, SD41, MA41, MA42, MC13, TA40, WB35
Lee, Hau L. WA59
Lee, Hau SC07
Lee, Heeseok WC17
Lee, Ho Woo WC15
Lee, Hsiao-Hui TC39, WB31
Lee, Hyoung-Yong WB17
Lee, Jae Yong SB45
Lee, Jeong-Wha WD41
Lee, Jinpyo SD49
Lee, Jon MA18, TC13, WA16
Lee, Joongsup SC31
Lee, Joonyoung WC11
Lee, Joungho WB28
Lee, Ju Yong WC23
Lee, Kyoungsun MD53
Lee, Loo-Hay MC48, TB01
Lee, Misuk SB50
Lee, Myeong-Soo WB26
Lee, Sang-Ho WB25
Lee, Se Won WC15
Lee, Seungho MA19, MB48
Lee, Shiwoo TA39
Lee, Soonhui SA50
Lee, Thiam SD50
Lee, Wenyih TD08
Lee, Won Hee TD60
Lee, Yong-Gil MA44
Lee, Yongheon SC46
Lee, Young Jin SA59
Lee, Youngho SD57
Lee, Yu-Ching MD55
Leeds, Elke WD44
Leemis, Lawrence TA19
Lehto, Mark SC39
Lehtonen, Hanna TC39
Lei, Lei SB12, MC32
Lei, Yong TA25
Leinart, James SC37
Lejeune, Miguel TA15
Lenk, Peter SA38
Lenox, Michael SD58
Leong, Thin Yin MD16
Leow-Sehwail, Yen-Ping MC48
Lera-López, Fernando TA32
Lesaja, Goran SD15
Leskelä, Riikka-Leena WD56
Leung, Janny MB28
Leung, Tim TC45
Leus, Roel SA59, MD12
Leventhal, Daniel SA18, SD58, MD28
Lever, Paul TA47
Levesque, Moren SB60
Levin, Hagay TA38
Levin, Yuri WC50
Levina, Tatsiana WC50
Levine, Arnold SA41
Levi, Retsef SD50, MD10, TC10, TD10
Levitin, Gregory SC30
Levy, Joshua TB48
Lewin, Arie SD58, MB60
Lewis, Mark E. SA54
Lewis, Mark SC28
Leyton-Brown, Kevin SC56
Li, Baohua SD54
Li, Chenyang MC16
Li, Chung-Lun SB12, SB32, TD15
Li, Cuihong SC03, MD02
Li, Dan WA43
Li, Duan WD38
Li, Fei SD12
Li, Gang WC14, WD14
Li, Gong WA09
Li, Haitao TB02
Li, Ivy MC21
Li, Jian SA11, MB10
Li, Jing MD31
Li, Jing-Quan TA47
Li, Jun MC12
Li, Kunpeng WC58
Li, Lefei WC15
Li, Lei MA08
Li, Lin TA49
Li, Michael SD32
Li, Peng SC08, MD54
Li, Qian WA48
Li, Qing TA41, TD07
Li, Rong SB06, TA06
Li, Shan SC49
Li, Shan-Lin SB12
Li, Shanling TA06
Li, Ta-Hsin W19
Li, Xiangyang TC23
Li, Xiaobai (Bob) MA27, MB17
Li, Xiaolin WB32
Li, Xiaopeng TD01
Li, Xueping SA35
Li, Yanjun WB13
Li, Yikang WA27, WD12
Li, Ying WB38
Li, Zhaojun SB30, SC30
Li, Zhaolin TD01
Li, Zhiguo WB25
Liang, Liping SB01
Liang, Zhe SB41
Liao, Haitao SA30, SB30, SC30, TC02
Liao, Lingrui SB51
Liberatore, Matthew WD09
Liberti, Leo MA12, TD14
Lichtendahl, Casey TA21, WD21
Liddon, Michelle TA37
Lidèn, Tomas MB52
Lidy, Martin TC37
Liebe, Robert SC09
Liechty, Merrill TA48
Lieckens, Kris TA05
Lien, Robert MA34
Liesiö, Juuso MA20
Liker, Jeff MB16
Lim, Andrew SC08, MD54, TC45, WA48, WC34
Lim, Churlzu TB50, WC18
Lim, Gino SA42, SB36, MA41, TD18
Lim, Kian-Guan TA14
Lim, Kyung-Kuk SB16
Lim, Michael SC36, MD07
Lim, Noah SA07

Lim, Yun Fong WC19, WD49
Liman, Surya WD08
Limaye, Shreyas S. MB31
Lin, Chin-I TD42
Lin, Chun-Ting SB09
Lin, Dung-Ying SA33, TA35, WA33, WB34
Lin, Grace MB05, WB05
Lin, Hui MD57
Lin, Li SD09
Lin, Nengpai MB08
Lin, Pei-Wei WA34
Lin, Runchang SC28
Lin, Wuqin TD51
Lin, Zhonglin TB27
Linares, Pedro TC22, WB46
Linderman, Kevin MD23, TD28
Linderoth, Jeff SD13, MC15, TC18
Lindor, Keith TA41
Linetsky, Vadim TB45, WA45
Linkletter, Crystal TC30
Linkov, I. MD21
Lipets, Vladimir MB25
Lippman, Steven SA56
Lipton, Candy SB39
List, Barry MA38
List, George MD33
Liu, Barry MA55
Liu, Chang-Chia MD41, WC26
Liu, Changzheng MD36
Liu, Chunli WD38
Liu, De MD17
Liu, Dengpan SA17
Liu, Guangwu SC48
Liu, Henry MC35, MD35, TA35, TA36
Liu, Hongrui SD16
Liu, Jian TC31, WA30
Liu, Jie IS- T
Liu, Jingang SC31
Liu, John SA32
Liu, Juqi WB49
Liu, Liming WC10
Liu, Nan WB07
Liu, Rujing SA01
Liu, Shaoxuan SD10, MC06
Liu, Sin-Long WA31
Liu, Tieming MD07
Liu, Xiangrong WB39
Liu, Yan SD47
Liu, Yifan SD42
Liu, Ying WC33
Liu, Yung-Wen SD30, TC23
Liu, Zhen MB41, TC15
Liu, Zhen MA54, MD54
Liu, Zhixin SA12, MC12
Liu, Zugang SB15
Lium, Arnt-Gunnar WD15
Livingstone, Kevin WC41
Ljubic, Ivana SD57
Llewellyn, Donna SC44, TA44, TB44, TC44, TD44
Llinas, James MD57
Lobb, John SC33
Lobel, Ilan SC50
Lobel, Ruben MA50
Loch, Christoph MB07, MC58, MC60, MD03, TD58, WA58
Lodi, Andrea TD10
Lodree, Jr., Emmett TA09
Loebbecke, Claudia SA23
Logendran, Rasaratnam SB36
Lokketangen, Arne SA28, SB28, WB39
Long, Elisa MC40, SB42
Lonsdale, Richard SC55
Loose, Jean-Philippe WA30
Lopes, Leo SC29, MC44, TC41
Lopez, Francisco MA15
Lortz, Tim WC28
Lotze, Thomas MA31
Lougee-Heimer, Robin SA29, SC29
Louie, Marcus WA37
Lounsbury, Mike SB58
Lou, Yingyan SA33, MC35, WD34
Lovejoy, William TB03
Lovell, David SA55, TC43, WA55
Lowder, Kelly MA37
Lowe, Ben SC29
Lowe, Timothy SA01, MC53, TD47
Lowery, Curtis W41
Lownes, Nicholas WC34, WD36
Lowsky, David TC06
Lu, Chin-Shan SB32
Lu, Chung-Cheng TA35, TB34, WA36, WB36
Lu, JC MD30
Lu, Jiangang MC35
Lu, Jingjing TA48
Lu, Lauren Xiaoyuan MA06
Lu, Shu MD35, TB14
Lu, Ye MB51
Lu, Yihao WA02
Lu, Yingdong TC51, WD19
Lu, Zhaosong SA15, MD29, TA31
Lubin, Benjamin MC56
Luboshitz, Eli SC43
Lucas, Jr., Henry C. MA17
Lucas, Tom WC53
Luche, Jose R. D. WC12
Luedtke, Jim SB18, TC13
Luen, Brad TA54
Lugo, Barbara MA44
Luo, Jingxiang W23
Lupu, Alex SA26
Lus, Betul MA59
Luss, Ronny TD14
Lustig, Irvin MC24
Lutze, Holly SC07
Lv, Hairong MD27
Lynn, Mike SD23
Lyridis, Dimitrios TA33
Lysgaard, Jens SA36

M

Ma, Huafan MD08
Ma, Jun SC29, SD29
Ma, Yuchao TC46
Macal, Charles SA46, SC48, SD48
Macarios, Alex MD40
MacCormack, Alan MC58
Macdonald, John TA08
MacDonald, Leo SA25
MacDuffie, John Paul MB60
MacGregor-Smith, Jim SA42
Machado, Fernando SC25
Machemehl, Randy WC34, WD36
Macher, Jeffrey SC60, TC60
MacLachlan, Doug WD26
Maculan, Nelson TD14
Madahar, Mukul WB27
Madanat, Samer TD35
Madapusi, Arun SD08, WB28
Madhavan, Anusha SC57
Madureira, Rafael MC32
Magallanez, Raymond SD14
Magaña, Mario TA16
Magazine, Mike SC59
Maglaras, Costis SB49, TC50, TD49
Magnanti, Thomas MA22, MD10
Magrogan, Mary MA38
Mahadevan, Sankaran WC22, WD43
Maharjan, Binod TC48
Mahdian, Mohammad MB38
Maheshwary, Siddhartha MC13
Mahlke, Debora MC18
Mahmassani, Hani SC34, TA35, TB34, WA36, WB36
Mahmoodi, Farzad SC01
Mahr, Tamas MD34
Mahut, Michael WA36
Maillart, Lisa SA30, SD39, SD40, MC40, WD21
Majumder, Pranab TA03
Makarychev, Konstantin MD10
Mak, Ho-Yin SB53, MD07, TB56
Makriyiannis, George TC52
Malladi, Sasidhar WC01
Mallick, Bani TC25
Mallik, Suman TC27
Malmborg, Charles TD33
Malmgren, Dean WD32
Malone, John SD41, TB09
Malter, Daniel WD37
Malvankar, Monali TD42
Mamani, Hamed WB40
Mamer, John SA56
Mandelbaum, Avishai MB25
Mandloi, Deelesh MC53
Mandoiu, Ion WD41
Mane, Muharrem SC14
Mangalam, Srikanth WA23
Manikas, Andrew WB08
Mankoff, Jennifer WC21
Mann, Christopher TA57
Manning, Allan MD37
Manning, Stephan MB60
Mannor, Shie TB15
Mansini, Renata SB16
Mantin, Benny TD03
Mantrala, Murali MB42
Marano, John MD46
Marasanapalle, Jayanth MA43
Maratt, Joseph TC42
Marchal, Fabrice SC33
Marcolini, Michael WB43
Marcos, Nicolas MB52
Marcotte, Patrice SD33, TC34
Marcus, Steven SA19, SA48
Margineantu, Dragos TA26
Margot, François TC13, TC18, WA16
Margulici, J.D. TD34
Margulies, Susan MA18
Marianov, Vladimir SD53, TB01, TC53
Marinescu, Radu MC28
Markham, Ina WB44
Markle, Alex MA21
Marklund, Johan MC10
Marla, Lavanya MD55
Marquard, Jenna MB21
Marquis, Jon TB12
Marra, Carlo MD42
Martell, David MB47
Martin, Alexander MC18
Martin, Hilary WC60
Martin, Kipp SC29, SD29, WB18
Martin, Peter WA34
Martin, Stephen MA37
Martinez, Wendy TB30
Martinez de Albeniz, Victor SA50, SB07, TC03, WB47
Martinez-Moyano, Ignacio J. MD09
Marx, Matt MA60
Maryan, Jacek SC43
Masin, Michael WA12
Masini, Andrea TD27
Mason, Scott TB12, TD36, WD34
Massey, Cade TD20
Massey, William MC54, MD54, TA57
Mastrangelo, Christina MB31
Mateescu, Robert TC28
Mathe, Hervè MA25
Matheson, James SC20
Mathews, Joseph SD13
Mathews, Scott SC43, WD04
Mathieu, Rick WB44
Mathur, Puneet WD01
Matis, Timothy MB57, WA25
Matsubayashi, Nobuo TD11
Mattfeld, Dirk C. SB36, TC22
Matthews, Deanna WC21
Mattigod, Shas WC21
Matwin, Stan TC39
Mawhinney, John SD44, WB44
Maxwell, Daniel WA37
Mayernik, George WB37
Mayes, Manya SA26
Mayo, Nancy SD40
Mayoral-Fierros, Abelardo WC38, WC42
Mayoral-Noriega, Abelardo WC38
Mayorga, Maria SA35, WB42
Mazzola, Joseph MB08
Mazzuchi, Thomas SA31
McAllister, Branford WA57
McAuliffe, Jon SB27
McCardle, Kevin MB03
McCarter, Matthew WD58
McClosky, Benjamin SD13, TD13
McConky, Katie SC48
McCord, Alan MB25
McCormick, S. Thomas MD47
McCormick, Thomas SB02
McCoy, Michael S. TC23
McCrea, Michael WD55

McDaniel, Chip TD05
McDaniel, Reuben WC16
McDill, Marc SA47, SC47, WB56
McDonald, Mark WC22, WD43
McElreath, Mark TA18
McFee, Robin MC09
McGarraghy, Sean WD19
McGill, Jeff MC49, WC50
McGinnis, Leon SC32
McGuire, Kelly SD23
McGurer, Melinda WA53
McInerney, Facep, Joan TC40
McLay, Laura SD09, MA36, MB36, WB44
McLin, John WC36
McMahon, Pamela SB39
McMillan, Matt MA05
McVittie, Patrick TA33
Meade, N WC45
Meagher, Conor MC47
Mease, David SD26
Meca, Ana SA10, SB10
Medal, Hugh SD37
Meeraus, Alex WA18
Mehrotra, Sanjay MD29, TA13, TC15, WD15
Mehta, Gayatri SA13
Mei, Yajun MA26
Meiri, Ronen MC27
Mejabi, Olugbenga WB28
Melachrinoudis, Emanuel MD53
Melkote, Shreyes TB31
Meller, Russell SA34, SC35, MA35, MC39
Mellor, Georgie WC40
Melnyk, Steven A. TA08
Melouk, Sharif MD48, TC57
Men, Chunhua MC41
Menachof, David A. MB32
Mendes Silva, Henrique SB60
Mendoza, Alejandro WC59
Mendoza, Alvaro TD48, WB22
Mendoza, Olga SB37
Menezes, Mozart SA53, SB53
Mennell, William K. MD32
Menon, Nirup WA17
Menon, Syam SA27, MA27
Menoyo, Jaime SC09
Meral, Sedef TD37
Mercier, Anne SD33, MD55
Mercier, Luc MD28, TB28
Merkhofer, Lee SC20
Merrick, Jason SA31, MA36, WA21
Merriweather, Sam WB19
Mersereau, Adam SD10, TD50
Merzifonluoglu, Yasemin MC50, TC16
Mesirov, Jill P. SA41
Messner, William TB21
Mestry, Siddharth TD11
Metan, Gokhan MA49
Mete, Huseyin Onur TC09
Meterelliyoz, Melike MD48
Metzger, Michael TD09
Meyer, Carl SA26
Meyer, Robert SA40, WB42
Mezzetti, Claudio SD56
Michael N, Katehakis WB08
Michael, T. S. SA40, TC06
Michalek, Jeremy SA38, SB11, WB16
Michalopolous, Dennis MD15, TD15
Michalowski, Wojtek TC39
Middelkoop, Timothy MD57
Midthun, Kjetil Trovik TC56
Midthun, Kjetil TC56
Mifflin, Robert TD14
Mihm, Jurgen MB58, MC58
Mikkola, Juliana H. TC58
Milch, Dan SC43
Mild, Pekka MA20
Miles, Ralph F. MC20
Milgrom, Paul MB56
Miller, Andrew SD18, MA13, MD44, TA29, TB13, WB13, WC13
Miller, Andrew MD39
Miller, George WB40
Miller, Janis SB59
Miller, Luke WB45
Miller, Nita WC53
Miller-Hooks, Elise SA34, SC36, WB36
Millhouse, John MD37
Mills, Robert SC37
Mills, Steven SA47, WB56
Milner, Joseph TD49, WC50
Min, Dae-Kee SD25
Min, Daiki SC39
Min, Jinyoung WC17
Min, Jo WA08, WC01
Miner, Anne S. SA58
Minner, Stefan MC10, TA23, WD51
Minniti, Maria SB60
Minoux, Michel MB13
Miranda, Jaime SD35
Mirchandani, Pitu TA47, TD56, WD35
Mirchandani, Prakash MA51
Mirrkoni, Vahab MB38, MD38
Mishalani, Rabi WA35
Mishra, Ajay WD01
Mishra, Anant TC58, WC58
Mishra, Asima WA03
Mishra, Nishant TA50
Mishra, Sumita MD57
Misirci, Muzaffer MC01
Misra, Sanjog TD59
Mitchell, John E. SA15, SD15, MD09, TB29
Mithas, Sunil MC17, WC06
Mitra, A. Kranthi TA51
Mitra, Amit MD31, WB38
Mitra, Gautam SB45, WA15
Mitra, Saby SC16, WB17
Mitsakis, Evangelos WD36
Mittal, Vikas WA32
Mittelmann, Hans MB19
Mittenthal, John MB34, TC53
Miwa, Masashi TD23
Miyamoto, John TD20
Miyano, Eiji SA16
Mladenovic, Nenad MB28
Mlakar, Joseph WB37
Moallemi, Ciamac TA54
Moellering, Karin TB07
Mohebbi, Esmail WA08
Mofya, E. Chisonge TB13
Mohamed Ismail, Mohamed Wahab SA43
Mohammadi, Ghorbanali WD59
Mohammed, Jaby WC58
Mohan, Karthik SB52
Mohan, Mayank MB21
Mohan, Srimathy TA41, WC23
Mohebbi, Esmail WA08
Mohr, Doug WB27
Mohr, Shirley MA38
Moinzadeh, Kamran SB01, SC07, WC03
Moitra, Soumyo WC57
Mojsilovic, Aleksandra WD19
Molyboha, Anton MB15, WB21
Momcilovic, Petar TA51
Möncks, Tycho MC08
Monroe, Eric SB30
Monsuur, Herman TD37, WB37
Monteiro, Renato SA15, IS-M, MC14
Montgomery, Douglas WB25
Montibeller, Gilberto WC20
Montrucchio, Luigi SB10
Mookerjee, Vijay SA17, SC13
Mookherjee, Reetabrata SD51, TA08
Moon, Seung Ki MB26, TC27
Moon, Sue SB41
Moon, Yongma WA22
Moonen, Hans MD34
Moonen, Linda MB12
Mooney, Ed TD12
Moore, Bruce MA45
Moore, David SC59, SD60
Moore, James SC37
Mooth, Rob MB27
Mora, Hugo SD51
Morabito, Reinaldo WC12
Morais, Danielle WD58
Morales, Juan M. MB46
Morales, Juan WD14
Moreira da Silva, Angela TB22
Moreno Perez, Josè Andrès MB28
Moreno, Eduardo TA47
Moreno-Centeno, Erick WD59
Moresino, Francesco MA25
Morgan, Granger SA21
Morgan, Kara TD21
Morgan, Philip G. WA25
Morin, Thomas SC13
Morita, Hiroshi TA48
Morrice, Douglas MC11
Morris, Kenneth WB42
Morrison, Brad SB23
Morton, Alec WB22, WC20
Morton, David SC45, MC11, MD15, TA15, TD15
Morton, David TD15
Moskowitz, Herb MA31
Moss, Lisa TB37
Moulton, Christina SA09
Moussawi, Lama TA59 TD32
Mouzon, Gilles WB12
Muckstadt, John TC03, TC10, WA07
Mueller, Ralph SD44
Mufalli, Frank MD57
Muharremoglu, Alp TA10
Mukherjee, Avijit SA55, MA55, TC43
Mukherjee, Avijit TC55, TD43
Mukherjee, Kankana SB22
Mukherjee, Sumitra MA27
Mukhopadhyay, Samar SA01, MD08, WB01
Mukhopadhyay, Tridas WC06
Mulamootil, Lency WA23
Müller-Merbach, Heiner MD05
Mulvey, John M. SC45, WB45
Muñoz, Vìctor SA56
Munson, Charles WC01
Munson, Todd SC15
Muradyan, Igor WB22
Murali, Pavankumar SD53, WD33
Murat, Alper SB33, MD53, WD48
Muratore, Gabriella WA56
Muriel, Ana MA59, WA02, WB05
Murphy, Diane WC17
Murphy, Fred SB46, MD46
Murphy, Jim WB27
Murphy, Pamela WD41
Murphy, Ryan MB23, WD32
Murray, Chase TD38
Murray, David TC03
Murray, Fiona SC60
Murray, Talisa MB05, TB05
Murthi, B.P.S. SA27
Murthy, Ishwar SC16, WB17
Musacchio, John MA50
Musalem, Andres SC02
Muten, Bengt SC52
Muthulingan, Suresh WB03
Muthuraman, Kumar SA11, SA39, TB16
Muthuraman, Kumar TA40
Mutlu, Fatih WA03
Mutzel, Petra MC18
Muyldermans, Luc TB32
Myall, Rockey MA49
Myers, Danny MA15
Myers, Jessica WB27
Myklebust, Jogeir WC56
Myklebust, Jogeir SB16
Myles, Steven TD28, WD08

N

Na, Paul SD45
Nabetani, Koichi TB14
Nachiappan, Subramanian TB22
Nagali, Venu SB43
Nagarajan, Mahesh SC10, MA02, MD02
Nagarajan, Viswanath SA16
Nagarur, Nagen WA48
Nagi, Rakesh MC53, MD57,

TB35, TD33, WA53
Nagi, Rakesh MD27, WB37
Nagle, Joyce TB52
Nagurney, Anna SB15, SC36, WA46, WB05
Nahapetyan, Artyom MA52
Nair, Rahul WB36
Najafi-Asadolahi, Sami TC49
Najafzadeh, Mehdi MD42
Nakamura, Taku SA16
Nakata, Kazuhide WA29
Nakata, Maho WA29
Nalca, Arcan TA03, TD03
Nalle, Darek SC47
Nam, Seong Hyun TC01
Nam, Seung Oh WC48
Namatame, Takashi MD48, WC48
Namazifar, Mahdi SD18
Nanadkeolyar, Udayan WB08
Nanduri, Vishnu SA46
Nannicini, Giacomo MA12
Napoleon, Karen SD60
Narasimhan, Sridhar WB17
Narayanan, Sriram WC06
Narayanan, Vishnu SC18
Narducci-Marìn, Francesco WD48
Nascimento, Juliana SA19
Naseraldin, Hussein TD07
Naser, Arab SB41
Nash, Hadon TB01
Nash, Stephen TB30
Nasiry, Javad MD50
Natarajan, Hari MD32, WC14
Natarajarathinam, Malini MB34
Nauss, Robert SB36
Navarro-Lechuga, Edgar WC40
Naveh, Eitan SD59
Naveh, Yehuda MC25
Navid, Ali WB41
Nazemetz, John WC57
Nazerzadeh, Hamid TD50
Nazzal, Dima TD53
Ncube, Ozias SD01
Nechushtai, Gil SC43
Nediak, Mikhail WC50
Nedich, Angelia SC54
Nelson, Barry L SA48
Nelson, Barry SC31
Nelson, Heidi TA41
Nelson, Karl TD26
Nemani, Ashish TC29
Nembhard, David A. WB11
Nembhard, David TD19
Nembhard, Harriet TB31, WA31
Nemhauser, George SB18, SD18, TC13, TC35
Nemirovski, Akardi WD15
Nemoto, Toshio WD34
Netessine, Serguei SA50, SD07, MB02, MC51, MD59, TA07, TB06, TB07, TD59
Netzer, Oded MB27
Newman, Alexandra MC47, MD47, TA47, WB16
Newman, David MA46
Newton, David SD13
Ng, Adam WB11
Ng, Hon Keung Tony MA30
Ng, Koi Yu Adolf MB32
Ng, ManWo WA33
Nguyen, Danh Cong TC42
Nguyen, Paul TB40
Nguyen, Vu Duc MC33
Ni, Hua TB23
Nicholson, Blake E. WD16
Nicholson, Emma TA46
Nickel, Stefan MC53, MD39
Nie, Xiaofeng SD09
Nie, Yu (Marco) MD35, WC33
Niederhoffer, Kate MB27
Niederhoff, Julie SA23
Nielsen, Thomas SC21
Nieuwesteeg, Peter WA18, WD39
Nigmatulina, Karima SC42
Nigus, Chrisopher TA48
Nikolaev, Alexander SD09
Nikolopoulous, Konsaninos IS- T
Nimmala Manikandan, Uday MC01
Niosi, Jorge MC59
Niranjan, Suman WB08
Niranjan, T T WB01
Nisan, Noam MC38
Niu, Annie SC38
Noble, James MA34
Nogales, Francisco J. MD14
Nolder, Greg MA24
Nomikos, Nikos K MB32
Nonaka, Ikujiro TC60
Nonas, Sigrid-Lise WA01
Noot, Han SA46
Norback, Judith Shaul WD44
Norden, Peter TB43
Norman, Bryan SD01
Norman, Joseph MA39
Norris, John MA31
Northcraft, Gregory WD58
North, Michael SA46, SC48
Norton, John SD38
Nosyk, Bohdan MD42
Novoa, Clara MD15, WD25
Nowak, Maciek SB34
Nowak, Matthias SB16, TC56, WC56
Nowrouzi Kashan, Fariba WC35
Noyan, Nilay IS- M
Ntaimo, Lewis SD47, MD15, TC15
Nunamaker, Timothy WC41
Nuñez, Alfredo SD35
Nunez, Manuel WA12
Nuyens, Misja TC48
Nygreen, Bjorn SA36

O

Obreque, Carlos TB01
Ochiumi, Hiroshi SB01
Ockenfels, Axel SA23, TA23
Odoni, Amedeo MA55, TA55, TC43
Odrey, Nicholas MD08
Oduntan, Olusola WB28
Oeltjen, Carmen SD37
Oeser, Nadine WC20
Ofek, Elie SB38, MB58
Oguntebi, Joy WB59
Oguz, Ceyda SA34
Oguz, Osman SC16
Oh, Jeongha Cath SB17
Oh, Kyong Joo WB17
Oh, Se-Kyoung SD56
Oh, Wonseok MA17
Ohlmann, Jeffrey TC57, TD47
Ohsawa, Yukio MC26
Ojala, Domnic WA48
Ojha, Charu TC36
Okabe, Atsuyuki TA53
Okogbaa, Geoffrey IS- M
Okuse, Yoshiyuki WA38
Okwo, Adaora TC08
O'Leary, Dianne TC14
O'Leary, Mike WC32
Olafsson, Sigurdur TB04
Oleg, Shylo MA28, WA16
Olesen, Ole B. TB22
Olinick, Eli SC57
Olivares, Marcelo SC02, MB02
Oliveira, Fernando MD46, WC12
Oliveira, Pedro TD58
Olivella, Jordi WC11
Oliveros, Santiago SA22
Olsen, Tava SA03, TC50, WB49
Olvera-Cravioto, Mariana MA10
O'Neill, Christopher SC33
O'Neill, Liam TD42
Onal, Hayri MA47
Onal, Mehmet MB51
Onay, Selcuk MA21, TC20
Onculer, Ayse TC20
Ong, Boon TC54
Onge, Art WB09
Onn, Shmuel MA18
Oppen, Johan WB39
Oraiopoulos, Nektarios TD58, WB03
Ordonez, Fernando SA36, SD53, MB36, TD09, WC15, WD33
Ordoobadi, Sharon WD07
Oren, Shmuel SC46
Orhan, Ilkay WD43
Orlin, Jim MB13, TD15
Ormeci, Lerzan TB54
Orsenigo, Carlotta TB27
Ortiz, Olga L. SA35, WB03
O'Sullivan, Dympna TC39
Osadchiy, Nikolay SC02
Osborn, John TA41
Oskoorouchi, Borhan TC43
Oskoorouchi, Mohammad SA15
Osogami, Takayuki TA57
Osorio-Ramirez, Carlos WD16
Ostlund, John TD26
Ostrowski, James SD13, TC18
Otsubo, Hironori WD51
Ou, Jinwen SB12
Ouhimmou, Mustapha SC47
Ouyang, Yanfeng TD01
Ovchinnikov, Anton SA09, WC50
Owens, Douglas SB42, MC40, TD09
Oxoby, Robert SD23
Oyama, Tatsuo TD23
Ozaltin, Osman MA53, MB18
Ozanne, Elissa TC21
Ozcan, Ozan WB53
Ozdaglar, Asu SC50, MA50
Ozdemir, M. Emre SC41
Ozdemir, Ozge SC46
Ozen, Ulas SA10, SB10
Ozener, Okan SC34
Ozer, Ozalp SA23, SC07, MA10, MB03, MC23
Ozkan, Gulru SD60, MB58
Ozkaya, Evren MA07, MC51
Ozkul, Ahmet WA38
Ozlen, Melih WA12
Ozpeynirci, Ozgur SA09
Ozsen, Leyla MC34, MD53, TB56
Ozturk, Murat Hakan WC59, WD20

P

Pachon, Julian WC55
Padman, Rema MC54, TB42
Paias, Ana SA28
Palma, Cristian MB47
Palmer, Karen WB46
Palmer, Nathan TC53
Palocsay, Susan WB44
Palomäki, Ari TC39
Panchalavarapu, Poornachandra MC11
Pandey, Rudra SA40
Pandza, Krsto TA60
Pan, Fei TC52
Pan, Feng WB14, WD36
Pan, Qisheng TC36
Pan, Rong SB30
Pang, Anthony SB32
Pang, Gu TB32
Pang, Jong-Shi SD15, TA46, TB34, WD54
Pang, Zhan (James) MB49, WC56
Pangburn, Michael WC51
Papadimitriou, Christos H. MD38
Papageorgiou, Dimitri WD14
Papamichail, K. Nadia TA05
Papier, Felix TB48
Paquin, Valerie SC11
Pardalos, Panos SA37, SC37, MD41, WA16, WA26, WC26
Parekh, Ojas WC52
Parija, Gyana SD47
Park, Chan MB46
Park, Chulsoon MA05, WC01
Park, Hae-Sang WD41
Park, Insu SC17
Park, Jin-Kyu MC59, TA58, TB50, TC58
Park, Kun Soo WB49
Park, Kwangtae MA05
Park, Myung-Ju WD39
Park, Namkyu WB28, WC58
Park, Sangsun WB58
Park, You-Jin WD25
Parker, Geoffrey TC11, WD09
Parker, Nathan TB36
Parker, Rodney SA03
Parker, Roger A SC55, TB55
Parkes, David MC56
Parkinson, Anita MD47
Parlakturk, Ali K. MD59
Parlier, Greg MD37, TA37, TC37
Parlour, Christine SB54

Parmar, Amandeep MB18
Parnell, Gregory SC09
Parry, Mark SD38
Partani, Amit SC05
Parvinen, Petri TC39
Parvin, Hoda SB31
Pas, Joshua W WD07
Pasaniuc, Bogdan WD41
Pasiliao, Eduardo MB15
Pastor, Rafael WC11
Pataki, Gabor TA13
Patankar, Jayprakash WB38
Paternina-Arboleda, Carlos MD16, WA42, WC40, WD48
Pathak, Praveen TD17
Pathak, Surya WC22
Patil, Gopal SA33, WB34
Patino Villamizar, Carlos Hernando WA23
Patrìcio, Pedro SC57
Patrick, David MD42
Patrick, Jonathan SC40, WC42
Patrizi, Giacomo WB20
Patterson, Jan E. WB40
Patvivatsiri, Lisa WA09
Paul, Anthony WB46
Paulus, J.J. WA12
Pavlov, Valery SC23, TB03
Pawar, Roshan TA52
Paz, Alexander TC34, WB34
Pazgal, Amit TB06
Pazour, Jen SA34
Peacock, Walter SD36
Peaks, Ya-Sin TC42
Pedraza, Fernan MC16
Peeta, Srinivas SA33, SC14, TA34, TB34, TC34, TD34, WB34
Pei, Jinxiang WA10
Pei, Pamela Pen-Erh SD02
Pekgun, Pelin MC50
Pelletier, Lori SD42
Peltsverger, Boris IS- T
Peltsverger, Svetlana WC14
Pena, Javier SB15
Peng, Hao SC30
Peng, Steve SD53
Peng, Xianhua TB45
Pentapalli, Mridul TD52
Penuel, John MA57
Perakis, Georgia SB50, SC50, MA49, MA50, MB50
Perdikaki, Olga SB07
Perea, Alejandro MB46
Pereira, Marianela MC47
Pereira, Mario WD39
Pereira, Ryan MB16
Perevalov, Eugene MB57
Perron, Laurent WD38
Perry, Marcus SC37, TC57, WA31
Perry, Michael TD20
Perry, Ohad WB51
Pesant, Gilles TC28
Peteraf, Margaret TA60
Petering, Matthew MC32
Peters, Brett SB35
Peters, Edward M. WA32
Peters, Valerie MA37
Petersen, Niels Christian TB22
Peterson, Ben WB12
Petrou, Christiana IS- M
Petruzzi, Nicholas SB02, WC03
Pfeifer, Phil SD21
Pfister, Henry WA37
Pfund, Michelle TB12
Phadke, Atul MD26
Pham, Huy SA26
Phan, Kenny WB60
Phelps, Corey SC58
Philbrick, C. Russ WA56
Philip, Deepu TD12
Phillips, Cynthia MB29, TB18
Phillips, Lawrence WC20
Phillips, Robert SA49, SB49, MC49, TA49, TC49
Philpott, Andy MC46
Pi, Liang WD28
Pibernik, Richard TD28
Pickering, Larry WA40
Pierson, Jeffery SC59
Pietz, Ferdinand SD41, WB35
Piller, Frank T. WB09
Pince, Cerag WD08
Pinciroli, Andrea MB31
Pineda, Salvador SD46
Pinedo, Michael SB12, MB12, MB45
Pinker, Edieal TC39, TD59
Pint, Bianica TB23
Pinter, Janos D. MD44, TC05, TD04, WC29
Pinto, Jervis SD54
Pintor, Jesus M TA32
Piramuthu, Selwyn TD17
Pirim, Harun WC16
Pittman, Sam SA47
Pitzler, Dan WC21
Pivovaroff, Michael TD26
Plambeck, Erica SD02, SD07, WB02, WB03
Plantenga, Todd TC05
Pochet, Yves WB13
Pohl, Ed SD37, WA57
Pohl, Letitia SC35, TB12
Polak, George TD28
Polasky, Stephen MA47
Polhemus, Neil TD24
Pollack, Ziv MC27
Pollock, Stephen MB41
Pollack-Johnson, Bruce WB44, WD09
Ponce, Silvia SC11
Popescu, Andreea SB05
Popescu, Dana MA30
Popescu, George WD41
Popescu, Ioana SB49, MD03, MD50
Popkov, Timofey WA24
Popkowski-Leszcyc, Peter SB56, SD38, TA56
Popova, Elmira SC45, TD15
Popova, Ivilina SC45
Porter, J. David TA16
Porter, Michael WA54
Posen, H. SD58
Posner, Marc SA12, SD12
Post, David TB55
Pot, Auke TD54, WB23
Poupart, Pascal SD54
Pourakbar, Morteza TD08
Powell, Steven MC57
Powell, Warren SA19, MA22, MA46, MD34, TB48, WD16, WD21, WD47
Prabhu, Tarun SD54
Prakash WB30
Prasad, Ashutosh MA02
Prasad, Kislaya MD17
Price, Carter WA40
Price, Jennifer MA50
Prieto, Diana SD41, WD40
Primbs, James MC45
Prina, Jose TC56, WA28
Printezis, Antonios TA41, WC23
Pritamani, Mahesh WC48
Privett, Natalie TC08
Proano, Ruben WB40
Prokopyev, Oleg MC15, WA16, WA26, WB35
Proon, Sepehr Nemati WD38
Provan, Chris TC03
Provera, Bernardino TA60
Prudius, Andrei SA48, SB48
Prybutok, Victor R WD17
Psaraftis, Harilaos TA33
Puerto, Justo SA10
Pullman, Mellie SD23
Punkka, Antti MA20
Punnakitikashem, Prattana TB41
Pureza, Vitoria WC12
Purnomo, Hadi TB41
Puterman, Martin SC40
Putnam, Aaron WC49
Pyke, David WD51
Pykina, Maia MC52, MD52

Q

Qiang, Qiang SC36
Qian, Zhiguang SB26, MD25, TA31, TD31
Qiao, Jianhong SD13
Qi, Lian MB53
Qi, Mei TC02
Qi, Xiangtong SB12, MC12
Qin, Hong WD17
Qin, Joe WB30
Qiu, Chun SB56
Qiu, Robin SC25
Qiu, Xin Ying WD26
Qu, Xiuli MA39, WA09
Quadrifoglio, Luca MC36
Quariguasi, Joao WC02
Quasem, Mohammad WD25
Quevedo, Valeria WD22
Queyranne, Maurice MD47, TC32
Quimper, Claude-Guy MC28
Quinteros, Martin SC47
Quiroga Becerra, Haydee WA23

R

Racer, Mike MC37
Rachamadugu, Ram MC11
Rader, David SD19, WA44
Radhakrishnan, Rajesh SB35
Radkevitch, Uladzimir MD56
Radner, Roy MD05
Radovanovic, Ana MB25, TC51, WD19
Raftery, Adrian TA21
Raghavan, S. SD57
Raghavender, N.P. SD33
Raghuram, Sumana SB41
Rahman, Ahmed TA41
Rahman, Atiar WD25
Rai, Sudhendu WD59
Rai, Vivek WA53
Rainwater, Chase TA01
Rajagopalan, Hari WC42
Rajagopalan, Raj TB50
Rajala, Risto WB57
Rajan, Deepak SC12
Rajan, Uday SB54, WB38
Rajaram, Kumar TC47
Rajaram, Vidya TA05
Rajaratnam, Kanshukan WC45
Rajgopal, Jayant SD01
Rakas, Jasenka TC43, TD35, WD55
Rakes, Terry TA52
Ralphs, Ted SA13, SB13, SD13, SD18, MA29, MB18, TA29, WB18
Ramachandran, Karthik TC59, WB58
Ramachandran, Vandana SD17
Ramadurai, Gitakrishnan TB34
Ramakrishnan, Ram WD54
Ramakrishnan, Sreeram MA19
Ramamurthy, Randeep WA40
Raman, Ananth SB07
Raman, Narayan WC58
Raman, Roopa WA17
Ramanan, Kavita TA54
Ramanathan, Dr.Ramakrishnan TB22
Ramaya, Krishnan TB42, WB48
Ramdas, Kamalini SC02
Ramìrez, Diana MD16, WC40
Ramirez-Marquez, Jose SD30, MB57, TB26
Ramìrez-Polo, Luis WA42
Ramnarayanan, Renu MA01
Ramos, Andres MB46
Ramthun, John TB30
Rana, Rupal WC12
Randhawa, Ramandeep TD49, TD51, WB51
Randolph, Steve WB40
Rangan, Sudarsan SB08
Ranganathan, Sridhar MC01
Rangarajan, Bharath MD29
Rangnow, Claudia WA60
Ransbotham, Sam SC16, WB17
Rao, Brijesh TC32
Rao, H. R. SC17
Rapoport, Amnon MB23, WD51

Rapp, Stephen SB37
Rardin, Ronald MA39, MA42, MC39
Rasekh, Lila WD15
Rashid, Majed TD32
Rasmidatta, Isaradatta SB36
Rasmussen, Henning WC51
Rastegari, Baharak SC56
Ratliff, Richard MC49, TA50
Rauf, Mohd Ali WA32
Ravichandran, N. TD32, WC40
Ravindran, A.Ravi SB09
Raviv, Tal WA12
Rawls, Carmen MA36
Raychaudhuri, Samik WD25
Ray, Gautam MD17
Ray, Saibal SB02, SB02, MB51, TA03, TD03, WC03
Ray, Saswati TD26
Ray, Thomas MA30
Raz, Gal SA06
Read, Daniel TC20, TD22
Realff, Matthew J WD07
Reaume, Daniel SD08, MB16
Rebennack, Steffen WA16
Reckhow, Kenneth SB21
Reed, Josh WB54
Reed, Randal TA60
Rees, Jackie TB52
Rees, Loren TA52
Reese, Josh SA42
Reeves, Kingsley SA56, WB53
Regan, Amelia TA36
Regenwetter, Michel TB21
Règin, Jean-Charles SA18
Regis de Farias Jr., Ismael SC13, WA13
Regis, Rommel SB14
Regnier, Eva MD20
Rego, Cesar SD19, MA28
Rei, Walter SB19
Reichenbach, Charles TD12
Reiman, Marty TB10
Reindorp, Matthew TD59
Reinertsen, Harald WC11
Reinhardt, Gilles TD39
Reinholz, Andreas MC08
Reiss, David WA41
Reitter, Norman TB37
Rekik, Monia MB56
Reklaitis, Gintaras WB42
Ren, Changrui MA01
Ren, Fei MA17
Ren, Justin SC25, MB02
Ren, Yuan WA30
Reneke, James TD22
Rentz, Otto TB53
Repenning, Nelson MA23
Resende, Mauricio G. C. SA37, SD28, MA28
Restrepo, Mateo MA39
Retchless, Todd WA37, WD22
Reveliotis, Spyros TC48
Rey, Pablo SD35
Reznik, Vivian TD40
Rhee, Byong-Duk WC01
Rhee, Hyeun-Suk SA17
Rhim, Hosun MA05, MB45
Riano, German MD49
Riaz, Adnan TD32
Ribbink, Dina WA43
Rice, Daniel MB17
Richard, Jean-Philippe SA13, MA13, MA42, MB18, MD13, MD32, TC13, WA13
Richards, Evelyn SA47
Richards, Timothy TB47
Richter, Anke MB39, TC40
Richter, Yossi MC25
Rideout, Doug SD47
Riehl, James TB35
Rifas, Bertram E. MA33
Rigdon, Matthew SD25
Righini, Giovanni MB31
Righter, Rhonda MA54
Rincon Mateus, Cesar TA57
Rindisbacher, Marcel WB45
Riquelme, Marcela SD35
Rispoli, Fred WB14
Ristock, Herbert MB25
Ro, Young K. TC58
Ro, Young TA59
Robbins, Tom WC28
Robert, Jacques MB56
Roberts, Edward SD60
Roberts, Jeffrey MC58
Roberts, Mark SC42, SD39, SD40, WD21
Roberts, Steven SA09
Robinson, Anne MB05
Robinson, Daniel WA14
Robinson, Jeffery A. SA38
Robinson, Stephen SC15, MB21
Robinson, Stewart SD48
Robles, Jose SD35
Robotis, Andrea WD02
Robu, Valentin SA46
Rocha, Clara TD22
Rockafellar, R. Tyrrell MC04, TB14, TD45, WB21
Rockart, Scott SD58
Rodrigues, Brian WD49
Rodrigues, Rita WA11
Rodrìguez, Miguel WB46
Roe, Charles M. WA25
Roelofs, Matthew WC33
Roels, Guillaume SA50, MA25
Roesener, August SB37
Rogan, Josè SA56
Rogers, Alex TA56
Rogers, Dale WD07
Rogers, Doug SB37
Rogers, Pamela SD08, WB28
Rogers, Scott WB46
Rogerson, Peter TA53
Rohde, Kirsten TC20, TD20
Rohlck, Gabriela WD43
Roithner, Tobias MA25
Roman, Diana SB45, WA15
Romanowski, Carol MD27
Romeijn, Edwin SD39, MB51, MB53, MC41, MC50, TA01, TC16
Romero Morales, Dolores MB56
Römo, Frode TA01, TC56
Romo-Fragoso, Salvador WD32
Ronen, David SB34
Rong, Ying WA59
Ronnqvist, Mikael SC47
Roos, Kees SD15
Rosales, Claudia SB35
Rose, Dawn IS- T
Rose, Marc WD43
Rosenberger, Jay MA15, MA26, MB26, TB41, WA46
Rosenfeld, Benjmain MB27
Ross, Kevin SA25, WA27
Rosoff, Heather MA09
Rossi, Matti WD37
Roth, Aleda SA23, SB59, MC07, TD58
Roth, Brian WD14
Roth, Richard MB16
Rothblum, Uriel G. MA16
Roubos, Dennis SC54
Roundy, Robin MD10, WA28
Roure, Josep TD26
Rouse, Paul MD22
Rouse, William WC45
Rousseau, Louis-Martin MC28, TC28
Royset, Johannes TB35
Ru, Jun WB06
Rubin, Edward SA21
Rubin, Paul TB60, TD36
Rubio, Enrique MD47
Ruckstuhl, Andreas WA06
Rudi, Nils MD59
Rueda, Guillermo WA52, WC60
Ruggeri, Fabrizio MC26
Ruggiero, John SB22
Ruiz Juri, Natalia WB33
Ruiz, Pablo WA56
Ruiz-Torres, Alex SC01
Rumi, Rafael SC21
Rump, Christopher TD57, WD45
Rumyantsev, Sergey MB02
Rungtusanatham, Johnny SA01
Ruperez Micola, Augusto SA46, TA08
Rush, Melodie SA24
Rusmevichientong, Paat SC49, TC03, TC10, TD50, WA07
Rusnak, John MC58
Russell, Gary WD26
Russell, Robert TA32
Ruszczynski, Andrzej WD39
Ruth, Maurer WD44
Ruth, R. Jean SA38, WA05
Ryabchenko, Valeriy TD45
Ryan, Jennifer TA06
Ryan, Sarah TA16
Ryan, Scott TD55
Ryder, Geoff SA25, WA27
Ryerson, James TC22
Ryu, Choonho SA13, WB28
Ryu, Jonghyun MC31
Ryu, Tae-Kyu TB08

S

Saar-Tsechansky, Maytal SB27, SD27
Saat, Rapik TD23
Saatçeiölu, Ömer WD09
Sabbaghi, Navid MC25, IS- M, WD01
Sabbagh, Mohammad S. WB14
Saberi, Amin TD50
Sabharwal, Ashish TC28
Sabhnani, Maheshkumar TD26
Sabido, Daniel TC52
Sabino, John SC14
Sabuncuoglu, Ihsan MC0, TD12
Sachdeo, Rajesh SA41
Sachon, Marc WD37
Sackellares, J. Chris MD41, WC26
Sadek, Adel SC33
Sadighian, Ali SB50
Sadykov, Ruslan MA12
Saez, Doris SD35
Safi, Danny MB57
Sagastizabal, Claudia TD14
Saghafian, Soroush SB08
Saglam, Mehmet SA45
Saharia, Aditya TC23
Saharidis, George WB16
Sahaym, Arvin SC58
Sahin, Ozge TA49, TC49
Sahinidis, Nick TD18
Sahinoz, Ahmet WC57
Sahoo, Nachiketa SC27
Sahu, Sushanta WC54
Sainathan, Arvind TD39
Saka, Gorkem SD39, TC15
Saksena, Nitin WD45
Salasznyk, Paul WB35, WD13
Saleeby, Odette WB42
Saleh, Amani TA09
Salehirad, Neda WD22
Salman, Sibel SA57
Salmeron, Antonio SC21
Salmeron, Javier WC18
Salmon, Jim WD04
Salo, Ahti MA20, WA20
Saltzman, Matthew SA29, SD13, MA29, TA18
Samanlioglu, Funda MB28, TA09
Samatli, Gulay WB31
Sambamurthy, Vallabhajosyula SD17, MC17
Samii, Amir TD28
Samson, Sundeep TD22
Samuelson, Doug MB43
Sanchez, Juan Jose TC46
Sanchez, Octavio TB47
Sandholm, Tuomas SB15, MA56, MC38
Sandikci, Burhaneddin SD40, WD21
Sangster, Sean SB39
Sankaranarayanan, Ramesh SB17
Sansom L, Stephanie TB40
Santanam, Raghu SC25, TB17
Santander-Mercado, Alcides MA31
Santiago, Leonardo SB60
Santibanez, Pablo SC40, MD47
Santiváñez, Josè MD53
Santos, Joost TC23
Saouma, Richard SD07
Sappington, David SD03
Sapra, Amar MA10, TA11, WA07
Sarabando, Paula MC21
Saraf, Nilesh TB17
Sarfare, Parag MB48
Sargut, F. Zeynep MA52
Sargut, Fatma Zeynep MB53

Sarin, Subhash C. TD12, WA12, WC28
Saripalle, Madhusalini SB33
Sarma, Pallav, SB05
Sarkar, Sumit SA27, SC27, MA27
Sarutipand, Pattharin WA35
Sarvary, Miklos WB02
Sarykalin, Sergey TD45
Sasaki, Mihiro MC53
Satijn, Stephan WC02
Sato, Hiroyuki TB35
Satterthwaite, Mark MA06
Satyam, Kumar WC54
Sauma, Enzo TD46
Saure, Antoine SC40
Saure, Denis MD51, TA10, WA47
Savachkin, Alex SD41, TB09, WD40
Savage, Sam MB21, WA51
Savard, Gilles SD33, WC37
Savasaneril, Secil MB50, WB10
Savaskan, Canan TD06
Savelsbergh, Martin, SC34, SD18, SD44, MB35, MC34, TC35
Savin, Sergei MC51, TD41
Savourey, David MA12
Savva, Nicos WA39
Sawaki, Katsushige WB45
Sawaya, Nicolas WC13
Sawik, Tadeusz MD01
Saxena, Anureet MA13, TA13, IS- T, WA13, WC14
Saxena, Umesh WA56
Sayin, Serpil MC27
Saydam, Cem WC42
Sayyady, Fatemeh SD36
Scanfeld, Daniel SA41
Scarf, Phil TD57
Scarsini, Marco SB10
Schade, Christian WA60
Schaefer, Andrew SC40, SC42, SD40, MC40, WD21
Schaefer, Andrew SC42, SD39, MA57, MB41, TA41, TC15
Schafer, Darwin WC36
Schapira, Michael MC38, TA38
Schatteman, Damien MD12
Schaub, Cornelius WC20
Scheibe, Kevin TA52
Scheller-Wolf, Alan SB19, SB51, SB54, SC03, SC06, TA57, TB51, TC47, TD06, WA47
Scherer, William WC36, WD47
Scherr, Wolfgang SC33
Schickinger, Thomas SB55
Schiff, Jeremy TA56
Schilling, Martin WC20
Schimert, James WD26
Schleef, Harold WD45
Schler, Jonathan MB27
Schleyer, Marc TD33
Schmeiser, Bruce W. WD48
Schmidt, Charles WC08
Schmidt, Glen TA58
Schmidt, Ursula Anna MD39
Schmitt, Amanda MD07
Schneider, Helmut SA09
Schneider, Jeff TD26
Schoene, Clare WB30
Schoenmeyr, Tor WD08
Scholler, Patrick SB43
Scholtes, Stefan TC42, WA39
Scholtz, Nicole IS- M
Schonberger, Richard SB59
Schonfeld, Paul TA16, TA55
Schott, Elizabeth MA44
Schroeder, Roger TD28
Schuff, David MD19
Schultz, Ken TA23
Schultz, Ximena MC47
Schulz, Andreas SC05, SC16, TA12
Schuster, Edmund TB47
Schutten, Marco TA32, WA12
Schütz, Peter TA01
Schwaiger, Katharina WA15
Schwartz, Galina MA50
Scott, Carlton TD14
Scott, Greg MD09
Scott, Michael J. SA38
Sebastian, Hans- Jürgen TA02
Secomandi, Nicola SB49, SD50, MC03, TC47, WA47, WB47
Secrest, Barry SB37
See, Chuen-Teck TB15
Segev, Dorry L. SA40, TC06
Seglie, Ernest A. TA37
Sehwail, Loay MA01
Seidmann, Abraham TA17
Seifert, Ralf MA03
Seiford, Lawrence SC32, MD22
Sellami, Moncef MC52
Sellamuthu, Sivakumar TC32
Sellman, Collin SC25
Sellmann, Meinolf SA18, MD28, TC28
Selot, Ajay WB16
Sen, Alper TB54, WD10
Sen, Sagnika TB17
Sen, Suvrajeet SA56, SB18, MB14, MD15, TD16, WB15
Sener, Neslihan WC60
Sengir, Gulcin WA05
Sengupta, Raghu TC01
Sengupta, Sanjit SA36
Seo, Fumiko TD22
Seo, Minseok SA16
Seo, Won Joo WC15
Sepil, Canan WD09
Serban, Nicoleta WD44
Seref, Michelle MH TB59
Seref, Onur WA26, WC26
Serel, Dogan MA08
Serin, Yasemin WD09
Serrano, Alejandro WA06
Seshadri, Sridhar SC02, MC02, WA07
Sessions, John SB47
Sethi, Suresh SD11, TB16, WB07
Sethuraman, Jay SD12, MA16, MC12
Setia, Pankaj MC17
Sewell, Edward SA16, SA40, WB40, WC40
Seyller, Thomas TA20
Sezer, Semih WA54
Sha, Mei SB32
Shachter, Ross SC21, TA20
Shah, Devavrat MD51, TA54
Shah, Hiral MA44
Shah, Janat WD01
Shah, Nilay MB41
Shah, Premal SA45
Shah, Shital TB26, WA42
Shah, Sonali K. SC58
Shahabuddin, Syed MD01
Shahady, David WC09
Shaikh, Salman WC58
Shakkottai, Srinivas TC50
Shaltayev, Dmitriy MD48
Shan, Chung-chieh MD27
Shanbhag, Uday MB14, WB32, WC46
Shang, Jennifer WA32
Shang, Kevin SD10, TA10
Shanker, Kripa TC01
Shanker, Murali WD56
Shanno, David MB19
Shanthikumar, George SC08, MA07, MD54, TC10, TC45, WA48, WD23
Shao, Bin TC38
Shao, Jing SB02
Shapiro, Alex WD15
Sharawi, Abeer TA09
Sharda, Ramesh MC19
Sharkey, Thomas IS- M, TC16
Sharma, Abhishek WC38
Sharma, Dushyant SA28, SC57
Sharma, Mayank MD51
Sharman, Raj SC17
Sharma, Vikas WA25
Shattuck, Lawrence WC53
Shaw, Tina SB55
Shearin, William SB43
Sheblè, Gerald SB46, WB27, WB48
Shechter, Steven SC42, MC41, WC42
Sheffi, Yossi MC25, WD01
Sheikh, Saad TC41
Shen, Haipeng SD06, MB25
Shen, Jierui MC15
Shen, Max SB53, SC49, SC53, MA07, MD07, TB56, TC10, TC16, TD10
Shen, Siqian WC15
Shen, Wei MD35, WC14
Shen, Wenjing MD59
Shen, Yanfang SD16
Shen, Yu-Chu TC40
Shen, Zhihong MB36, TD09
Sheng, Huanyuan TA13
Shenoy, Prakash P. SC21
Sheopuri, Anshul WA07
Shepard, Jo-anne SB39
Sherali, Hanif MC15, TD12, WD55
Sherer, Susan MB01
Sherry, Lance WC43
Sheth, Arnav MA15
Shetty, Vijay TB35
Shi, Chunming WD01
Shi, Jianjun (Jan) MD31, TC31, WA30
Shi, Jianming WB39
Shi, Jin TA40
Shi, Jing WA09
Shi, Junmin WC32
Shi, Leyuan SA40, TA29, TB04, WA43, WB42, WD28
Shi, Min MC32
Shi, Ning WD14
Shi, Ruixia MB11
Shi, Victor TD03
Shi, Xiaoning TB38
Shiau, Deng-Shan MD41, WC26
Shieh, Yiwey TC21
Shier, Douglas MC48, WC14
Shim, Yohan TB46
Shin, Hyoduk SD56, TA07
Shin, Hyun WB38
Shin, Jaejoon MC32
Shin, Jiwoong TA17
Shin, Wan-Seon SD25
Shioda, Romy SA51, TC26
Shittu, Ekundayo WB46
Shivendu, Shivendu SD17
Shkolni, Niv MC27
Shmatov, Cyril SB50
Shmoys, David SC49, MA04, MD10, TD10
Shmueli, Galit SB31, SD27, MA31, MD25
Shoemaker, Christine SB14
Shortle, John MB55
Shrivastava, Abhishek TA31
Shu, Jun TC27
Shughart, Larry MA52
Shulman, Jeff TD06
Shuman, Larry WA09, WB35
Shumsky, Robert SD49, TD59
Shunk, Dan SC01
Shunko, Masha SB51, WB06
Shylo, Volodymyr WA16
Si, Jennie SD54
Sibdari, Soheil WA32
Siddiqui, Afzal SD46
Siegel, Micah TA59
Sieke, Marcel MA03
Siemsen, Enno SB59, MA23, MC07, TD58
Sigman, Karl SC12
Silva, Eduardo MC32
Silva, Julio WA42
Silva, Marcos SA28
Silva-Risso, Jorge SB43
Silver, Edward TD07
Sim, Melvyn TA14, TB15
Simao, Hugo MD34
Simchi-Levi, David SC04, MB51, MC22, TC33, TD10, TD15, WA10, WB40
Simeone, Bruno MC05
Simon, Carine MA49
Simonetti, Luidi SD57
Simons, Robert L. TC23
Simpson, Timothy MB26, TC27
Sim, Thaddeus MC53
Sims, Jason WA34
Sin, Peter TB59

IS-M Interactive Session, Monday (12:30- 1:30) ***IS-T Interactive Session, Tuesday (12:30- 1:30)***

Singh, Chanan TA15
Singh, Inderjeet TD15
Singh, Mohit WC52
Singh, Param Vir SB17
Singh, Sanjeet TB22
Singh, Shweta SA27
Singhal, Vinod MB02
Singhose, William TB32
Singhtaun, Chansiri TC53
Sinha, Amitabh SC34, SD34, MC03, WB38
Sinha, Kingshuk TC58, WB53, WC58
Sinha, Rajiv SC25
Sioshansi, Ramteen TA46
Sir, Mustafa MB41
Sircar, Ronnie TC45
Sittikariya, Sittipan WD36
Sittivijan, Peerapol TC36
Sivaramakrishnan, Kartik MD29
Sivaramakrishnan, Konduru TC17
Skidmore, Frank WC26
Skopalik, Alexander MD38
Skroch, Eric TB09
Slaughter, Sandra MC58, WC06
Sleptchenko, Andrei TD08
Slikker, Marco SB10
Small, Mitchell MA53
Smeers, Yves SC46, TC56
Smilowitz, Karen SA04, SB34, MA34, TC08
Smirti, Magan TC43
Smith, Alice E. MC57
Smith, Barry SD55
Smith, Cole MC15, TB13
Smith, J. Cole MA57, MC41, TB50
Smith, James SA21, MB20, TA20, TB20, WB15, WD21
Smith, Jeff MA48, MB48
Smith, Kimothy TD26
Smith, L Douglas SB36
Smith, Marc MC19
Smith, Michael D. MA17, WC17
Smith, Milton WA09
Smith, Robert L TD16, TD37, WC28, WD16
Smith, Stephen SB54
Smith, Stuart WC55
Smith-Daniels, Dwight SA59
Smith-Daniels, Vicki SA59
Sniekers, Daphne SA39
Snyder, Lawrence MD07, WA59, WB05
So, Anthony Man-Cho MC14, MC56
So, Rick SD10, MC06
So, Samuel SB42
Sobel, Matthew MD11, TD20
Soberanis, Policarpio MC29
Sochats, Ken WB35
Soda, Giuseppe TA60
Sodhi, Manbir WA53
Soerensen, Troels Bjerre MA56
Sofer, Ariela MA42
Sohn, SugJe MA05, TC01
Sohoni, Milind SD49, MC02, MD55
Sokol, Joel SD44, SD49, MB18, TC41
Solak, Senay TB32, TD43
Solorio Magana, Carlos SC30
Solyali, Oguz TD08
Somani, Kamalesh MA52
Sommer, Svenja TB58
Son, Jai-Yeol SA17
Son, Young-Jun MA19, MB48
Sondak, Harris WB32
Song, Haiqing MC48, TD01
Song, Jeannette SC07, SD02, MA10, TB10
Song, Sang Hwa SC11, MA01, TA22
Song, Wheyming TC42, WA31
Song, Yangqiu MD27
Song, Yuyue SB02, WC03
Song, Ziqi MD35
Soni, Anita TB57
Sonmez, Erkut MC03
Soofi, Ehsan SA31
Soorapanth, Sada TC40
Sorensen, Stephen TB40
Soriano, Patrick SB19
Sorochuk, Craig WC51
Sosa, Lourdes SA60
Sosa, Manuel MC58, TA58, TB58
Sosic, Greys SA10, SB10, SD03, MA02
Sotomayor, Luz TB48
Sougstad, Ryan SC43
Souhan, Brian WD22
Sounderpandian, Jayavel TB38
Sourirajan, Karthik WC10
Sousa Lobo, Miguel SD50
Souyris, Sebastian SD35
Souza, Gilvan MB03, WD02
Sowlati, Taraneh WD22
Sox, Charles SB08, MB34, TC53
Soyer, Refik SA31, MC26, TD32
Sparks, John TD17, TD52
Speck, Doug TD26
Spiegler, Israel MC27
Spieksma, Frits MB12, TB32
Springer, Mark WC33
Sprintson, Alex TD23
Squillante, Mark S. MD51, WD19
Srabstein, Pablo SC43
Sridhar, Dr. Banavar TC55, WA55
Srikant, R. TA51
Srinivasan, Ashok TA03
Srinivasan, Mahesh SD01
Srinivasan, Rajagopalan SC08
Srinivasan, Shuba SD38
Sriskandarajah, Chelliah SC13, MB12, TB11
Srivastava, Rajesh Kumar WD58
Srivathsan, Sandeep TC36, WC23
Srour, F. Jordan MD34
St. Clair, Larry SC52
Staats, Brad MA58
Stacey, Jennifer MB34
Stahlbock, Robert MA33
Stahl, James TB40
Stallaert, Jan TA17
Stanciu, Alia WB42
Stander, Justin SA13
Standridge, Charles SB33
Stanfield, Paul MB28
Stanford, Robert E. TD53
Stecke, Kathryn MA02, TB11, WB09
Steenkamp, Dawie WB56
Steensma, Kevin SC58
Stefanescu, Catalina MA45
Steffes, Erin SA27
Steffy, Dan WA11
Steier, David SD27
Steijn, Ivo WD46
Stein, Cliff SD12
Stein, William WD51
Steinberg, Richard MB56
Steiner, George WB12
Stengel, Donald WB56
Stephen, Tamon SD15
Stern, Scott SC60
Stern, Zvi SD59
Stevens, Soraya SD37
Stewart, Dale MC09
Stier-Moses, Nicolas SC50, TA10
St-Louis, Patrick MD28
Stojkovic, Goran TD55
Stolletz, Raik WC32
Stolyar, Alexander TA51
Storer, Robert MD34
Storti, Bill MC43
Stow, Craig SB21
Stoyan, Stephen WB45
Strachan, Denis WC21
Stranlund, John WA46
Stratila, Dan MD10
Stratman, Jeff WC49
Strauss, Stephen MB43, TA43, TB43
Street, Nick TA42, TC26, WD26
Strong, Diane SD42
Su, Che-Lin SC15
Su, Ping SB06, MA59
Su, Xuanming SC51, SD03, MB06, MD03, TB06
Su, Xuemei SA17, WB01
Su, Zheng SC42
Subramanian, Dharmashankar WA51
Subramanian, Ravi SB38, WB03, WD02
Subramanyam, Ramanath TC17, WD02
Sudit, Moises SC48, TB35, WB37
Sudjianto, Agus SD26
Sue Wing, Ian WA46
Suedel B, Kim J MD21
Suhl, Leena IS- M
Sukchotrat, Thuntee TB26
Sulewski, Charles WD22
Sun, Daewon WC08
Sun, Dengfeng TA55
Sun, Hao WC02
Sun, Jie TB15
Sun, Jiong SA06, TB11
Sun, Linhui TC01
Sun, Linyan TC01, TC23, WA01, WA48
Sun, Monic TD38
Sun, Peng MA40, WB15
Sun, Peter MD28
Sun, Yang SA35, WA59, WB11
Sundaramoorthi, Durai TB41
Sundararaghavan, P WB08
Sundararajan, Arun SC38
Sundararajan, Mukund MC56, TA38
Sundaresan, Shankar WC51
Sung, Dan Keun WC23
Sung, Tai-Kuan MA15
Sungur, Ilgaz SA36
Sunnecti, Aysun MD22
Sural, Haldun SD35, TD08
Suri, Rajan WC54
Susarla, Anjana TC17
Sutherland, Scott TB23
Sutton, Warren MD22, TA22
Suwandechochai, Rawee WB49
Suzuki, Atsuo MC53, TA53
Sviridenko, Maxim MD10, TD10
Swaminathan, Jayashankar SB07, MA11, MC06, MD59, WB02, WC06
Swamy, Chaitanya MC38
Swan, Bill SD32
Swann, Julie SB51, SD40, MA36, MA40, MC07, TB57, WA40
Swersey, Arthur SA25
Swinney, Robert MB06, TA07
Szmerekovsky, Joseph SA59, TB42
Szymanoski, Edward TB23

T

't Hoen, Pieter Jan SA46
Taaffe, Kevin SA35, SD51, WB32, WD35
Tabata, Tomoaki MD48, WC48
Taboada, Heidi SD30
Tadikamalla, Pandu MA30, WA32
Tafazzoli, Ali MD48
Tafti, Ali Reza MC17, WC06
Tajibaeva, Liaila MA47
Takano, Yuichi MC45
Talbot, Brian TC32
Tallberg, Mathias MA44
Talreja, Rishi WB51
Talukdar, Debabrata TD38
Tamayo, Pablo SA41
Tambe, Prasanna WB59
Tamir, Arie MC34
Tan, Baris SB03
Tan, Burcu WD09
Tan, Daniel SB42
Tan, Li TC48
Tan, Tarkan WD10
Tan, Yong WA04
Taneri, Denis WA40
Taner, Mehmet Rustu MC01, WB31
Tang, Boxin TD31
Tang, Christopher MB03, TB06
Tang, Guo-Chun SB12
Tang, Guoxin IS- M
Tang, Kaizhi MD26
Tang, Kwei SC13, MD11, TC52
Tang, Lei WC59
Tang, Sammi WB01
Tang, Victor WD12
Tang, Wenjie MB23
Tangpong, Chanchai TC58
Tanner, Matthew MD15, WC15

Tanrisever, Fehmi MC11, WA58
Tao, Xing WA34
Tao, Zhijie TC07
Tardif, Valerie SB51, TB56
Tarimcilar, Murat MC26
Tarim, S. Armagan MD01
Tarman, Tarcan WB60
Tarr, Peri SC43
Tarun, Prashant MB26, WA46
Taseli, Aysun WA25
Taskin, Nazim WC48
Taskin, Selda TA09
Taskin, Zeki Caner MA57, MC41
Taub, Shai MB25
Tavares, Gabriel MC05, TB24, TC18
Tavares, Gabriel MB13
Tawarlamani, Mohit TC13
Tayfur, Esengul TA18,WD35
Taylor, A.H. SD58
Taylor, Carol SC17
Taylor, Christine WB39
Taylor, Terry SD07, MA02
Tayur, Sridhar SA03, SB51, TB56, TD06
Teegavarapu, Ramesh TA33
Tekin, Eylem WB19
Telang, Rahul WC17
Temel, Melih WA53
Temiyasathit, Chivalai MA26
Teo, Chee Chong TC03
Teo, Chung-Piaw SD05, TA06, TB15, TD10
Teoh, Chin-Chuen WB48
Terekhov, Daria TB28
Terlaky, Tamas SD15
Terrizzano, Ignacio SC43
Terwiesch, Christian SC02, MA60, MB03, MC40, TA04, TD06
Tezcan, Tolga MB25, WB54
Thain, Greg TC18
Thakur, Mayur MA19
Thal, Al WC09
Tharakunnel, Kurian TD52
Theisen, Kacie TD05
Theofanis, Sotiris MB33, MD33
Thiele, Aurelie MA49
Thille, Henry MD46
Thirumalai, Sriram WB53
Thomas, Barrett MC34, MC53
Thomas, Bex MA43, WD28
Thomas, Dougals SD01
Thomas, Gail Fann MD19
Thomas, Lyn MA45, MC26
Thomas, Marlin MC30, WD53
Thompson, David SC56
Thompson, Kimberly MD20, TC21
Thompson, Matthew SB47
Thompson, William WA40
Thonemann, Ulrich MA03, MB52, MC23, TA23, TB07, TB48
Thorsson, Vesteinn WA41
Tian, Zhigang SC30
Tian, Zhongjun WC49
Tibben-Lembke, Ronald WD07
Tiedemann, Peter TC28
Tien, Shin-Lai TA55
Tillman, Tracy MA44
Tilson, Vera SA59, TC39, WB31
Tiwari, Manoj Kumar TD12
Tocchella, Barbara SB16
Tokar, Travis MD23
Toh, Rex SD32
Tokar-Erdemir, Elif TA53
Tokdar, Surya WB07
Tokou, Helene MB08
Toktay, Beril MA03, TA10, TB03, WA59, WB03
Toledo, Benjamìn SA56
Tolstad Uggen, Kristin TC56
Tomasgard, Asgeir SB16, TC48, TC56, WA15, WC56
Tomberlin, David MB47
Tomlin, Brian SC06, MB10
Tomlin, John TD29
Tong, Chunyang TC32
Tong, Dehui SD53
Tongarl, Mustafa SC31
Topaloglu, Huseyin SD34, MA39, MD49, TA50
Toptal, Aysegul MC01, TD12
Toriello, Alejandro SD18
Torres, Jacob TD23
Torres, Marcelo SB57
Torres, Octavio Andres WD52
Torzhkov, Andrey WB54
Toth, Sandor SA47
Totomanov, Alex SB22
Tourki, Bechir MA12
Toyasaki, Fuminori WB02
Töyli, Juuso MA44
Toyoizumi, Hiroshi WD32
Trafalis, Theodore B. MB42
Transchel, Sandra WD51
Trapp, Andrew WA26
Trapp, Natalya SB51
Tremblay, Nicolas WA36
Triantaphyllou, Evangelos SA26, SB09
Trick, Michael MC28
Trietsch, Dan SD04
Trigeorgis, Lenos TD48
Tripathi, Atul WB30
Trofimov, Alexei SB39, SD05
Trotter, Leslie E. MC44
Trubian, Marco MB31
Truss, Lynn WA11
Tsai, Peifang TD12
Tsai, Yi-Chun WA19
Tseng, Chung-Li WD46
Tseng, Paul MA14, TB14
Tsetlin, Ilia SC20, SD56, MB23
Tsilingiris, Panagiotis TA33
Tsitsiklis, John SB39, SD05, MC25, MC46, TA54, WD01
Tsuchiya, Koji TA48
Tsui, Kwok-Leung SB26, SC31, MA26, TD40
Tsung, Fugee SC25, TD30
Tsurkov, Vladimir IS- M
Tüll, Peet WA40
Tuma, Axel WC02
Tunca, Tunay SD56, MD56, TA07
Tuncel, Ali MA42
Tuncel, Levent SA15, SA51
Tuncelli, Aysegul MC27
Tural, Mustafa TA13
Turcic, Danko MD11, TD20
Turetken, Ozgur MD19
Turkay, Metin SA34, SC41, MB42, IS- M
Turkcan, Ayten TA40
Turko, Timofey TD45
Turner, John TD06
Turnquist, Mark SD36, MA36
Tustin, Jeffrey SD37
Tuunainen, Virpi Kristiina WD37
Tuzhilin, Alexander SC27
Twaites, Greg WB31
Twomey, Janet TC02, WB12
Tyworth, Gene TB33
Tzur, Michal TD10

U

Ubeda, Sergio TA32
Ucar, Hatice WD48
Uchoa, Eduardo SD57
Ucros, Juan WD16
Uffinger, Alexander WC02
Ugiliweneza, Beatrice WC16
Ugray, Zsolt TC05
Uhan, Nelson SC05, TA12
Uhlig, Paul MC42
Ukai, Takamori IS- T
Ukkusuri, Satish SA33, MA36, TB34, TC35, WA33, WB34, WD35
Ulas Acikgoz, Saadet TB48
Ulku, M. Ali SD34
Ulku, Sezer TA58
Ulrich, Karl MA60
Ulu, Canan TB20, WD21
Ulusoy, Gunduz WB57
Umyarov, Akhmed SC27
Uney Yuksektepe, Fadime MB42
Ungar, Lyle MB27
Unluyurt, Tonguc SA57, IS- T
Unnikrishnan, Avinash TA34, TA35, TC34, TD35
Upadhyaya, Shambhu SC17
Upfal, Eli TC28
Upton, David MA58
Urban, Tim TD53
Uribe, Andres SD41, WD40
Ursulenko, Oleksii WA26
Uryasev, Stan WB21
Uryasev, Stanislav TD45
Usanmaz, Gokhan MB02
Uster, Halit MC34, MD57, TB13, WA02
Ustun, Volkan MA48
Utterback, James MC60
Uyar, Emrah SC34
Uzsoy, Reha WC11

V

Vailati, Riccardo TD46
Vairaktarakis, George TA12
Vajiac, Mihaela MA11
Vakharia, Asoo TB59
Vakhutinsky, Andrew SB57
Vakili, Nasim TA55
Vakratsas, Demetrios SD38
Valdebenito, Victor SC47
Valdez, Jose IS- T
Valdez, Rupa SD31
Valdivia, Juan Alejandro SA56
Valente, Christian WB15
Valenzuela, Jorge MB46, WD56
Valero, Camilo WA24
Valian, Haleh SA45, SB41, WD14
Valles-Rosales, Delia MA44
Valsaraj, Varunraj TD35, WB34
Van Alstyne, Marshall MC17
van de Velde, Steef MD34
van den Heuvel, Wilco TC16
Van der Heyden, Ludo WA58
van der Weij, Wemke TC48, WA53
van Donselaar, Karel SD10, WA06
Van Groningen, Charles SD37
van Heck, Eric MD56
Van Hentenryck, Pascal SC19, MD28, TA28, TB28, TC28
van Hoeve, Willem-Jan SA18, TC28
van Houtum, Geert-Jan TB07
Van Mieghem, Jan MD59
van Ooijen, Henny TD28
Van Oyen, Mark SB08, TC07
van Raaij, Erik TB02
Van Roy, Benjamin MA06, MD50, TA54, TD50
van Ryzin, Garrett SC51, MC49, MC51, MD06, TB49, TC49
Van Vliet, Ben MD58
Van Wassenhove, Luk TA23, TB02, TC02, TD04, WB02, WC02
Van Weele, Stuart TB26
van Woensel, Tom SD10, TB32, WA06, WC54, WD10
VanAsperen, Eelco WD36
VanBriesen, Jeanne MA53
Vandaele, Nico SD01, TA05, WD54
Vande Vate, John MA07
Vanderbei, Robert MB19
Vanderby, Sonia SA39
Vandevonder, Stijn MD12
Vanmaele, Hendrik WC08
Vanteddu, Gangaraju WD01
Vargas, Jaime Mora TD12
Vargas, Luis WB42
Vasquez, Juan SB37
Vazacopoulos, Alkis TC18
Veatch, Michael SA54
Veeramani, Raj TA39
Veeraraghavan, Senthil SA50, SB54, TB06
Veit, Daniel J. SB46

IS-M Interactive Session, Monday (12:30- 1:30) ***IS-T Interactive Session, Tuesday (12:30- 1:30)***

Vela, Adan TB32
Velasquez, Jesus WA24
Veloso, Francisco MB60
Velu, Deepa SC17
Veludo, Maria TB42
Vempala, Santosh SA40
Vendrell Simö, Josep Maria WB47
Vengazhiyil, Roshan SD26, TB25, TB31, TC31
Venkatasubramanian, Venkat WB42
Venkat, Kumar WC56
Venkatraman, Srinivasan SD21
Ventura, Jose SA16
Vera, Jorge WC39
Vercellis, Carlo TB27
Vergez, Juan Fernando WD52
Vergo, John SC43
Vergu, Elisabeta WA31
Verma, Abhinav TA13
Verma, Manish SB02, WC34
Verma, Rohit SA25, MA23, MB07
Verma, Swati WB53
Vernik, Dinah TA20
Vernon, Mary WC54
Verona, Gianmario TA60
Verter, Vedat SB02, SD33, SD40, MA53, MD53, WB02, WC34, WD02
Vertesi, Les TD39
Vesilo, Rein TB51
Vetsikas, Ioannis WD56
Vickery, Shawnee MC17
Victorino, Liana MA23
Vidyarthi, Navneet IS- T
Vieira Junior, Hèlcio WC37
Vielma, Juan Pablo SA47, TC13
Vielma, Laura MD49
Vigerske, Stefan SB29
Vigfusson, Ymir MC38
Villalobos, J Rene SD44, TB47, TD19, WC32
Villalobos, Jorge TD34, WD35
Vinze, Ajay TB17
Virine, Lev WD20
Viry, Patrick SD24
Vis, Iris WC08
Visbal, Javier WC40
Visoldilokpun, Siriwat MB26
Viswanathan, Siva SD17
Vitolo, Thomas WB38
Vityaev, Evgenii MD26
Vlasiou, Maria MA40, TB51
Vlassis, Nikos SD54
Vliegen, Ingrid TB07
Vöcking, Berthold MD38
Vohra, Rakesh TD50
Vohra, Seema TD42
Vollbrecht, Kitty MD52
von Haartman, Kathrine SD16
von Krogh, Georg TC60
von Winterfeldt, Detlof MA09, MC20
Vose, David TD48
Voss, Stefan SB28, MA33, TB38
Vossen, Thomas WA10, WC11, WD55
Vukadinovic, Danica MB12
Vulcano, Gustavo TA50, TD49
Vural, Arif MB34

W

Wadhwa, Vijay SB09
Waechter, Andreas TC13, WA16
Wagelmans, Albert P.M. TC16
Wagner, Hermann-Josef MC18
Wagner, Janet WD27
Wagner, Michael R. WB33
Waicekaus, Kevin WB32
Waithe, Michael MA07
Wakker, Peter P. TC20, TD20
Walawalkar, Rahul TD56
Walczak, Darius SA49
Walker, Russell SD45
Wallace, William MD09, TB29, WB35, WD13
Wallenius, Jyrki TB12
Waller, Matthew MD23
Waller, S. Travis SA33, TA34, TA35, TC34, TD35, WA33, WB33, WB34, WB36
Walrand, Jean MA50
Walsh, Susan TC24
Waltz, Richard MA14
Waltz, Richard SB24, TC05
Wan, Guohua SD12
Wan, Hong SC31, MC31, TD30
Wan, Lin WD19
Wan, Zhixi MD02
Wang, Aihong MA52
Wang, Bruce SA36
Wang, Chao TD27
Wang, Cheng(Marshal) WD39
Wang, Chenyun TD35
Wang, Chin-Fang WD07
Wang, Chun TA29, WC13
Wang, David TD56
Wang, Di WD29
Wang, Fan WC43
Wang, Gang TC22
Wang, Grant SA40
Wang, Haibo SC28
Wang, Haifeng MA03
Wang, Haiyan WB49
Wang, Haiyuan WD12, WD33
Wang, Hsueh-Ming TB42
Wang, Hui SC11, TA30
Wang, Jiahui TC36
Wang, Jiamin SA53
Wang, Jian WB50
Wang, Jianwei WA34
Wang, Kaibo TD30
Wang, Kwo Chen WC49
Wang, Letian TA06
Wang, Lie WD17
Wang, Lijuan SB36
Wang, Lin SD01
Wang, Ling SD11
Wang, Lizhi MB46, TB08
Wang, Mulan X. TC47, WB47
Wang, Qiong TB10
Wang, Qiong WB02
Wang, Qiong MD54
Wang, Sheng-Pen TD08
Wang, Shidong SB36
Wang, Ta-Wei TB52
Wang, Tian-Wei MB28
Wang, Tong TA10
Wang, Wei MA01, TD16, TA15
Wang, Wendai SB30
Wang, Wen-ping WC02, WC57
Wang, Xia IS- M
Wang, Xiaoting SB09, SB54
Wang, Xiaozhe WC35
Wang, Xin WD56
Wang, Yan TA16
Wang, Yihua SA36
Wang, Yimin MB10
Wang, Yong WC29
Wang, Yucheng SA01
Wang, Yulan SD02, WB57
Wang, Yunzeng WB06
Wang, Zhi TA60
Waniek, Daniel MC18
Ward, Amy SD06, TD51
Ward, Edward WA42
Wardell III, Clarence TB38, WA39
Ware, Keith WB27
Warren, Jon TC51
Warsing, Don SD28, TB56
Wasil, Edward SB19, MD32, WA40
Wasserkrug, Segev MB25
Watson, Jean-Paul SA18, MB29, TB18
Weber, Bruce SD45, MA17
Weber, Charles SC60, SD60, WA52, WD52
Weber, Christian MB52
Weber, Theophane TA54
Webster, Scott WA12, WD01
Wee, Kwan Eng WC03, WD49
Weghorst, Suzannae IS- M
Weidlich, Anke SB46
Weight, Ryan MC51
Wein, Anne WA23
Wein, Lawrence SB04, SC42, MB09
Weintraub, Andres SC47, MB47, MC47, MD47
Weintraub, Gabriel SC50, MA06
Weissensteiner, Alexander WA15
Welch, Kimberly MA37
Wells, Michael MC55
Wen, Ue-Pyng WA08
Wen, Zaiwen WA14
Wendell, Richard WC09
Weng, Hua-Hung(Robin) SB59
Werker, Greg SC40
Werneck, Renato SD28, TB32
Werners, Brigitte MA51
Wernz, Christian WB20
Wertenbroch, Klaus WD21
Wessels, Gys WB56
Wesover, Jonathon H. WB32
West, Ken MC03
West, Paul SA20
Westerlund, Mika WB57
Westerlund, Tapio WA16
Wettergren, Thomas WC37
Whinston, Andrew MD17, WB48
Whitcomb, Kathleen WC35
White III, Chelsea C. SA35
White, Barbara Jo SC28
White, Chip SB34
White, Preston SD48
White, Sheneeta TD27
Whitman, Lawrence TC02
Whitt, Ward SC12, WB51
Wiecek, Margaret M. SA09, SB09
Wieland, Fred MB55, WB43
Wieland, Jamie R. WD48
Wiesenfeld, Batia MD17
Wikum, Erick WD28
Wilbur, Kenneth SB38
Wilck, Joseph SA47, TA32
Wild, Stefan SB14
Wiley, Mark MB24
Wilhelm, Wilbert TA29, TB13
Wilk, Szymon TC39
Wilkening, Dean MB09
Wilkinson, Dennis MC58
Willems, Sean MB02
Williams, Brian TD31
Williams, Clay SC43
Williams, Gareth TC03
Williams, Ian SB45
Williams, Jonathan SC02
Williams, Julie Ann MA39
Williams, Pamela MC48
Williams, Ruth J. MB54
Williamson, Carey WD23
Willis, Deanna MA31
Willis, Henry SC09
Willis, John TA37
Willoughby, Keith TB39, WC42
Wilson, J. Doug WD41
Wilson, James MD48
Wilson, James SC31
Wilson, John WC51
Wilson, Nathan MC46
Wilson, Theresa SA37
Winkler, Robert L. SC20, TA21, WD21
Winter, Emilie MA12
Winter, Ralph SA03
Wirojanagud, Pornsarun WD19
Wischik, Damon MD51
Wissman, Luke A. SA38
Wlodarczyk, Romain MB52
Wojcik, Barbara WC16
Wojtaszek, Daniel MC13
Wolcott, Mike TD05
Wolf, Joel SC12
Wolff, Ronald MA54
Wollenweber, Jens TA02
Wolsey, Laurence MA18, TD10, WC13
Womer, Keith TB02
Wong, Antonio WD45
Wong, Richard SB19
Wong, Weng-Keen TD26
Wood, Kevin MB09, TA47, TB09, WC18
Wood, Sam SD24
Woodaman, Ronald (Fred) TB37
Woodruff, David SB28
Woolley, Trisha WA46
Worsöe, Ulf WB29
Wortman, Martin WD53
Wright, Christopher SD49
Wright, George MB17
Wright, Ken MC55
Wright, Stephen TA31
Wry, Tyler SB58
Wu, Andy WC28

Wu, C. F. Jeff SD26, MD30, TB25
Wu, Changxu (Sean) MD41
Wu, D.J. MD56
Wu, David MD16, TA11
Wu, Desheng MA07
Wu, Diana MD23
Wu, Fang MB38, MC23
Wu, George MA21
Wu, Jianghua SA32
Wu, Jianhong WA40
Wu, Joesph SC42, SD41, WD40
Wu, Lifang SA17
Wu, Owen TC47
Wu, Peiling WA05
Wu, Ping (Amy) WA20
Wu, Shengnan WA09, WB35
Wu, Shuning WD28
Wu, Sze-jung Sandra SC39
Wu, Teresa TD14
Wu, Tianyi MD26
Wu, Tsung-Lin SA41, MA42
Wu, Xianyi SC12
Wu, Xiaoli TD07
Wu, Xiaowei WD41
Wu, Yaozhong MB07, MD03, TD58, WA58
Wu, Zhengping MB01
Wunderling, Roland MC13, TC18
Wurgaft, Hernan WD13
Wyner, Abraham SD26
Wysk, Richard MB48

X

Xanthopoulos, Petros WC26
Xi, Bowei MD25
Xia, Cathy H. MA54, MD54
Xia, Haifeng TC25
Xia, Nan MB11, TB50
Xia, Yusen SA08, MB01, TA23
Xiang, Chester MA59
Xiang, Ling WC36
Xiao, Cai SC35, MA35
Xiao, Wenqiang MA02, TD06
Xiaolin, Sun WD38
Xie, Chi SD36
Xie, Junjun TA56
Xie, Ming SD26
Xie, Ting WD12, WD33
Xie, Xiaolan WC10
Xin, Lei TD42
Xiong, Jing MA55
Xu, Feng TD32
Xu, Jianhua MA53
Xu, Jianjun WD08
Xu, Jie SA48
Xu, Liang MA14
Xu, Liang WC43
Xu, Linli TC26
Xu, Ning TD36
Xu, Ping TC03
Xu, Sean Xin MD32
Xu, Shenghan WD13
Xu, Shubin TA16
Xu, Susan SA54, TB10, TD02
Xu, Xiaojing TA32
Xu, Xiaolin TA06
Xu, Xiaowei MB01, TD07, WA28
Xu, Yan MA29, SD13
Xu, Yi TD06
Xu, Yi MB58
Xu, Zhiyong WA01
Xu, Zhou WC34
Xue, Mei MB45, MC07
Xue, Zhengliang MA10

Y

Yada, Visnu SB33
Yadav, Prashant TD28
Yadavalli, Sarma SD01
Yagi, Kyoko WB45
Yahav, Inbal SB31
Yalabik, Baris WB28
Yalcin, Ali WD29
Yamada, Masataka WA38
Yamada, Yuji MC45
Yamashita, Koji WA38
Yamazaki, Kazutoshi IS- T, WD16
Yan, Houmin MA03
Yan, Jia SD32
Yan, Keqi TD07
Yan, Ping TB40
Yan, Sun WA48
Yan, Tingting WB08
Yan, Xinghao MD11, WB06
Yanasse, Horacio WA11
Yand, Mark WD36
Yang, Chao-Lung TA27
Yang, Chun Li TD27
Yang, Fan MC35, MD36
Yang, Feng SC31
Yang, Hongjiao MC01
Yang, Hongyan SC58
Yang, Hui TA25, WA30, WD22
Yang, Jian MC12
Yang, Jiayi TC22
Yang, Jimmy MB51
Yang, Kai WD01
Yang, Kum Khiong WC19, WD49
Yang, Nan SD07, MB10, TD03
Yang, Ning TA16
Yang, Qingyu SD30
Yang, Shilei WC01
Yang, Shu-Jung Sunny MB11
Yang, Wei SB47, WB48
Yang, Xi TC11
Yang, Xu MA35
Yang, Zhibin MB10
Yankov, Daniel WD29
Yankovic, Natalia MC40
Yano, Candace MC22, MD11, MD47
Yao, David D. TA51
Yao, Liming WA12
Yao, Tao SD51, WA22
Yao, Yuliang MB01
Yates, Justin MB36
Yates, Lloyd MA33, MD05
Yauch, Charlene WC57
Yavuz, Mesut SA37
Yayla-Kullu, Muge MD59
Ye, Hengqing TA51, TB51
Ye, Kenny TC30
Ye, Yinyu SB53, SC53, SD14
Yeh, Sonia SA21
Yemelyanov, Alexander TA05
Yemelyanov, Alla TA05
Yen, Joyce WC05
Yeung, Thomas WB31
Yi, Jinxin SB19
Yi, John WA28
Yi, Sangyoon TD38
Yiöit, Aybeniz WD09
Yih, Yuehwern SC39, MD32, TA27
Yildirim, Bayram TC02
Yildirim, Fetih WC36
Yildirim, Mehmet WB12
Yildirim, Tuba Pinar WA32
Yildirim, Utku SA51, WC50
Yildirim, Yildiray SA45, MA45
Yildiz, Hakan MC28
Yilmaz, Hurrem WA38
Yin, Rui TB06, WB08
Yin, Shuya TA03, TD27
Yin, Wenjun SD26, MD27, TB27
Yin, Wotao WA14
Yin, Yafeng SA33, MC35, MD35, WC33, WD34
Yin, Zigeng MD07
Yip, Kenneth SC40
Yoo, Si-Won WD41
Yoo, Steve WA28
Yoon Christiand IS-T
Yoon Jungwon IS-T
Yoon, Yoonjin WA55
Yoshise, Akiko SA15
Yoshizaki, Hugo WD38
You, Han-Min WB25
Youn, Eun S. WB26
Youngblood, Jonathan WB27
Yu, Dennis SA06
Yu, Huizhen SC54
Yu, Lian TC45
Yu, Ming TC23, TD27
Yu, Yimin SB03
Yuan, Di SA57
Yuan, Ding WD26
Yuan, Hong WB38
Yuan, Jiguang SA32
Yuan, Ming SA15, TC30
Yuan, Yang SB18
Yuangyai, Chumpol TB31
Yucekaya, Ahmet WD56
Yucesan, Enver TA10
Yuditskiy, Semen WB22
Yue, Wei SA27
Yue, Xiaohang SA01, SA17, WB06
Yuen-Reed, Gigi TB23
Yuhaski, Steven TD37
Yukizane, Takahiro TB27
Yuksel Ozkaya, Banu MC07, WB10
Yüksel, Ynci TD37
Yun, Hyunjung SD57
Yun, Sangwoon MA14
Yunes, Tallys SB51
Yushimito, Wilfredo MA36, TC35
Yuzukirmizi, Mustafa WA11

Z

Zabarankin, Michael MB15, TB35, TD45, WB21
Zabinsky, Zelda SD16, MA08, TC09, TD16
Zaccour, Georges SB38
Zahavi, Jacob MC27
Zak, Eugene WA56
Zakeri, Golbon MC46
Zalewski, Janusz WA37
Zang, Israel WA39
Zangeneh, Shabnam WC39
Zappe, Chris SA44, SB44
Zarama, Roberto SA56, TB57, WD52
Zaric, Greg MB39, TC42, WC44
Zaric, Gregory TD42
Zarpas, Emmanuel SC43
Zayas-Castro, Jose SD59, MA31, MB31
Zeck, Christiane TA53
Zeevi, Assaf MD50, MD51, TA49, WB54
Zelikovsky, Alex WD41
Zelmer, Andrea MC18
Zeltyn, Sergey MB25
Zeng, Bo SA13, MA13, TC52
Zeng, Li TC25
Zenios, Stefanos SB40, MA40, MB22, MD40, TC06, TD41
Zenobia, Brent SD60, WD52
Zentano, Cecilia MC23
Zenzen, Fran WB31
Zepeda, David TA32
Zhan, Lezhou (Roger) SB53, SC53
Zhang, Ai Jun TD12
Zhang, Bin TB27
Zhang, Dengfeng SA01
Zhang, Di MB14, WC46
Zhang, Fan TB40
Zhang, Fuqiang SC03, SC25, SD10, MC06, TB06
Zhang, Guangming SB34
Zhang, Guoren SA36
Zhang, Hang TD25
Zhang, Hao SA40, SC10, SD03, WB42
Zhang, Hongchao MA14
Zhang, Hui TC42
Zhang, Huiju SB48
Zhang, Jennifer TA17
Zhang, Jiang SA11, MD08
Zhang, Jiawei SB53, SC10, TD10
Zhang, Jichen TD56
Zhang, Jiheng TC51
Zhang, John TA17
Zhang, Juheng TD17
Zhang, Jun SA11, MB11, MB45, MC07, MD11
Zhang, Jun WB58
Zhang, Kuilin WB36
Zhang, Lei SB36, SD33, MD36, TA36, TD36, WB48, WC25
Zhang, Li MA54, MB38, TD33
Zhang, Lian-Sheng WC29

IS-M Interactive Session, Monday (12:30- 1:30) ***IS-T Interactive Session, Tuesday (12:30- 1:30)***

Zhang, Lihui WC33
Zhang, Michael MD35, IS- T, WC14
Zhang, Min TD33
Zhang, Muhong WC13
Zhang, Pengcheng SC14
Zhang, Peter G. MB01
Zhang, Rachel MD02, TC11
Zhang, Rui WB12
Zhang, Sidong TC12
Zhang, Xiaoping WD36
Zhang, Xin SA45
Zhang, Xinhui WC12
Zhang, Yang SD41, WC57
Zhang, Yue SB02, MA53, MC41
Zhang, Yuhan MC50, TA14
Zhang, Zhe George WB23
Zhang, Zhengjie SC55
Zhao, Hui MD11, WB06
Zhao, Jinye TA46, TB34, WD54
Zhao, Lei MC41, MD39
Zhao, Ming SC13, WA13
Zhao, Wenhui SA12
Zhao, Xuan SC38, TD03
Zhao, Xuying MA02
Zhao, Yao TB10, TD01, TD07
Zhao, Zhenying WC22
Zhegu, Majlinda MC59
Zheltova, Ludmila SA30, WA22, WB22
Zheng, Eric SA27
Zheng, Hong SD36
Zheng, Kai TB42
Zheng, Li MD39
Zheng, Qipeng (Phil) MD35
Zheng, Xiaona TD27
Zhong, Fang (Vivian) MD56
Zhong, Hongsheng SB19
Zhong, Jing WA30
Zhou, Enlu SA19
Zhou, Jia SB31
Zhou, Jianer MC02
Zhou, Jieyun SC46
Zhou, Jing (Jenny) SB01
Zhou, Jing WB45
Zhou, Junyi WA09
Zhou, Liang WA34
Zhou, Ling WB11
Zhou, Nan TC32
Zhou, Sean SC01, TA10, TC07
Zhou, Shiyu MD31, TA30, TB30, TC25, WA30, WB25, WC31, WD31
Zhou, Shu SD11
Zhou, Wei TD17
Zhou, Xian SC12
Zhou, Xuesong MD33, WA34
Zhou, Yingjie WD12, WD33
Zhou, Yong-Pin SA49, SB01, SC07, MB25, MB58,
Zhou, Zach SD17
Zhou, Zhi WD12, WD29, WD33
Zhou, Zhihong MB14
Zhu, Dan MB17
Zhu, Endong SA34
Zhu, Jiaping SD15
Zhu, Kaijie MA02, TC11
Zhu, Kevin MD32
Zhu, Minghua TB27
Zhu, Mu TC30
Zhu, Wanshan MB01, MC03
Zhu, Wei WD46
Zhu, Xiaowei SA01
Zhu, Yi SB38
Zhu, Yuntao TD29
Zhuang, Jun SA22
Ziedins, Ilze TA54
Zielinski, Sharon SA38
Ziemba-Davis, Mary SC59
Ziliaskopoulos, Thanasis WC36, WD36
Zinchenko, Yuriy WB42
Zipkin, Paul SC07, WC01
Ziya, Serhan SB40, SD42, MD49, WA19
Zohar, Aviv MC38, TA38
Zuddas, Paola TB33
Zuidwijk, Rob MC01, MD34, WA02
Zuo, Ming J. SC30
Zou, Nan WA34
Zwart, Bert MD51, TC51
Zwierzykowski, Ewelina SD47

Sunday, 8:00am - 9:30am

SA01 Supply Chain Management I
SA02 Issues in Product Life Cycle and Durability Management
SA03 Inventory in Supply Chains
SA04 Tutorial: Community-based Operations Research
SA05 2007 Dantzig Dissertation Award Finalists
SA06 Product Variety, Markets, and Operational Tradeoffs
SA07 Behavioral Operations
SA08 Managing Supply Chain Risks
SA09 Multicriteria Decision Making I
SA10 Cooperation in Inventory Management I
SA11 Multi-echelon/Multi-product Inventory Optimization
SA12 Integration and Approximation Issues
SA13 Theory and Applications of Integer Programming
SA15 Conic Optimization and Complementarity Problems
SA16 Combinatorial Optimization I
SA17 Joint Session ISS/ICS: Systems Evaluation
SA18 Integrated Methods
SA19 Computational Advances in Approximate Dynamic Programming
SA20 Joint Session DAS/MAS: Military Decision Analysis
SA21 Joint Session DAS/ENRE: Expert Elicitations For Energy Technology
SA22 Game Theory and Homeland Security
SA23 Behavioral/Experimental Economics Research in Supply Chain Management
SA24 Software Demonstration
SA25 Management of Complex Service Systems
SA26 Joint Session DM/ICS/CPMS: Real World Applications of Text Mining
SA27 Data Mining and Analysis
SA28 Metaheuristics in Logistics and Transportation
SA29 Free Open-source Software for Operations Research: An Introduction to COIN-OR
SA30 Prognostics and Maintenance Management
SA31 Bayesian Reliability Modeling
SA32 Logistics Insurance and Risk Management
SA33 Urban Transportation Planning Models I: Models and Methods for Transportation Network Design
SA34 Freight Transportation
SA35 Stochastic Multi-Stage Resource Allocation Model with Reservation
SA36 Transportation I
SA37 Munition Applications
SA38 Marketing I
SA39 Critical Decisions in Healthcare
SA40 Pierskalla Award
SA41 Medical Diagnosis and Disease Prediction
SA42 Combinatorial Optimization in Medicine and Bioinformatics
SA43 Probability Management
SA44 Teaching Case Competition 1
SA45 Financial Services Section Student Paper Competition
SA46 Agent Based Modeling
SA47 Forestry I: Harvest Scheduling with Spatial Constraints
SA48 Optimization via Simulation I
SA49 Topics in Price Optimization and Revenue Management
SA50 Competition and Strategic Behavior in Revenue Management
SA51 Revenue Management Applications in the Hospitality Industry
SA52 RASIG Student Paper Session
SA53 Location Analysis
SA54 Control of Queueing Systems
SA55 Allocation and Exchange of Airport Slots
SA56 Economics
SA57 Joint Session TELECOM /ICS: Optimization in Wireless Networks
SA58 Innovative Approaches to Technology Entrepreneurship
SA59 Issues in Project Management
SA60 Innovation and Entrepreneurship

Sunday, 10:00am - 11:30am

SB01 Supply Chain Management II
SB02 Integrated Operations-marketing Models for Supply Chains
SB03 Cooperation in Supply Chains and Operations
SB04 Tutorial: Operations Research and Homeland Security: From Models to Implemention
SB05 2007 Dantzig Dissertation Award Finalists
SB06 Integrated Risk Management
SB07 Retail Operations
SB08 Supply Disruptions and Risk
SB09 Multicriteria Decision Making II
SB10 Cooperation in Inventory Management II
SB11 Manufacturing System Design for Product Variety
SB12 Scheduling Applications & Algorithms
SB13 Computational Integer Programming
SB14 Derivative-free Nonlinear Programming
SB15 Dynamic Variational Inequalities
SB16 Combinatorial Optimization II
SB17 Online Social Networks
SB18 Computational Stochastic Programming
SB19 New Directions in Vehicle Routing
SB20 Directions in Machine Learning and Reasoning
SB21 Joint Session DAS/ENRE: Decision Analysis and the Environment
SB22 DEA Theory & Application I
SB23 Modeling Behavior in Operations with System Dynamics
SB24 Software Demonstration
SB25 Panel Discussion: Technology Management in the Service Sector
SB26 Joint Session DM/ICS/Computational Methods for Data Mining: Statistical Modeling and Machine Learning Algorithms for Data Mining
SB27 Optimization and Statistical Approaches to Data Mining
SB28 Multiple Solutions for Combinatorial Problems
SB29 Interfacing to Coin-OR
SB30 Design and Analysis of Reliability Testing
SB31 Joint Session HAS/Service: Quality and Statistical Decision-making in Healthcare Applications I
SB32 Global Logistics Management
SB33 Urban Transportation Planning Models II: Dynamic Routing with Real-time ITS Information
SB34 Vehicle Routing
SB35 Crossdocks and Warehouses
SB36 Transportation II
SB37 Military OR Applications
SB38 Marketing II
SB39 Health Policy for the Care Delivery
SB40 Stochastic Models in Health Care
SB41 Optimizing Real Life Networks with Catastrophe Consideration
SB42 Infectious Disease Prevention and Treatment Models
SB43 2007 Franz Edelman Award Finalists Reprise
SB44 Teaching Case Competition II
SB45 Practice of Risk Management
SB46 Agent-based Modelling of Energy Markets
SB47 Forestry II: Harvest Scheduling with Spatial Constraints
SB48 Optimization via Simulation II
SB49 Panel Discussion: Issues in Pricing and Revenue Management Education
SB50 New Applications of Pricing and Revenue Management
SB51 Pricing Issues

SB52 Academic Contributions to Railroad Operations Research
SB53 Facility Location and Computing
SB54 Models for Designing Service Systems and Understanding Customer Behavior
SB55 Joint Session AAS/TSL: Advances in Airline Decision Support Systems
SB56 Auction Design
SB57 Optimization in the Internet
SB58 Institutions, Innovation and Entrepreneurship
SB59 Empirical Research in Supply Chain Management
SB60 Entrepreneurship

Sunday, 1:30pm - 3:00pm

SC01 Supply Chain Management III
SC02 Empirical Research
SC03 Service Outsourcing, Procurement, and Contract Design
SC04 Tutorial: When More is Better
SC05 Nicholson Student Paper Prize Competition, I
SC06 Operations Management and Security
SC07 Contemporay Issues in Supply Chain Management
SC08 Measuring Risks and Benefits of Mitigation Strategies
SC09 Joint Session Homeland/DAS: Decision Models for Homeland Security
SC10 Algorithms, Complexity and Computational Issues in Inventory Games
SC11 Manufacturing Complexity Management for Product Variety
SC12 Distributed Computing and Stochastic Models
SC13 Integer Programming and Applications
SC14 Systems of Systems Optimization
SC15 Games, Equilibrium, and Variational Inequality Problems
SC16 Discrete Optimization
SC17 Social and Technical Aspects of Information Assurance
SC18 Topics in Mixed Integer Nonlinear Programming
SC19 ICS Leading Edge Tutorials
SC20 Multiattribute Utility: Theory and Practice
SC21 Graphical Models for Decision Analysis
SC22 JFIG Paper Competition Finalists I
SC23 Behavioral Issues in Market Design
SC24 Software Demonstration
SC25 Service Science: Research and Practice
SC26 Tutorial: Innovation Science: Frameworks and Industrial Practices
SC27 Recommendation and Personalization
SC28 Integer Programming Models and Applications
SC29 New COIN-OR Projects
SC30 System Reliability Modeling and Optimization I
SC31 Joint QSR/Simulation Session
SC32 Panel Discussion: Seth Bonder's Keynote Address: Some Thoughts on Our Profession
SC33 Urban Transportation Planning Models III: Computational and Theoretical Extensions of the UTP Paradigm
SC34 Topics in Vehicle Routing
SC35 Facility Logistics I
SC36 Measuring and Managing Risk, Vulnerability and Other Emergency Measures
SC37 Social Network Analysis Methods for Military Operations
SC38 Marketing III
SC39 System Approach to Healthcare Delivery System
SC40 Advances in Health Care Operations Research
SC41 Joint Session B&SB/HAS: Optimization in Biology
SC42 OR Models for Infectious Diseases
SC43 Show Me the Money: Managing Value in Software and Systems Development
SC44 Bring OR into your Local High School: Mission Not Impossible
SC45 Trading Strategies and Hedge Funds
SC46 Pricing and Risk Management in Energy Markets
SC47 Forestry III: Transportation and Logistics
SC48 Simulation Modeling: and Tutorial on Agent Based Simulation
SC49 Product Assortment Optimization
SC50 Game Theoretical Models of Competitive Networks
SC51 Dynamic Pricing and Revenue Management: New Models
SC52 Rails to the Sea: Current Issues in Railway-port Interchange (Roundtable)
SC53 Location, Allocation, and Computing
SC54 Joint Session AP/ICS: Approximate Dynamic Programming I
SC55 Methods of Airline Network Analysis
SC56 Valuation Uncertainty and Revenue Monotonicity
SC57 Joint Session TELECOM /ICS: Optimization Models for Routing in Telecommunication Networks
SC58 Learning, Innovation and Entrepreneurship
SC59 Joint Session TM/Health: Hospital Process Change and Improvement
SC60 Knowledge, Learning, Intellectual Capital-I: Knowledge Systems

Sunday, 4:30pm - 6:00pm

SD01 Supply Chain Management IV
SD02 Contracts in Multi-tier Supply Chains with Information Asymmetry
SD03 Issues in Supply Chain Management
SD04 Tutorial: A Tutorial on Safe Scheduling
SD05 Nicholson Student Paper Prize Competition, II
SD06 Advances in Call-center Research
SD07 Competitive Models in Operations Management
SD08 Flexibility and Disruptions Reduction in Supply Chains
SD09 Aviation Security Applications
SD10 Inventory Inaccuracy and Value of Information
SD11 Pricing in Competitive Environment
SD12 Contemporary Scheduling
SD13 Development and Application of Mixed Integer Programming
SD14 Large-scale Optimization
SD15 Linear Programming and Linear Complementarity Problems
SD16 Meta-control Applications to Optimization
SD17 Information Systems Economics
SD18 Real-time Integer Programming
SD19 Joint Session ICS/INFORMS-ED: Recommendations of the INFORMS Computing Society Education Committee
SD20 DA Practice Award Finalists
SD21 Behavioral Aspects of Decision Making Under Uncertainty
SD22 JFIG Paper Competition Finalists II
SD23 Behavioral Queuing
SD24 Software Demonstration
SD25 Service Planning, Modeling and Assessment
SD26 Joint Session DM/ Computational Methods for Data Mining: Recent Advances in Data Mining and Machine Learning
SD27 Business Data Mining Applications
SD28 Metaheuristics for Location Problems
SD29 Optimization Services and Third Party Software
SD30 System Reliability Modeling and Optimization II
SD31 Joint Session QSR/HAS/Service: Quality and Statistical Decision-making in Healthcare Applications II
SD32 Airport Benchmarking and Air Transport Logistics
SD33 Urban Transportation Planning Models IV: Pricing and Tolls
SD34 Dynamic and Stochastic Models in Transportation and Logistics
SD35 Facility Logistics II
SD36 Evacuation Planning

SD37 Defense Supply Chain Analysis
SD38 To The Memory of Frank Bass
SD39 Health Care Systems Optimization
SD40 Stochastic Models in Health Care
SD41 Strategies for Pandemic Response
SD42 Operations Research in Health Care
SD43 Things That Go Bump in the Project: Risk Management in Software and Systems Development
SD44 Classroom Games from INFORMS Transactions on Education
SD45 Performance Evaluation and Risk Management
SD46 Risk Management in the Energy Sector
SD47 Forestry IV: Wildfire Management
SD48 Advances in Simulation Output Analysis
SD49 Applications in Airline Alliances
SD50 Data-driven and Learning-based Methods in Revenue Management
SD51 Pricing, Revenue Management and Applications
SD52 Rails to the Sea - Continuation
SD53 Economic Location Models
SD54 Joint Session AP/ICS: Approximate Dynamic Programming II
SD55 Research Challenges in Aviation
SD56 Auction Design - Efficiency and Optimality
SD57 Joint Session TELECOM /ICS: Network Design
SD58 Innovation: Entry, Learning and Change
SD59 Hospital Process Improvement
SD60 Knowledge, Learning, Intellectual Capital-II: Human Learning

Monday, 8:00am - 9:30am

MA01 Supply Chain Management V
MA02 Supply Chain Incentive Contracts
MA03 Risk Hedging and Management in Supply Chains
MA04 Tutorial: Approximation Algorithms for Stochastic Inventory Control Models
MA05 Korea's Sustainable Competitive Advantage in the East Asian Economy and Beyond
MA06 Operations Economics
MA07 Topics in Inventory Management
MA08 Supplier Selection for Mitigating Disruption in Supply Chains
MA09 Decision Analysis for Homeland Security
MA10 Advances in Inventory Management
MA11 Managing Inventories in Two-stage Supply Chains with Multiple Suppliers and/or Multiple Retailers
MA12 Scheduling and Routing
MA13 Cutting Planes in Mixed-integer Programming
MA14 Large-scale Numerical Optimization
MA15 Linear Programming
MA16 Markov Decision Processes and Indexed Policies with Single and Multiple Criteria
MA17 Empirical Research on IT and Firm Performance
MA18 Integer Programming - Theory and Computation
MA19 Computer Science Techniques for Industrial Engineering
MA20 Applications of Portfolio Decision Analysis
MA21 Behavioral Decision Making
MA22 An Interactive Panel/Audience Discussion: Operations Research in Engineering - Expectations for Junior Faculty
MA23 Decisionmaking and Pricing
MA24 Software Demonstration
MA25 The Pricing and Planning of Knowledge Based Services
MA26 Applications of Functional Data Mining
MA27 Data Mining and Information Privacy
MA28 Metaheuristics for Hard Discrete Optimization
MA29 Open Source MIP Solvers
MA30 Naval Research Logistics/Quality, Statistics and Reliability Session
MA31 Joint Session QSR/HAS/Sevice: Quality and Statistical Decision-making in Healthcare Applications III
MA33 Containerization Mini Cluster: Overview and History of Containerization
MA34 Location Analysis and Routing
MA35 Facility Logistics III
MA36 Emergency Response and Relief Logistics
MA37 PHM Methods and Applications
MA38 INFORMS Communities/Subdivisions Session on INFORMS Web Pages
MA39 Resource Scheduling and Allocation Problems in Healthcare
MA40 Health Care Operations Management I
MA41 Joint Session HAS/ICS: Optimization in Medicine and Biology
MA42 Cancer Therapeutics
MA43 GE Financial Engineering and Portfolio Analytics
MA44 Education
MA45 Credit and Interest Rate Risk Modeling
MA46 Modeling Energy Systems Risk
MA47 Forestry V: Nature Reserve Design
MA48 Simulation-based Intruder Behavior and Detection
MA49 Robust and Risk-averse Revenue Management
MA50 Pricing for Networks and Services
MA51 Pricing and Revenue Management I
MA52 New Operations Research Models for Railroad Planning
MA53 Facility Location for Public Policy and Management
MA54 Joint Session AP/Computing: Resource Allocation for Distributed Computing Systems
MA55 Models and Data in Dynamic Air Traffic Management
MA56 Auctions from a Computational Perspective
MA57 Joint Session TELECOM /ICS: Discrete Network Optimization Challenges
MA58 Empirical Research in Innovation and Technology Management
MA59 Making Capacity Acquisition Decisions Under Uncertainty
MA60 Joint Session TM/NPD: Innovation: Problem Solving Processes and Creativity

Monday, 10:00am - 11:30am

MB01 Supply Chain Management VI
MB02 Empirical Studies of Supply Chain Management
MB03 New Product Introduction in Supply Chains
MB04 Tutorial: Generating Robust Project Baseline Schedules
MB05 Panel: The Industry Job Search
MB06 Managing Operations with Strategic Customers
MB07 Behavioral Issues in Operations
MB08 Joint Session Managing Disruptions/ Homeland: Risk Management in Large Scale Supply Chains
MB09 Mathematical Models in Homeland Security and Counterterrorism
MB10 Strategies and Tactics for Managing Supply Risks
MB11 Flexibility in Supply Chain Management
MB12 Models for Machine Scheduling and Autonomous Agents
MB13 Discrete Optimization in Memory of Peter L. Hammer
MB14 Stochastic Nonlinear Programming
MB15 Optimization and Decision Making under Uncertainty in Defense Applications
MB16 Optimizing Automotive Product Development and Manufacturing
MB17 Joint Session ISS/ICS: Trends in Information Privacy and Security
MB18 Integer Programming - Theory, Computation, Visualization
MB19 Recent Progress in Integer and Nonlinear Optimization
MB20 Panel Discussion: Essential Topics in Teaching Decision Analysis
MB21 Presenting and Conveying Models
MB22 Health Care Research from an OR/OM Perspective

MB23 Emerging Areas in Behavioral Operations
MB24 Software Demonstration
MB25 Services Workforce Management I
MB26 Joint Session DM/ ICS/Computational Methods for Data Mining: Mining and Modeling for Optimizing Complex Systems
MB27 E-voice of the Customer: Mining News, Blogs and Discussion Boards
MB28 Metaheuristics
MB29 Comparisons of State-of-the-art Linear Math Programming Software
MB30 Best Student Paper Competition
MB31 Joint Session QSR/HAS/Service Science: Quality and Statistical Decision-making in Healthcare Applications IV
MB32 Shipping, Port and Logistics Finance and Investment
MB33 Containerization Mini Cluster: Berth Allocation, Berth Scheduling and Vessel Planning
MB34 Current Research in Transportation Science and Logistics
MB35 Panel Discussion: Transportation 2030 - Trends and Challenges
MB36 Homeland Security Problems in Transportation
MB37 Military Force Sizing
MB38 Market Algorithms and Applications
MB39 Resource Allocation in Healthcare
MB41 Joint Session HAS/ICS: Clinical Applications of Operations Research
MB42 Data Mining in Bioinformatics and Health Care
MB43 Real World Applications I
MB44 Tutorial: Designing and Delivering a Better Management Science Course for MBA Students
MB45 Risk,Technology and Operations in Financial Services
MB46 Uncertainty in Electric Power Markets
MB47 Forestry VI: Decision Making Under Uncertainty
MB48 Simulation-based Control
MB49 Revenue Management in Competitive Environments
MB50 Competition in Pricing for Supply Chains
MB51 Pricing and Revenue Management II
MB52 European Rail Research
MB53 Location and Sourcing
MB54 The Applied Probability Society Markov Lecture
MB55 Reducing Delays in the National Airspace System
MB56 Combinatorial Auctions
MB57 Ad-hoc Wireless Networks
MB58 Managing the NPD Resources
MB59 Panel Discussion: Meet the Editors
MB60 Offshoring

Monday, 12:30pm - 1:30pm

Interactive Session

Monday, 1:30pm - 3:00pm

MC01 Supply Chain Management VII
MC02 Information Flow, Incentives, and Supply Chain Contracts
MC03 Risk Management in Operations
MC04 Tutorial: Approaches to Risk in Optimization Under Uncertainty
MC05 In Memory of Peter L. Hammer
MC06 RFID in Supply Chain Management
MC07 Applications of Empirical Science in OM
MC08 Managing Risks for Goods in Transit
MC09 Professionals in Emergency Management
MC10 New Developments In Multi-Echelon Systems
MC11 Flexible and Integrative Strategies for Manufacturing Systems and Distribution Networks
MC12 Game Theory and Applications
MC13 Advances in Integer Programming
MC14 Semidefinite Programming and Its Applications
MC15 Algorithms and Computing for Stochastic Integer Programming
MC16 Distributed Optimization and Learning
MC17 New Frontiers in Research on Business Value of Information Technology
MC18 Integer Programming - Applications and Computation
MC19 Joint Session ICS/ISS: Interdisciplinary and Analytical Approaches to Email Management
MC20 Advances in Decision Analysis - The Book
MC21 DA Arcade I
MC22 An Interactive Panel/Audience Discussion: Research and Publications
MC23 Human Behavior on the World Wide Web
MC24 Software Demonstration
MC25 Services Workforce Management II
MC26 Data Mining Applications in Service Industry
MC27 Data Mining Models and Applications
MC28 Integrating CP and OR
MC29 Joint Session ICS/OS: Modeling and Computation in Cone Programming
MC30 Panel Session: Reliability - Research Directions and Curriculum Needs
MC31 Control Charting with Complex Data Structures
MC32 Shipping, Maritime, and Supply Chain
MC33 Containerization Mini Cluster: Container Terminal Operations
MC34 Distribution and Inventory Applications
MC35 Methods and Models for Congestion Pricing I
MC36 Urban Transportation Planning Models V: Transit
MC37 Street to Fleet: Using Simulation and Optimization to Manage the Navyís Manpower and Personnel Business
MC38 Algorithmic Mechanism Design I
MC39 Panel Discussion: Improving Healthcare Supply Chains and Logistics
MC40 Innovations in Models for Healthcare Operations and Policy
MC41 Joint Session HAS/ICS: Medical Decision Making
MC42 Computational Challenges in Radiotherapy Design
MC43 Real World Applications II
MC44 Joint Session INFORMS-ED/ICS: Modeling Languages in the Classroom
MC45 Optimization Based Methods in Finance
MC46 Power and Energy Market Modeling I
MC47 Mining Applications: Open Pit Sequencing
MC48 Simulation I
MC49 Panel Discussion: Revenue Management Research That is Used in Practice: Past, Present and Future
MC50 Price Optimization and Price Elasticity Estimation
MC51 Pricing in Services
MC52 Fleet Sizing
MC53 Recent Advances in Location Analysis and New Applications Session
MC54 Queueing Applications in Computing
MC55 Performance and Productivity of the NAS: Domain Analyses
MC56 Complex Dynamic Mechanisms
MC57 Network Design and Management
MC58 Software Evolution and Organization Dynamics
MC59 Management of Technology
MC60 Panel Discussion: Innovation and Product Development: Engineering, Organizational and Technology Perspectives

Monday, 4:30pm - 6:00pm

MD01 Supply Chain Optimization I
MD02 Auctions and Mechanism Design in Supply Chain Management
MD03 Behavioral Operations
MD04 Tutorial: The Coordination of Pricing and Production Decisions
MD05 OR History
MD06 MSOM FELLOWS Presentations
MD07 Joint Session MSOM/Managing Disruptions: Supply Chain Disruption Management
MD08 Supply Chain Coordination and Risk Sharing for Managing Disruptions
MD09 Judgment and Decision Models for Threat Intervention and Consequence Mitigation
MD10 Primal-dual Algorithms for Inventory Management Problems
MD11 Supply Chain Competition, Risk, and Asymmetric Information
MD12 Project Scheduling
MD13 Group Theoretic Approaches in Mixed Integer Programming
MD14 Portfolio Selection via NLP
MD15 Stochastic Programming and Applications
MD16 Decentralized Optimization
MD17 Digital and Social Interactions
MD18 Panel Discussion: ICS 10th Anniversary Celebration and Quiz Show
MD19 Joint Session ICS/ISS: New Approaches to Email Management
MD20 Decision Analysis Society Awards
MD21 Joint Session DAS/MAS: Muli-criteria Decision Analysis: Army Corps of Engineers Application Case Studies
MD22 DEA: Theory and Application II
MD23 Group Decisions-making
MD24 Software Demonstration
MD25 Joint Session QSR/ DM: Statistical Methods with IT Applications
MD26 Data Mining Applications
MD27 Data Mining-statistical Issues
MD28 Recent Advances in Combinatorial Optimization and Satisfaction
MD29 Joint Session ICS/OS: Computational Decomposition and First Order Methods for Large Scale Conic Programming
MD30 Panel Discussion: Quality and Productivity Improvement in Nanomanufacturing
MD31 Developments and Applications in Multivariate Quality Improvement
MD32 Logistics
MD33 Containerization Mini Cluster: Landside Container Distribution
MD34 Dynamic and Stochastic Logistics Problems
MD35 Methods and Models for Congestion Pricing II
MD36 Urban Transportation Planning Models VI: Stochastic Networks
MD37 Military Supply Chain Innovation
MD38 Convergence and Approximation in Games
MD39 Process Improvement in the Hospitals Around the World
MD40 OR Models in Health Care Management
MD41 Joint Session HAS/ICS: Optimization Challenges in Brain Research
MD42 Cost Effectiveness Analysis in Health Care
MD43 A Week/Month in the Life of an OR Practitioner
MD44 Joint Session INFORMS-ED/ICS: Optimization Software in the Classroom
MD45 Financial Engineering and Portfolio Optimization
MD46 Power and Energy Market Modeling II
MD47 Mining Applications: Topics in Open Pit and Underground Mining
MD48 Simulation II
MD49 New Methods for the Capacity Control Problem in Revenue Management
MD50 Topics in Pricing and Revenue Management
MD51 Stochastic Networks and Resource Allocation
MD52 Rail Demand Forecasting
MD53 New Location Models and Algorithms
MD54 Dynamic Pricing and Multi-armed Bandits
MD55 Robustness and Recovery in Passenger Aviation (A Joint Event with the Alfred P. Sloan Industry Studies Program)
MD56 Auctions in the Wild: Field Studies of Reverse Auctions
MD57 Design Issues in Wireless Sensor Networks
MD58 Spreadsheets in OR Practice: Papers from the Interfaces Special Issue
MD59 Capacity and Technology Acquisition
MD60 TMS Distinguished Speaker

Tuesday, 8:00am - 9:30am

TA01 Supply Chain Optimization II
TA02 Optimization in Postal Logistics
TA03 Supply Chain Operations
TA04 Tutorial: Econometric Models in Operations Management
TA05 Decision Analysis
TA06 Supply Chain Planning under Uncertainty
TA07 Competition and Incentives (talks by job market candidates)
TA08 Strategies and Architecture of Supply Chains for Managing Disruptions
TA09 Emergency Response and Disaster Relief Logistics Planning
TA10 Supply Chains: Information and Product Flows
TA11 Capacity Management and Channel Incentives
TA12 Competition, Cooperation and Contracts in Scheduling Games
TA13 Integer Programming
TA14 Robust Optimization Modeling and Applications
TA15 Stochastic Programming Applications and Modeling
TA16 Optimization Applications
TA17 Services Management and Pricing Strategies
TA18 Condor for High-Throughput Computing at Clemson
TA19 ICS Prize Winners 2006
TA20 DA Arcade II
TA21 Scoring Rules: Eliciting and Evaluating Forecasters' Probabilities
TA22 Data Envelopment Analysis I
TA23 Laboratory Studies of the Newsvendor Problem
TA24 Software Demonstration
TA25 Wavelet Applications (Multiscale Pattern Analysis)
TA26 Joint Session DM/ICS/Computational Methods for Data Mining: Trees and Tree Ensembles: Software and Applications
TA27 Data Mining Applications
TA28 Production Scheduling
TA29 Joint Session ICS/OS: Decomposition Methods in Integer Programming I
TA30 IIE Transactions Paper Session
TA31 Optimization Methods in Quality, Reliability and Statistics Applications
TA32 Vehicle Routing I
TA33 Containerization Mini Cluster: RFID and Container Security
TA34 Transportation Hazard Planning and Operations
TA35 Transportation Network Pricing
TA36 Urban Transportation Planning Models VII: Extensions of Network Design
TA37 Military Logistics Transformation
TA38 Algorithmic Mechanism Design II
TA39 RFID Applications in Healthcare Industry
TA40 Data Driven Models in Healthcare Engineering
TA41 Planning and Scheduling in Healthcare

TA42 Machine Learning Approaches to Medical Diagnosis and Health Care
TA43 Panel Discussion: How to Have an OR Career
TA44 Pedagogical Research: What is it and What is it Not?
TA45 Portfolio Optimization
TA46 Power and Energy Market Modeling III
TA47 Mining Applications: Topics in Open Pit Mining
TA48 Simulation III
TA49 New Directions in Revenue Management
TA50 Network Revenue Management
TA51 Dynamic Control of Queueing Networks
TA52 Artificial Intelligence Applications I
TA53 Network Location
TA54 Message-passing: New Algorithms and Analytical Tools for Applied Probability
TA55 Joint Session AAS/TSL: Air Traffic Management
TA56 Online Auctions
TA57 Performance Analysis and Resource Management in Computer-communication Systems
TA58 Product Architecture
TA59 Capacity Planning and Inventory Control
TA60 Linking Managerial Agency and Technological Change: A Dynamic Capability Perspective

Tuesday, 10:00am - 11:30am

TB01 Supply Chain Optimization III
TB02 Supply Chain Practice and Empirics
TB03 Procurement and Supply Chains
TB04 Tutorial: Solving Large-scale Discrete Optimization Problems: Introduction to the Nested Partitions Method
TB05 Panel: The Academic Job Search
TB06 Customer Behavior in Operations Management
TB07 Challenging Inventory Problems in After Sales Services
TB08 Sustainable Development
TB09 Joint Session Homeland/DAS: OR in Homeland Security I
TB10 Assemble-to-order Systems, Allocation Rules and Component Commonality
TB11 Supply Chain Management Considering Production, Capacity, Distribution, and New Technology Effects
TB12 Scheduling Potpourri
TB13 Contemporary Issues
TB14 Variational Analysis and Equilibria
TB15 Applications of Robust Optimization
TB16 Applications of Optimization in Finance
TB17 The Dynamics of Digital Goods Markets
TB18 Parallel Combinatorial Optimization
TB19 ICS Prize Winners 2007
TB20 Dynamic Programming Applications
TB21 Testing Decision Theories and Decision Axioms
TB22 Data Envelopment Analysis II
TB23 Operations Research in the Public Sector
TB24 Software Demonstration
TB25 Quality Control in Nanomanufacturing
TB26 Data Mining Applications for Productivity
TB27 Data Mining Methods
TB28 Uncertainty in Combinatorial Optimization
TB29 Joint Session ICS/OS: Decomposition Methods in Integer Programming II
TB30 Panel Discussion: Meet the Program Managers
TB31 Design and Analysis of Experiments
TB32 Vehicle Routing II
TB33 Containerization Mini Cluster: Intermodal Systems
TB34 Advances in Dynamic Traffic Network Methodologies
TB35 Models and Algorithms for Aircraft Routing
TB37 Defense Logistics Analysis
TB38 Game Theory
TB39 The Congested Emergency Department
TB40 OR in Public Health
TB41 Operations Research in Nurse Planning
TB42 Healthcare Delivery
TB43 Panel Discussion: Internships, Co-ops and Student Projects: How Can You Get Real World Experience Before Leaving the Graduate School Womb?
TB44 Pedagogical Research: How to Get Started
TB45 Market Risk and Credit Risk
TB46 Energy Models and Methods
TB47 OR Models in Agricultural Planning
TB48 Stochastic Processes/Optimization I
TB49 New Directions in Revenue Management and Pricing
TB50 Product Strategy
TB51 Queueing Systems - Performance Analysis
TB52 Joint Session AI/ICS: AI Applications in Finance and OR
TB53 Location Applications
TB54 Pricing and Auction Applications
TB55 Air-traveler Behavior
TB56 Tactical Logistics Optimization: Inventory, Transportation and Location
TB57 Ethics in OR
TB58 Searching for Good Ideas
TB59 Capacity and Pricing Decisions for New Products
TB60 Strategic Sourcing

Tuesday, 12:30 pm - 1:30pm

Interactive Session

Tuesday, 1:30pm - 3:00pm

TC01 Supply Chain I
TC02 OR/MS and Sustainability
TC03 Applied Research on Order Fulfillment
TC04 Tutorial: Computational Global Optimization
TC05 Joint Session Optimization/ICS: New Developments in MINLP Solvers
TC06 Innovations in Healthcare Operations
TC07 Stochastic Inventory Models
TC08 Humanitarian Relief Chain Management
TC09 Joint Session Homeland/DAS: OR in Homeland Security II
TC10 Data-driven Inventory Control
TC11 Operational Issues in the Management of Outsourced Supply Chains
TC12 Economic Models for Managing and Scheduling Capacity
TC13 Mixed Integer Nonlinear Programming: Theory and Computation
TC14 Nonlinear Programming
TC15 Interior Point Method, Finite Element Method, and Inverse Optimization in Stochastic Programming
TC16 Supply Chain Optimization
TC17 The Design of IT Outsourcing Contracts
TC18 Parallel Computing and Integer Programming
TC19 INFORMS Computing Society Student Paper Award Winners
TC20 Intertemporal Preferences and Decisions I
TC21 Joint Session DAS/Technology Evaluation and Assessment: Medical Technology Evaluation and Assessment I
TC22 Decision Analysis Fundamentals
TC23 Risk Analysis I
TC24 Software Demonstration
TC25 Advanced SPC for Profile Monitoring I
TC26 Joint Session DM/ICS/Computational Methods for Data Mining: Math Programming in Data Mining
TC27 Service Industry I
TC28 Data Structures in Constraint Programming
TC29 Joint Session ICS/OS: Innovation in Network Flows and Very Large-Scale Neighborhood Search

TC30 Techometrics Paper Session on Variable Selection
TC31 Robust Design
TC32 Business Applications I
TC33 Maritime and Port Operations
TC34 Network Behavior Modeling with Uncertainty
TC35 Air Transport and OR: New Approaches
TC36 Urban Transportation Planning Models VIII: Freight and Logistics
TC37 Analysis for Nation Building
TC38 Marketing I
TC39 Operations in Emergency Medicine
TC40 Public Health and Public Health Preparedness
TC41 Joint Session B&SB/HAS: OR and Systems Biology
TC42 OR Models in Healthcare I
TC43 New Research in Airport and Terminal Airspace Operations
TC44 Pedagogical Research: Working on a Course Design Project
TC45 Models and Analysis in Financial Engineering
TC46 Electricity Markets Simulation
TC47 Valuation and Control of Commodity Storage
TC48 Stochastic Processes/Optimization II
TC49 Revenue Management Models
TC50 Revenue Management for Congestion-sensitive Services
TC51 Stochastic Networks
TC52 Artificial Intelligence Applications II
TC53 Facility Location
TC54 Queues
TC55 Future Air Traffic Management Concepts
TC56 Energy Gas and Thermal
TC57 O.R. in Sports
TC58 Issues in Technology and NPD
TC59 Economic Modeling of New Product Innovation: A Deep Dive
TC60 Knowledge, Learning, Intellectual Capital-III: Knowledge-Based Views

Tuesday, 4:30pm - 6:00pm

TD01 Supply Chain II
TD02 PhD Student Research
TD03 Competition in Supply Chains
TD04 Tutorial: Supply Chain Management in the Context of Humanitarian Disasters
TD05 OR Applications in the Automotive Industry
TD06 Marketing-operations Interface Research
TD07 Stochastic Inventory Models
TD08 Inventory Management
TD09 All Hazards: OR and Homeland Security
TD10 Inventory Management Optimization
TD11 Manufacturing
TD12 Scheduling I
TD13 Combinatorial Optimization
TD14 Nonlinear Programming I
TD15 Joint Session Stochastic Optimization /Optimization: Stochastic Optimization Applications to Electric Power Generation and Nuclear Safety
TD16 Global Optimization
TD17 Current Issues in IS
TD18 Computational Approaches for Large-scale Optimization Problems
TD19 Panel on Future Research Needs in Workforce Engineering
TD20 Intertemporal Preferences and Decisions II
TD21 Joint Session DA/Technology Evaluation and Assessment: Medical Technology Evaluation and Assessment II
TD22 Decision Analysis Theory
TD23 Risk Analysis II
TD24 Software Demonstration
TD25 Advanced SPC for Profile Monitoring II
TD26 Mining Data to Maintain Situational Awareness
TD27 Service Industry II
TD28 Operations Management I
TD29 Joint Session ICS/OS: Optimization-computer Science
TD30 Journal of Quality Technology Paper Session
TD31 Recent Advances in Computer Experiments
TD32 Business Applications II
TD33 Models for Facilities and Warehouse Design
TD34 Traffic Modeling for Network Applications
TD35 Development and Management of Transportation Infrastructure I
TD36 Transportation III
TD37 Military Applications I
TD38 Marketing II
TD39 Operations Research in the Emergency Department
TD40 Service Theory, Work ReDesign and Simulation: From Theory to Practice
TD41 Matching Demand and Supply in Medical Care
TD42 Healthcare Allocation
TD43 Stochastic Optimization in Aviation
TD44 Pedagogical Research: Closing Session - A Panel of Researchers
TD45 Optimization Approaches in Finance
TD46 Benefits and Costs of Transmission Expansions in Power Systems
TD47 Operations Management in Agribusiness
TD48 Risk in Business
TD49 Revenue Management & Pricing in Operations
TD50 Revenue Management with Demand Uncertainty
TD51 Queueing Systems in Heavy Traffic
TD52 Reinforcement Learning in Business and Economics
TD53 Facilities Layout & Design
TD54 Operational Planning in Call Centers
TD55 Airline Optimization at Boeing and Jeppesen
TD56 Energy
TD57 O.R. in Sports
TD58 Behavioral Issues in TM and NPD
TD59 Empirical Studies of Capacity Management and Technology Acquisition
TD60 Knowledge, Learning, Intellectual Capital-IV: Knowledge Horizons

Wednesday, 8:00am - 9:30am

WA01 Supply Chain III
WA02 Quantitative Models for CLSC Design and Operation
WA03 Supply Chain Research
WA04 Tutorial: Social Networks: Theory and Applications
WA05 Operations Research in Vehicle Development - Panel Discussion by Women in General Motors R&D: OR, Vehicle Development, and Design & Technology Fusion
WA06 Empirical Research in Retail Operations
WA07 Inventory Problems with Dual Supply Sources/Modes
WA08 Capacity and Inventory
WA09 Homeland Security
WA10 Inventory Management with Radio Frequency Identification
WA11 Flexible Manufacturing
WA12 Scheduling II
WA13 Recent Advances in Integer Programming
WA14 Nonlinear Programming II
WA15 Stochastic Programming I
WA16 Nonconvex MINLP Theory & Algorithms
WA17 Information Systems and Healthcare Practice
WA18 Optimizing Your Optimizer
WA19 Stochastic Control in Workforce Engineering
WA20 Valuing Risk and Flexibility in New Product Development
WA21 DA Arcade III

WA22 Decision Analysis Applications I
WA23 Risk Analysis III
WA24 Software Demonstration
WA25 Reliability I
WA26 Optimization in Data Mining
WA27 Service Industry III
WA28 Operations Management II
WA29 Joint Session ICS/OS: Latest Developments in SDP Software
WA30 Quality Control and Improvement for Multistage Systems I
WA31 Statistical Process Control Methods for Autocorrelated Processes
WA32 Business Applications III
WA33 Challenges in Vehicular Ad Hoc Networks
WA34 Real-time Traffic Management and Operations
WA35 Development and Management of Transportation Infrastructure II
WA36 Advances in Dynamic Traffic Assignment
WA37 Military Applications II
WA38 Marketing III
WA39 Contract Design in Pharmaceuticals
WA40 Pandemic Flu, Childhood Vaccines, and Hospital Operations
WA41 Joint Session B&SB/HAS: Computational Methods for Learning and Modeling Genome-Wide Biological Control Networks
WA42 Health Systems Analytics
WA43 Aviation Applications I
WA44 Undergraduate OR Education in the Liberal Arts Environment
WA45 Derivatives Pricing Models and Methods
WA46 Environmental Modeling
WA47 Operations Planning and Technology Adoption in Commodity Markets
WA48 Risk Management in Finance
WA49 Special Topics in Revenue Management and Pricing
WA50 Measuring Pricing Performance
WA51 Probability Management
WA52 Policy Decisions in Technology Management
WA53 Facilities Material Handling
WA54 Sequential Change Detection Problems
WA55 Weather or Not: Coping with Weather Uncertainty in Aviation Operations
WA56 Energy Industry Issues
WA57 Sports & Entertainment
WA58 Groups in NPD: Dynamics, Biases, and Control
WA59 Technology and Capacity Choice
WA60 Economic Experiments: Applying a New Method to Questions in Innovation and Entrepreneurship

Wednesday, 10:00am - 11:30am

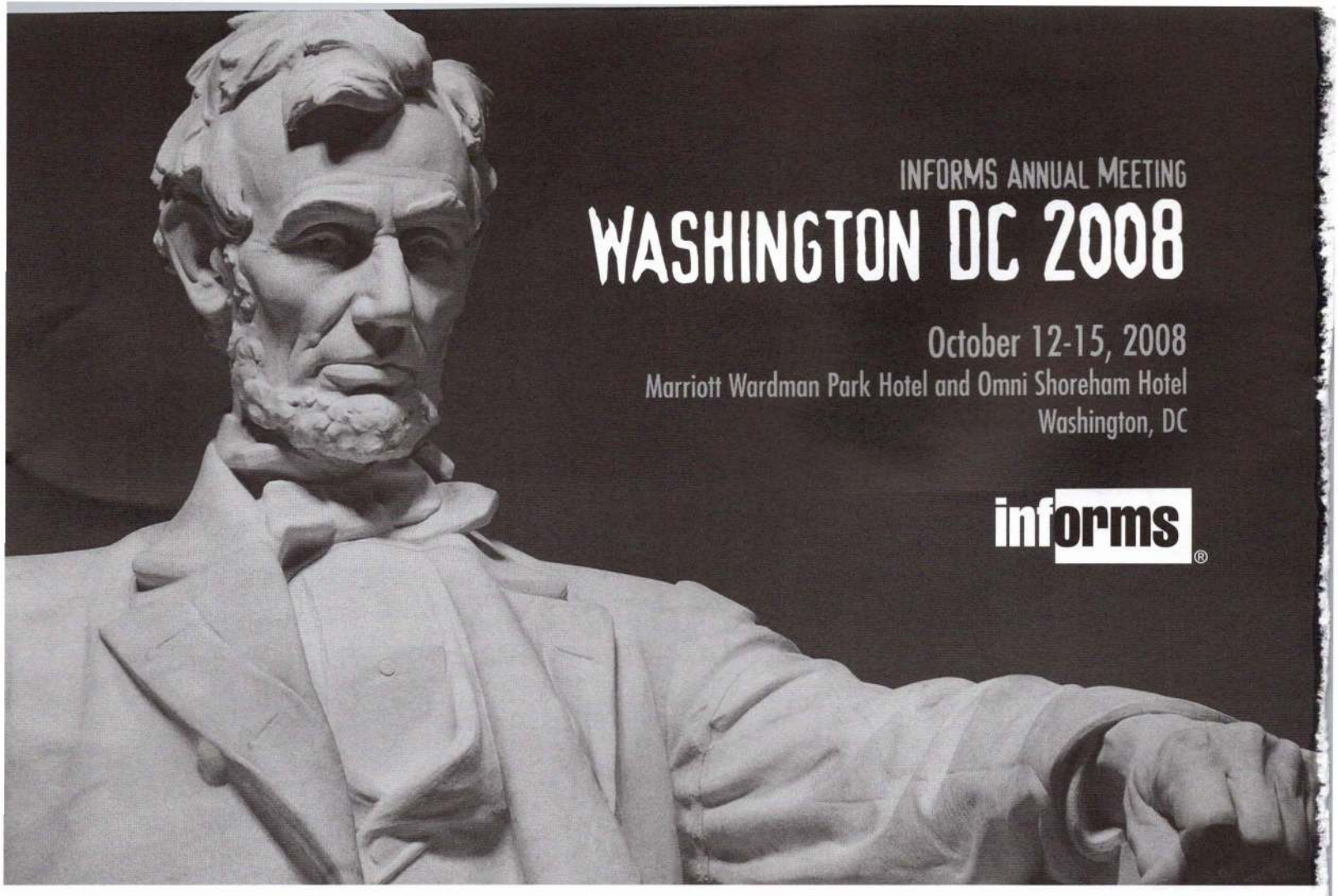
WB01 Supply Chain Competition and Coordination I
WB02 Effects of Take-back Legislation on Supply Chain Design and Operations
WB03 Sustainable Operations
WB04 Tutorial: Trends in OR and MS Education at the Introductory Level
WB05 Panel Discussion: Dual Careers - Challenges and Creative Solutions
WB06 Game Theory Applications in Supply Chains
WB07 Partially Observed Inventory Models
WB08 Inventory Management in Supply Chain
WB09 Supply Chain Design for Large Scale Mass Customization
WB10 Coordination and Collaboration in Inventory Control Problems
WB11 Production & Scheduling I
WB12 Scheduling III
WB13 Polyhedral Aspects and Strong Formulations for Integer Programming
WB14 Networks & Graphs
WB15 Stochastic Programming II
WB16 Nonconvex MINLP Applications
WB17 Information Systems
WB18 Panel: Meeting the Challenges of Solver Independence
WB19 Workforce Flexibility in Service Systems
WB20 Distributed Decision Making
WB21 Axiomatic Foundations of Risk Analysis
WB22 Decision Analysis Applications II
WB23 Queueing Models I
WB25 Statistics/Quality Control I
WB26 Joint Session DM/QSR/ ICS/Computational Methods for Data Mining : Data Mining in Manufacturing and Web
WB27 Modeling Applications Using Spreadsheets (and More)
WB28 Operations Management III
WB29 Joint Session ICS/OS: Recent Development in Software for Linear and Convex Optimization Problems
WB30 Quality Control and Improvements for Multistage Systems II
WB31 Reliability II
WB32 Planning
WB33 Adaptive Route Choice Models
WB34 Transportation Network Calibration, Consistency and Flexibility
WB35 Simulation-based Emergency Response Planning
WB36 Intermodal Transportation Network Modeling
WB37 Military Applications III
WB38 Marketing IV
WB39 Optimization Techniques
WB40 OR and Infectious Disease I
WB41 Joint Session B&SB/HAS: Network Biology: Metabolism and Gene-Regulation
WB42 Operations Research in Medicine and Health Care I
WB43 Transforming the ATC System: A Look into the Future
WB44 Classroom Innovations for Teaching OR/MS
WB45 Financial Indices
WB46 Energy Under the CO2-constrained World
WB47 Commodity Trading and Financial Hedging
WB48 Financial Applications
WB49 Revenue Management in Service and Retailing
WB50 Applications in Revenue Management
WB51 Topics in Service Management
WB53 Industry Focused Research on the Medical Device and Equipment Industry
WB54 Heavy Traffic Limit Theorems for Queues
WB55 Advances in Airline Optimization - I
WB56 Natural Resource Issues
WB57 Innovation/Entrepreneurship
WB58 New Product Development
WB59 Techology Management I
WB60 Decision Modeling in Technology Management

Wednesday, 1:30pm - 3:00pm

WC01 Supply Chain Competition and Coordination II
WC02 Facility Location in Closed-loop Supply Chains
WC03 Demand Characteristics in Supply Chain Models: Dependence on Inventory, Substitution, Pricing and Time
WC04 Tutorial: Differential Game Models in Marketing Science
WC05 Discussion: Unconscious and Implicit Biases and the Impact on Women and Underrepresented Groups in Science and Engineering
WC06 Resource Allocation Models in Software Management
WC07 Inventory
WC08 Inventory Management - Pricing
WC09 Project Management I
WC10 Optimization Issues in Inventory Models
WC11 Production & Scheduling II
WC12 Scheduling IV
WC13 Integer Programming Theory
WC14 Network Optimization I
WC15 Stochastic Optimization/Large Scale Optimization I
WC16 OR Models in Healthcare II
WC17 Information Systems and Security
WC18 Computing and Optimization Challenges in Multiplayer Games
WC19 Work Sharing through Bucket Brigades
WC20 Decision Analysis: Socio-technical Perspectives
WC21 Energy and the Environment
WC22 Decision Support Systems Tools
WC23 Queueing Models II
WC25 Statistics/Quality Control II
WC26 Data Mining Applications in Neuroscience
WC27 Spreadsheet Technology and Engineering
WC28 Operations Management IV
WC29 Joint Session ICS/OS: Global Optimization: Software Development and Applications
WC30 Discussion Session: Challenges and Opportunities for QSR Community I
WC31 Discussion Session: QSR-related Curriculum Development I
WC32 Applied Probability I
WC33 Transportation IV
WC34 Transportation V
WC35 Statistics in OR
WC36 Transportation VI
WC37 Military Applications IV
WC38 Computer Science-OR Applications to CS
WC39 Robust Optimization
WC40 OR and Infectious Disease II
WC41 Joint Session B&SB/HAS: Systems Biology: From Biology to OR
WC42 Operations Research in Medicine and Health Care II
WC43 Aviation Applications II
WC44 Teaching with Cases
WC45 Models in Financial Engineering
WC46 Addressing Competition and Uncertainty in Electricity Markets
WC48 Finance Theory and Empirics
WC49 Joint Revenue Management and Operations Management
WC50 Topics in Revenue Management
WC51 Revenue/Yield Management
WC52 Approximation and Network Optimization
WC53 Military Technology and Security System Assessment
WC54 Queuing Networks
WC55 Advances in Airline Optimization - II
WC56 Energy Issues
WC57 Computer Analysis
WC58 Product Development
WC59 Techology Management II
WC60 Technology Life Cycle Management: Road from Intelligence to Commercialization

Wednesday, 3:30pm - 5:00pm

WD01 Supply Chain Competition and Coordination III
WD02 Proposed Practices in Closed Loop Supply Chains
WD04 Tutorial: Business Engineering: A Practical Approach to Valuing High-Risk High-return Projects Using Real Options
WD07 Reverse Supply Chains
WD08 Inventory Management- Information
WD09 Project Management II
WD10 Advanced Models in Supply Chain Management
WD12 Forecasting
WD13 Integer Programming Applications
WD14 Network Optimization II
WD15 Stochastic Optimization/Large Scale Optimization II
WD16 Dynamic Programming/Control
WD17 Quality and Statistics
WD19 Workforce Planning in the Services
WD20 DA Arcade IV
WD21 DAS Student Paper Contest Finalists
WD22 Decision Support Systems Applications
WD23 Queueing Models III
WD25 Applications of Statistic and Simulation
WD26 Data Mining Techniques for Business Applications
WD27 Spreadsheets in Education
WD28 Joint Session Comp. Methods/DM/ICS: Data Mining Applications in Logistics and Scheduling
WD29 Modeling Systems & Languages
WD30 Discussion Session: Challenges and Opportunities for QSR Community II
WD31 Discussion Session: QSR-related Curriculum Development II
WD32 Applied Probability II
WD33 Transportation VII
WD34 Transportation VIII
WD35 Facility and Roadway Evacuation Modeling
WD36 Transportation IX
WD37 E-Business/Commerce
WD38 Constraint Programming
WD39 Stochastic Optimization/Large Scale Optimization III
WD40 Model Based Strategies for Mitigation of Large Scale Pandemic Outbreaks
WD41 Biotechnology
WD43 Aviation Applications III
WD44 Enhancing Industrial Engineering and Business Undergraduates' Presentation Skills
WD45 Financial Engineering
WD46 Energy Trading and Risk Management
WD47 Research & Development
WD48 Simulation - Optimization
WD49 Dynamic Pricing and Revenue Management
WD51 Pricing and Revenue Management III
WD52 Intelligent Agents
WD53 Technological Forecasting of S&E Personnel Requirements
WD54 Fork/Join and Assembly Systems
WD55 Air Traffic Management: Models and Algorithms
WD56 Auctions/Competitive Bidding
WD58 Group Decision Making
WD59 Industry Applications



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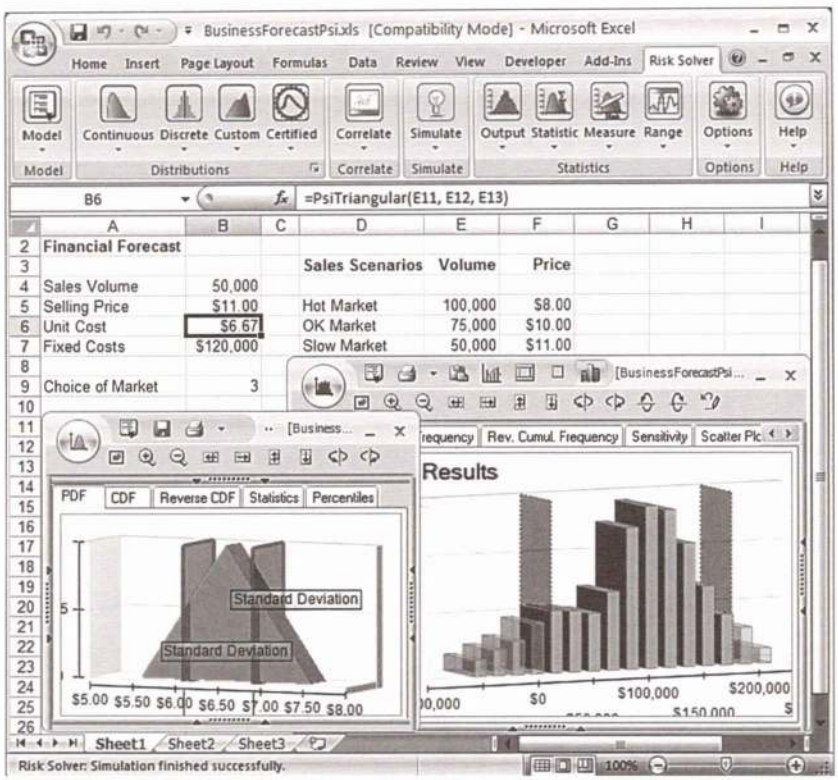
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