How to Navigate the Technical Sessions

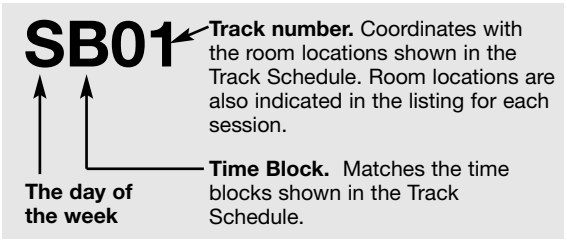
There are three primary resources to help you understand and navigate the Technical Sessions:

- This Technical Session listing, which provides the most detailed information. The listing is presented chronologically by day/time, showing each session and the papers/abstracts/authors within each session.
- The Session Chair, Author, and Session indices provide cross-reference assistance (pages 426-463).
- The Track Schedule is on pages 46-53. 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 430-453) — the session code for your presentation(s) will be shown along with the track number. You can also refer to the full session listing for the room location of your session(s).

The Session Codes



Time Blocks

Sunday-Thursday

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

Wednesday

A - 8:00am – 9:30am
B - 11:00am - 12:30pm
C - 1:45pm – 2:15pm
D - 2:45pm - 4:15pm
E - 4:30pm - 6:00pm

Room Locations/Tracks

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

Sunday, 8:00am - 9:30am

■ SA01

C-Room 21, Upper Level

Panel Discussion: The Society of Decision Professionals - Building a True Profession

Sponsor: Decision Analysis
Sponsored Session

Chair: Carl Spetzler, Chairman & CEO, Strategic Decisions Group (SDG), 745 Emerson St, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

1 - The Society of Decision Professionals - Building a True Profession

Moderator: Carl Spetzler, Chairman & CEO, Strategic Decisions Group (SDG), 745 Emerson St, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com, Panelist: Larry Neal, David Leonhardi, Hannah Winter, Jack Kloeber, Andrea Dickens

When we take stock of 40 years of Decision Analysis practice. Decision professionals still assist in only a small fraction of important and difficult choices. In this panel, practitioners will explore why this is the case and discuss how to form a true profession to transform the way important and difficult decisions are made.

■ SA02

C-Room 22, Upper Level

Joint Session DA/HAS:Decision Analysis in Health Applications

Sponsor: Decision Analysis & Health Applications
Sponsored Session

Chair: Israel David, Professor, Ben-Gurion University, 14/38 Rahavat-Ilan Street, Givat-Shmuel, Israel, idavid@bgu.ac.il

1 - The Search for Compatible Kidneys for Transplantation - A Handy Research and Decision Aid

Israel David, Professor, Ben-Gurion University, 14/38 Rahavat-Ilan Street, Givat-Shmuel, Israel, idavid@bgu.ac.il, Michal Moatty-Assa

We study the prospects of patients for kidney transplant and their optimal acceptance-rejection policy for varying-quality tissue matching. We present a computational tool to calculate the probabilities of present-day relevant HLA mismatches, and the optimal policy in terms of critical times. The accompanied Excel software may serve both the surgeon and the organizer of a donation program. Its use sheds light on debated issues such as race discrimination in unrelated-donor organ transplantation.

2 - Decision Making Methodology for the Budget Impact Analysis of Breast Cancer Screening Strategies

Luis Hernandez, BSc, MSc Candidate, Universidad de Los Andes, Calle 100 #49-85 Bloque 2 Apt. 402, Bogota, Colombia, gabr-her@uniandes.edu.co, Mario Castillo

This work develops a decision analysis methodology to evaluate the budget impact of the introduction and diffusion of a new health technology in a health care system formulary. This methodology is supported in a flexible and innovator Excel model, according to all international recommendations and guidelines. The methodology was applied to a real case in Colombia and it can be adapted to other disease areas and health technologies.

3 - Pharmaceutical Marketing Decision under a Price-volume Agreement

Hui Zhang, Assistant Professor, Lakehead University, 955 Oliver Rd., Thunder Bay, ON, P7B5E1, Canada, hzhang2@lakeheadu.ca, Greg Zaric

Pharmaceutical marketing, which includes physician detailing and direct-to-consumers advertising, will promote drug sales but may decrease its health benefit on patients. Price-volume agreements, in which the manufacturer returns to the payer a portion of sales exceeding a volume threshold, have emerged as a way to manage this issue. We develop a principal-agent model to derive the optimal marketing decision with the volume threshold is determined by the payer or by the manufacturer.

■ SA03

C-Room 23A, Upper Level

Game Theory and Computational Economics I

Cluster: Game Theory
Invited Session

Chair: Nicolas Stier-Moses, Columbia Business School, 418 Uris, New York, United States of America, stier@gsb.columbia.edu

Co-Chair: Gabriel Weintraub, Columbia Business School, 402 Uris, New York, United States of America, gweintraub@columbia.edu

1 - The Linear Programming Approach to Solving Large Scale Dynamic Oligopoly Models

Gabriel Weintraub, Columbia Business School, 402 Uris, New York, United States of America, gweintraub@columbia.edu, Denis Saure, Vivek Farias

Dynamic oligopoly models are used in industrial organization and the management sciences to analyze diverse dynamic phenomena. The computational complexity of solving for the equilibrium has severely limited the applicability of these models. We introduce approximation methods based on the LP approach to approximate dynamic programming that dramatically reduce the computational complexity. Our methods greatly increase the set of dynamic oligopoly models that can be analyzed computationally.

2 - Pricing with Markups under Horizontal and Vertical Competition

Nicolas Stier-Moses, Columbia Business School, 418 Uris, New York, United States of America, stier@gsb.columbia.edu, Jose Correa, Roger Lederman

We model a market for a single product that may be composed of sub-products that face horizontal and vertical competition. Each firm, offering all or some portion of the product, adopts a price function proportional to its costs by deciding on the size of a markup. Customers then choose a set of providers that offers the lowest total cost. We characterize equilibria of the two-stage game and study the efficiency resulting from the competitive structure of the market.

3 - Markov Perfect Equilibria in Stochastic Games

Matthieu Monsch, MIT, 70 Pacific St, Apt 586B, Cambridge, 02139, United States of America, monsch@mit.edu, Georgia Perakis, Vivek Farias

Computation of closed-loop equilibria in dynamic pricing games under fixed capacity is a hard problem. We study Markov Perfect Equilibria (MPE) in finite horizon discrete-time stochastic games. We show how Best Response dynamics converge to an MPE for linear demand. We suggest a natural dynamic that converges under mild assumptions to an MPE that capture a large class of nonlinear functions.

4 - Comparing Multilateral and Bilateral Exchange Models for Content Distribution

Ramesh Johari, Atanford University, ramesh.johari@stanford.edu, Christina Aperjis, Michael J. Freedman

Peer-assisted content distribution matches user demand for content with available supply at other peers in the network. Inspired by this supply-and-demand interpretation of the nature of content sharing, we employ price theory to study peer-assisted content distribution. We rigorously analyze the efficiency and robustness of price-based multilateral exchange, and compare and contrast multilateral content exchange with bilateral exchanges such as BitTorrent.

■ SA04

C-Room 23B, Upper Level

Combinatorial Auctions in the Lab

Cluster: Auctions
Invited Session

Chair: Martin Bichler, TU München, Boltzmannstr. 3, Garching, 85748, Germany, martin.bichler@in.tum.de

1 - An Experimental Comparison of Iterative Combinatorial Auction Formats

Martin Bichler, TU München, Boltzmannstr. 3, Garching, 85748, Germany, martin.bichler@in.tum.de, Pasha Shabalin, Georg Ziegler, Tobias Scheffel

Combinatorial auctions are used for the efficient allocation of heterogeneous goods. Several promising iterative combinatorial auction formats have been developed. In this talk, we provide the results of lab experiments testing these different auction formats in the same setting. We analyze aggregate metrics, such as efficiency and auctioneer revenue for small and medium-sized value models as well as individual bidding behavior.

2 - On the Exposure Problem in Large Spectrum Auctions

Jacob Goeree, California Institute of Technology, Pasadena, CA, 91125, United States of America, jacob.goeree@gmail.com, Yuanchuan Lien

We analyze the dynamic simultaneous ascending auction (SAA) and a sealed-bid variant (SSA). In both formats, competition takes place on an item-by-item basis, which creates an exposure problem. When competing aggressively for a package, a bidder may incur a loss when winning only a subset. We characterize the Bayes-Nash equilibria for SSA and SAA. With many licenses for sale the SAA generates efficient outcomes. This surprising result provides an important justification for its widespread use.

3 - A Data-driven Exploration of Bidder Behavior in Continuous Combinatorial Auctions

Alok Gupta, University of Minnesota, United States of America, agupta@csom.umn.edu, Shawn Curley, Pallab Sanyal, Gedas Adomavicius

Computational and cognitive complexity in Combinatorial Auctions has prevented this mechanism from reaching the online marketplace. Our study uses a data-driven approach to explore bidder behavior in such auctions using three experimental treatments that differ in the type of information feedback provided to participants. The enumeration of the strategies along with the analysis of their financial implications will help practitioners design better combinatorial auction environments.

■ SA05

C-Room 23C, Upper Level

Advancements in Data Analysis

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Rajesh Ganesan, Assistant Professor, George Mason University, 4400 Univ Dr. MS 4A6, Fairfax, VA, 22030, United States of America, rganesan@gmu.edu

1 - Characterization of Nonlinear Profiles Variation Using Mixed-effect Models and Wavelets

Kamran Paynabar, University of Michigan, 2292, Stone road, Ann Arbor, Ann Arbor, United States of America, kamip@umich.edu, Judy Jin

Nonparametric methods such as Wavelets have been effectively used in nonlinear profile monitoring. Traditionally, the profile variability is often modeled by i.i.d. random noises. Differently, this research considers both within- and between-profiles variations using a mixed effect model of transformed wavelet features. A change-point model is applied to ensure the identicalness of the profiles distribution. Finally, the performance of the model is evaluated using simulation and a case study.

2 - Function Approximation: A Quality Comparison Between Different Methods

Rajesh Ganesan, Assistant Professor, George Mason University, 4400 Univ Dr. MS 4A6, Fairfax, VA, 22030, United States of America, rganesan@gmu.edu

The talk presents a comparison between different known methods and diffusion wavelets for function approximation of multidimensional data. Computational complexity and mean square error performance metrics are compared.

■ SA06

C-Room 24A, Upper Level

Decision Analysis and Risk Management

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Tianyang Wang, McCombs School of Business, The University of Texas at Austin, Austin, TX, 78712, United States of America, Tianyang.Wang@phd.mccombs.utexas.edu

1 - The Correlated Multivariate Decision Tree

Tianyang Wang, McCombs School of Business, The University of Texas at Austin, Austin, TX, 78712, United States of America, Tianyang.Wang@phd.mccombs.utexas.edu, James Dyer

There is a growing need for the ability to specify and generate correlated random variables as primitive inputs to stochastic models. This paper presents a correlated decision tree model allowing multiple correlated uncertainties with arbitrary marginal distributions. Compared to the alternative copulas-based approach, the proposed correlated decision tree model presents a computationally efficient and standardized method for multivariate decision and risk analysis.

2 - An Informative Initial Sample Approach to Active Fraud Detection

Jing Ai, The University of Hawaii at Manoa, Shidler College of Business, 2404 Maile Way C305, Honolulu, HI, 96822, United States of America, jinga@hawaii.edu, Maytal Saar-Tsechansky

This paper proposes a new active learning method using an "informative" initial training sample pre-selected by an unsupervised method. By using an "informative" initial sample rather than a random initial sample, this new

method could lead to better learning performance and "front-loaded" cost savings. This method is especially pertinent to applications such as fraud detection, where a random initial sample tends to be biased and needs to be obtained at a substantial cost.

3 - Simulating Non-stationary, Non-Poisson, Non-renewal Arrival Processes

Barry L Nelson, Professor, Northwestern University, Department of Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, C210, Evanston, IL, 60208-3119, United States of America, nelsonb@northwestern.edu, Ira Gerhardt

Every simulation software product includes renewal arrival processes, and many support non-stationary Poisson arrivals. But real arrival processes can be non-stationary, non-Poisson and non-renewal. We present a convenient framework for fitting and simulating arrival processes that may have time-dependent arrival rates, may be more variable or more regular than a Poisson process, and may exhibit dependence among arrivals.

4 - Algorithms for Poisson and Negative Binomial Random Vector Generation

Raghu Pasupathy, Assistant Professor, Virginia Tech, 221 Durham Hall, Blacksburg, VA, 24061, pasupath@vt.edu, Kaeyoung Shin

We present fast algorithms for Poisson random vector generation. These algorithms have complete coverage in two dimensions, and rigorous error control for robust implementation. Furthermore, they have demonstrably faster preprocessing and generation times compared to NORTA. We will also discuss simple extensions for generating negative binomial random vectors through a well-known transformation that uses the gamma distribution.

5 - Multivariate Inputs with Time-varying Distributional Properties

Bahar Biller, Assistant Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States of America, billerb@andrew.cmu.edu, Jim Foster

Although the joint distributional properties of multivariate time-series input processes often vary with time, most of the simulation input models have been developed for stationary processes. We present a model for input processes with possibly many components having time-varying joint distributional properties. This model further generalizes some of the well-known conditional heteroskedastic models used routinely for financial time-series modeling.

■ SA07

C-Room 24B, Upper Level

Data Mining Algorithms for Parsimonious Modeling

Sponsor: Data Mining
Sponsored Session

Chair: Seoung Bum Kim, Assistant Professor, Korea University, Anam-dong Seongbuk-Gu, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

1 - How to Integrate the Diverse Measures for Hospital Fraud Detection?

Hyunjung Shin, Assistant Professor, Ajou University, Suwon, Korea, Republic of, shin@ajou.ac.kr, Junwoo Lee

To detect fraudulent and abusive bill claims of medical care providers, a variety of indexes have developed and evaluated diverse aspects of bill claim pattern. When taking all of indexes into consideration, however, it becomes confusing to find out which index is of more importance than others, and even more difficult if the respective results are significantly discordant. To avoid the ambiguities, we propose a method integrating the diverse degrees of anomaly based on 2007 Korean HIRA data.

2 - A One-class Classification Based Fault Isolation Method for Multivariate Process Diagnosis

Thuntee Sukchotrat, Research Faculty, University of Texas at Arlington, United States of America, thuntee.sukchotrat@mavs.uta.edu, Seoung Bum Kim

A number of fault isolation methods have been developed to identify the contribution of alarms signaled from multivariate control charts. However, most of them require a distributional assumption that restricts their applicability to a wide range of problems. To overcome such limitation, we propose a nonparametric fault isolation approach that decomposes the monitoring statistics obtained from a one-class classification algorithm into components that reflect the contribution of each variable.

3 - Unsupervised Feature Selection Using Weighted Principal Components

Panaya Rattakorn, PhD Candidate, University of Texas at Arlington, Arlington, TX, United States of America, panaya.rattakorn@mavs.uta.edu, Seoung Bum Kim

We proposed an unsupervised feature selection method that combines weighted principal components (WPCs) with thresholding algorithms. Each coefficient of the WPCs represents the importance of each individual feature. To identify the significant coefficients, we proposed two thresholding algorithms: a recursive thresholding algorithm and a bootstrap thresholding algorithm. Our experimental results with simulated data and real datasets demonstrated the effectiveness of the proposed methods.

4 - PCA-Based Feature Selection Method for NDP Approximation to the CRL Scheduling Problem

Jin Young Choi, Assistant Professor, Ajou University, Suwon, Korea, Republic of, choijy@ajou.ac.kr, Seoung Bum Kim

We present a principal component analysis (PCA)-based feature selection method for the neuro-dynamic programming (NDP) approximation to the capacitated re-entrant line scheduling problem. In particular, the PCA-based feature selection method is examined for its potential efficacy of the approximation by generating some example capacitated re-entrant lines.

■ SA08

C-Room 24C, Upper Level

High Dimensional Variable Selection with L1 Type Penalties

Sponsor: Data Mining
Sponsored Session

Chair: Gareth James, Associate Professor, University of Southern California, 522 Hoffman Hall, Information and Operations Management, Los Angeles, CA, 90089, United States of America, gareth@usc.edu

1 - Algorithms for Very Large Scale L1 Minimization and Related Problems

Emmanuel Candes, CalTech, emmanuel@acm.caltech.edu, Jerome Bobin, Stephen Becker

This talk introduces novel algorithms for L1 minimization and other nonsmooth norms such as the nuclear norm. These algorithms are based on ideas from Nesterov, namely, accelerated descent methods and smoothing techniques. We demonstrate the effectiveness of these methods on several examples taken in a variety of different fields.

2 - Forward-LASSO with Adaptive Shrinkage

Peter Radchenko, Assistant Professor, University of Southern California, Los Angeles, CA, Peter.Radchenko@marshall.usc.edu, Gareth James

Both Forward Selection and the Lasso provide computationally feasible methods for performing variable selection in high dimensional regression problems involving many predictors. We propose a new method we call Forward-Lasso Adaptive Shrinkage (FLASH), which incorporates the two approaches as special cases. We provide theoretical justifications and also demonstrate on an extensive set of simulations that FLASH generally outperforms many competing approaches.

3 - A Unified Approach to Model Selection and Sparse Recovery Using Regularized Least Squares

Jinchi Lv, Assistant Professor, University of Southern California, IOM Department, HOH 504, University of Southern California, Los Angeles, CA, 90089, United States of America, jinchilv@marshall.usc.edu, Yingying Fan

In this paper we study the properties of regularization methods in model selection and sparse recovery under the unified framework of regularized least squares (RLS) with concave penalties. For model selection, we establish conditions under which a RLS estimator enjoys the nonasymptotic weak oracle property, where the dimensionality can grow exponentially with sample size. For sparse recovery, we present a sufficient condition that ensures the recoverability of the sparsest solution.

4 - Partial Correlation Estimation by Joint Sparse Regression Models

Ji Zhu, Associate Professor, University of Michigan, 439 West Hall, 1085 South U Ave, Ann Arbor, MI, 48109, United States of America, jizhu@umich.edu

In this talk, we propose a computationally efficient approach for selecting non-zero partial correlations under the high-dimension-low-sample-size setting. This method assumes the overall sparsity of the partial correlation matrix and employs sparse regression techniques for model fitting. It is shown that our method performs well in both non-zero partial correlation selection and the identification of hub variables, and also outperforms two existing methods.

■ SA09

C-Room 25A, Upper Level

Analysis of Multi-server and Non-stationary Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Natarajan Gautam, Texas A&M University, 3131 TAMU, 235A Zachry, College Station, TX, 77843, United States of America, gautam@tamu.edu

1 - Large Scale Dynamics for Multi-server Queues with Abandonment
William Massey, wmassey@Princeton.EDU, Rudy Horne, Avishai Mandelbaum

The fluid and the diffusion models for a multi-server queue with abandonment arise as uniform asymptotic scalings of the time-varying Poisson arrival rate and the number of servers. The fluid model is a one-dimensional, non-linear dynamical system. When the diffusion is a Gaussian process, then its variance coupled with the fluid model forms a two-dimensional dynamical system. We study these dynamics to characterize the time-varying behavior of the multi-server queue.

2 - Heavy-traffic Extreme-value Limits for Erlang Models
Ward Whitt, Professor, Columbia University, 500 West 120th Street 313 Mudd, New York, NY, 10027, United States of America, ww2040@columbia.edu, Guodong Pang

We consider the maximum queue length and the maximum number of idle servers in the Erlang delay model and the generalization allowing customer abandonment. We use strong approximation to show, under regularity conditions, that properly scaled versions of them converge jointly to independent random variables with the Gumbel distribution in the QED and ED regimes as n and t increase to infinity together appropriately.

3 - Ph_t/M_t/s/c Time-Dependent Departure Process and Queues in Tandem
Michael Taaffe, Associate Professor, Virginia Tech, 209 Durham Hall, Blacksburg, VA, 24061, taaffe@vt.edu, Walid Nasr

We approximate the time-dependent moments of the number-in-system for tandem queues having M_t service and Ph_t exogenous arrival processes. We develop partial-moment differential equations and closure approximations for the time-dependent departure-count moments for the upstream node and then fit the departure-count moments of the upstream node to an approximate \widetilde{Ph_t} process to be used as the approximate arrival process to the downstream node.

4 - Performance Analysis of Multi-server Non-stationary Queueing Systems
Young Myoung Ko, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ymko@tamu.edu, Natarajan Gautam

We consider non-stationary multi-server queueing systems. An asymptotic method called "strong approximation" can be easily applied to various types of systems thanks to its generality. It, however, requires a strong assumption that is usually not satisfied in many multi-server queueing systems. To address this limitation, we develop a new method by enhancing the strong approximations and achieve better accuracy preserving its versatility.

■ SA10

C-Room 25B, Upper Level

Stochastic Networks and Related Processes

Sponsor: Applied Probability
Sponsored Session

Chair: John Hasenbein, Associate Professor, University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, jhas@mail.utexas.edu

1 - Heavy Traffic Limits for G/G/1 SRPT Queues
Amber Puha, Associate Professor, California State University San Marcos, Department of Mathematics, 333 S. Twin Oaks Valley Road, San Marcos, CA, 92096, United States of America, apuha@csusm.edu, H. Christian Gromoll, Lukasz Kruk

We present a heavy traffic analysis for a G/G/1 queue in which the server uses the shortest remaining processing time (SRPT) policy. We prove heavy traffic limit theorems for a measure-valued state descriptor processes.

2 - Reflected Brownian Motion in Three Dimensions: Tail Behavior of the Stationary Distribution
J. Michael Harrison, Professor, Stanford University, Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, harrison_michael@GSB.Stanford.Edu

Let Z be a three-dimensional Brownian motion confined to the non-negative orthant by oblique reflection at the boundary. Necessary and sufficient conditions are known for Z to be a positive recurrent semimartingale. Assuming only those conditions, a large deviations principle (LDP) is conjectured for the stationary distribution of Z, and a simple method is described for computing the associated rate function.

3 - Queueing Systems with Finite Arrivals
Yu Wang, University of Minnesota, Indutrial and Systems Engineering, Minneapolis, MN, 55455, wang1075@umn.edu, Oualid Jouini, Saif Benjaafar

Motivated by applications with a distinct rush hour regime, we consider queueing systems where the number of arrivals is finite but inter-arrival times are non-identically distributed. We characterize the distribution of number of customers in the system and obtain several delay-related performance measures. We show how ignoring either the finiteness in the number of arrivals or the heterogeneity in inter-arrival times can lead to significant errors in evaluating these performance measures.

■ SA11

C-Room 25C, Upper Level

Port Security and Nuclear Interdiction

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Laura McLay, Assistant Professor, Virginia Commonwealth University, Statistics & Operations Research, 1001 W. Main Street, Box 843083, Richmond, VA, 23084, United States of America, lamclay@vcu.edu

1 - An Efficient Branching Scheme for the Stochastic Network Interdiction Problem
Mike Nehme, mikenehme@yahoo.com, David Morton

We describe a stochastic network interdiction model for deploying radation detectors at border checkpoints to detect smugglers of nuclear material. While the problem is NP-Complete in the general case, we can compute wait-and-see bounds in polynomial time if we are only allowed to install detectors at checkpoints of the origin and destination countries. These bounds augment a scheme which heuristically identifies critical subsets of smuggler paths and branches on which subsets are interdicted.

2 - A Systems Concept for Detecting Nuclear Materials
Gary Gaukler, TAMU, TAMU-3131, College Station, United States of America, gaukler@tamu.edu, Yu Ding, Chenhua Li

In this talk, we discuss a layered container inspection system for detecting illicit nuclear materials. A key contribution of this inspection system is the incorporation of sensor measurements at checkpoints that the container previously visited. We present an inspection policy structure and evaluate the impact of prior checkpoint information on system performance.

3 - Optimal Test Management through Dynamic Programming
Endre Boros, Professor, Rutgers University, boros@rutcor.rutgers.edu, Paul Kantor

Many constraints in optimal detection are linear, indexed by the path that a particular item follows through the screening tree. Adapting thresholds in subsequent tests, based on the results of earlier ones, yields optimal detection at a given cost. For stochastically independent tests, Dynamic Programming yields further dramatic computational improvements. The algorithms have been implemented in highly efficient Java code. Supported by DNDO and ONR.

4 - Risk-Based Policies for Detecting Nuclear Material on Cargo Containers
Rebecca Dreiding, Virginia Commonwealth University, Statistics & Operations Research, 1015 Floyd Ave, Richmond, VA, 23284, United States of America, dreidingra@vcu.edu, Jason Merrick, Laura McLay

We introduce a framework for screening cargo containers for nuclear material at security stations throughout the United States using knapsack problem models. The approach investigates how to define a system alarm given a set of screening devices, given a multi-layered prescreening system. Containers that yield a system alarm undergo secondary screening, where more effective and intrusive screening devices are used to further examine containers for nuclear material.

■ SA12

C-Room 26A, Upper Level

Computational Issues in Approximate Dynamic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Warren Powell, Professor, Princeton University, Sherrerd Hall 230, Princeton, NJ, 08544, United States of America, powell@princeton.edu

1 - Ambulance Redeployment
Shane Henderson, Professor, Cornell University, School of ORIE, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu, Matthew Maxwell, Huseyin Topaloglu

Ambulance redeployment, or system status management, involves relocating ambulances in real time in an attempt to minimize the fraction of calls with large response times. We present an update on our work in using approximate dynamic programming for ambulance redeployment.

2 - Convergent Least Squares Policy Iteration Algorithm for High-Dimensional Markov Decision Process
Jun Ma, Princeton University, Dept of Operations Research and Fin Engg, Princeton, NJ, 08544, United States of America, junma@princeton.edu

In this paper we propose a least squares policy iteration algorithm for infinite-horizon Markov decision problems where the state and action spaces are continuous and the expectation cannot be computed exactly. We show that, under certain problem structure assumptions on value functions, the algorithm converges in the mean, meaning that the mean error between the approximate policy value function and the optimal value function shrinks to zero as successive approximations become more accurate.

3 - Robust Design of Global Supply Chains
Linda Nozick, Professor, Cornell University, Ithaca, NY, 14853, United States of America, lkn3@cornell.edu, Ningxiong Xu

As supply chains become more and more dependent on the efficient movement of materials among facilities that are geographically dispersed there is more opportunity for disruption. One of the common disruptions is the loss of production capability at supplier sites. We formulate a two-stage stochastic program and a solution procedure to optimize supplier selection to hedge against these disruptions.

4 - Hierarchical Knowledge Gradient for Sequential Sampling
Martijn Mes, Professor, University of Twente, School of Management and Governance, P.O. Box 217, Enschede, 7500 AE, Netherlands, m.r.k.mes@utwente.nl, Warren Powell, Peter Frazier

We consider the problem of selecting the best of a finite but large set of alternatives. We propose a hierarchical sequential sampling policy based on the knowledge-gradient policy. This policy optimizes the expected increment in the value of sampling information in each time period at various aggregation levels and uses the common features shared by alternatives to learn about many alternatives from even a single measurement. We demonstrate how this hierarchical knowledge-gradient policy can be applied to efficiently maximize a continuous function and prove that this policy finds a globally optimal alternative in the limit.

■ SA13

C-Room 26B, Upper Level

Infrastructure Management/Analysis

Sponsor: Computing Society
Sponsored Session

Chair: Cynthia Phillips, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, caphill@sandia.gov

1 - Optimizing Transformation of the United States Nuclear Weapons Infrastructure
Carol Meyers, Applied Mathematician, Lawrence Livermore National Laboratory, 7000 East Avenue, L-153, Livermore, CA, 94550, United States of America, meyers14@llnl.gov, Victor Castillo, Clifford Shang

The US nuclear weapons complex has undergone substantial consolidation in the last 30 years, including the closure of over 40% of all nuclear production and testing sites. Moreover, the National Nuclear Security Administration has pledged a further 30% reduction in the square footage of remaining facilities. We discuss mixed integer programming models we have developed to help optimize this transformation process, both in terms of infrastructure and the composition of the future stockpile.

2 - Nonlinear Sensor Placement Problems for Contamination Warning Systems
William Hart, Distinguished Member of Technical Staff, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, wehart@sandia.gov, Cynthia Phillips, Regan Murray

Reliable, clean water is critical for maintenance of public health, protection of public infrastructure and the operation of key industries. A critical aspect of water security is the design of sensor networks to rapidly detect contaminants. This presentation will discuss OR challenges for modeling and solving complex sensor placement formulations. In particular, we will consider how nonlinearities can be managed to provide scalable techniques for large-scale sensor placement applications.

3 - Braess-like Paradoxes on a Bipartite Exchange Network: More Connections Are Not Always Better
Randall Laviolette, Sandia National Laboratories, MS 1235, P.O. Box 5800, Albuquerque, NM, 87185, United States of America, ralavio@sandia.gov, Vitus Leung

We model exchanges in which price is fixed and the amount transferred depends only on supply, demand, and links between actors. We prove that trading sessions on the resulting bipartite graph can reduce demand to zero iff it consists of components each of which are complete bipartite and for each, supply equals or exceeds demand. A Braess-like paradox can be generated for a minimally connected bipartite graph whose demand can be reduced to zero, because it may fail to do so as links are added.

■ SA14

C-Room 27A, Upper Level

Innovative Applications of CP

Sponsor: Computing Society
Sponsored Session

Chair: Laurent Michel, Associate Professor, University of Connecticut, 371 Fairfield Rd, Storrs, CT, 06269, United States of America, ldm@engr.uconn.edu

1 - Real-Time Tabu Search for Video Tracking Association
Ivan Dotu, Postdoctoral Researcher, Brown University, 115 Waterman st., Providence, RI, United States of America, idotu@cs.brown.edu

This work considers the data association problem arising in Intelligent Visual Surveillance (IVS) systems, which consists in assigning blobs (connected sets of pixels) to tracks (objects being monitored) in order to minimize the distance of the resulting scene to its prediction (which may be obtained with a Kalman Filter). We propose a tabu-search algorithm for this multi-assignment problem that can process more than 11 frames per seconds, thus, significantly outperforming the state of the art.

2 - Constraint Programming Applications From IBM Research
Yehuda Naveh, Haifa Research Lab, IBM, Haifa University Campus, Mount Carmel, Haifa, 31905, Israel, NAVEH@il.ibm.com, Yael Ben-Haim, Bella Dubrov, Odellia Boni, Sigal Asaf, Merav Aharoni, Wesam Ibraheem, Michael Veksler, Haggai Eran, Ari Freund

IBM Research has long been in the business of developing constraint solvers and using them for hardware verification and for steel manufacturing scheduling. In this talk we will present newer industrial applications of our solvers, namely, workforce management, vehicle configuration, floorplanning, and virtual machine placement. We will focus on the challenges of each domain, and the CP-based solutions we designed for solving them. We will describe the extent of usage of the applications by IBM.

■ SA15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Oracle - Crystal Ball
Michael Franden, Oracle, 77 Technology Way, Denver, CO, michael.franden@oracle.com

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

2 - American Optimal Decisions - Portfolio Safeguard by AORDA
Gaia Serraino, Consultant, American Optical Decisions, 5214 SW. 91 Way, Suite #130, Gainesville, FL, 32608, United States of America, serraino@aorda.com

Portfolio Safeguard by AORDA is an advanced optimization package for risk management, financial engineering, military, medical and other applications. Design and solve complex optimization problems with built-in functions (linear, quadratic, maximum, St. Dev., variance, probability, VaR, CVaR, cardinality, fixed-charge). Real-life case studies in Windows, MATLAB, C++, Run-File. Download problems/data from www.aorda.com/aod/psg.action.

■ SA16

C-Room 28A, Upper Level

Social Networks and Web 2.0

Sponsor: Information Systems
Sponsored Session

Chair: Param Singh, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, United States of America, psidhu@cmu.edu

1 - The Existence and Identification of Influentials
Jacomo Corbo, Postdoctoral Research Fellow, The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, Jacomo@wharton.upenn.edu

There is debate as to whether influentials, a minority who influence an exceptional number of their peers, are important to the formation of public opinion. We explore the so-called influentials hypothesis. We find that the existence, identity, and relative influence of influentials is inextricably tied to the structure of spillovers. We show that identifying influentials can be a hard problem and that even in simple domains effective heuristics are functions of the full influence network.

2 - Informational Cascades and Contagion in Online Social Networks
Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu, Jeong-ha Oh, Yong Tan

Cascades are triggered when small initial shocks affect highly connected nodes in a social network. In this paper we are interested in how the network structures on YouTube influence the formation and propagation of informational cascades that lead to the phenomenal popularity of some videos. The two questions we explore are: (i) what characteristics of content creators and content adopters cause online informational cascades? and (ii) how does network position of users cause cascades to tip?

3 - Privacy Concerns and Information Disclosure: An Illusion of Control Hypothesis
Laura Brandimarte, PhD Student, Carnegie Mellon University - Heinz College, 4800 Forbes Avenue - Room 238, Pittsburgh, PA, 15213, United States of America, laura.brandimarte@email.it, Alessandro Acquisti

This paper investigates one possible explanation for people's conflicting attitudes regarding revelation and protection of private information. We introduce and test the hypothesis that people may confuse control over publication with control over accessibility to private information by third parties: an hypothesis we refer to as 'illusion of control'. Results from 2 experiments (surveys to students of a North American University) provide empirical evidence of illusion of control.

4 - Do I Follow My Friends or the Crowd? Informational Cascades in Online Movie Rating
Young Jin Lee, University of Washington, Foster School of Business, Box 353200, Seattle, WA, 98195, United States of America, younglee@u.washington.edu, Yong Tan

Online product review as a form of online Word of Mouth (WOM) and User-Generated Content has attracted much attention recently. This study analyzes how online movie user ratings are generated through a complex interrelationship between product information, marketing effort, and social influences. In particular, we examine the effect of comparable WOM from the crowd and friends on user movie ratings.

■ SA17

C-Room 28B, Upper Level

Digital Technologies and Public Policy

Sponsor: Information Systems
Sponsored Session

Chair: Xianjun Geng, Assistant Professor, University of Washington, Michael G. Foster School of Business, University of Washington, Box 353200, Seattle, WA, 98195, United States of America, gengxj@u.washington.edu

1 - Entertainment Without Borders: The Impact of Digital Technology on Government Cultural Policies
Jane Feng, Assistant Professor, University of Florida, 360 Stuzin Hall, Gainesville, FL, 32611, United States of America, jane.feng@cba.ufl.edu, Hsing Cheng, Sean Marston

New distribution avenues created by digital technology have allowed domestic consumers to access foreign entertainment programs while bypassing the government protection methods. Using a unified analytical framework we study the impact of the government's choice of cultural protection policies including quota, tariff, and subsidy, on domestic firm profits and consumers.

2 - Competing with Piracy: A Multi-Channel Sequential Search Approach
Xianjun Geng, Assistant Professor, University of Washington, Michael G. Foster School of Business, University of Washington, Box 353200, Seattle, WA, 98195, United States of America, gengxj@u.washington.edu, Young Jin Lee

We consider an online market where consumers may obtain digital goods from two alternative channels: the legitimate channel consisting of some law-biding retailers, or the piracy channel consisting of some piracy services. We analyze consumer choice, retailer strategy and piracy control using a sequential search approach where it is costly for some consumers (non-shoppers), yet costless for others (shoppers), to search for information.

3 - New Generation Games - Online or Offline?
Fang Fang, Assistant Professor, California State Univ. at San Marcos, 333 S Twin Oaks Valley Rd, San Marcos, CA, 92096, United States of America, fangfang@csusm.edu, Yi Sun, Jack Leu

Many video games now have both online and offline versions, while some have online (or offline) versions only. We analyze strategies for releasing video games based on two factors affecting a player's version selection: gaming skill and social enjoyment level. More specifically, we attempt to answer the following research questions from the perspective of a game provider: whether providing the offline version of a game helps improves the profit or hurts the profit by introducing competition.

4 - Effects of Online Marketing Communication Exposures on Final Conversion
Lizhen Xu, University of Texas at Austin, 1 University Station B6500, IROM Department, Austin, TX, 78712, United States of America, Lizhen.Xu@phd.mccombs.utexas.edu, Jianqing Chen, Andrew Whinston

Advertisers spend millions of dollars on various online marketing communication (MarCom) vehicles. How are they worth it? This paper investigates the effects of different online MarCom vehicles on the conversion of consumers, based on a dataset from a major electronic device manufacturer and seller recording all of its MarCom interactions with consumers and the associated purchases. We use a panel probit model to estimate the marginal effect of each MarCom click on the likelihood of purchase.

■ SA18

C-Room 28C, Upper Level

Stochastic Control and Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Yang Wang, Stanford University, Packard Electrical Engineering, 350 Serra Mall, Stanford, CA, 94305, United States of America, yw224@stanford.edu

1 - Singular Stochastic Control and Composite Markov Processes
Xiren Cao, Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, eecao@ust.edu.hk

We propose a composite model for Markov processes. The state space of a composite Markov process consists of two parts, J and J-. When the process is in J-, it evolves like a continuous-time Levy process; and once the process enters J, it makes a jump instantly like a discrete-time Markov chain. The composite Markov process provides a new model for singular stochastic control problem, and we show that this problem can be solved using a direct-comparison method.

2 - Computationally Tractable Performance Bounds for Constrained Linear Stochastic Control
Yang Wang, Stanford University, Packard Electrical Engineering, 350 Serra Mall, Stanford, CA, 94305, United States of America, yw224@stanford.edu

We present computational lower bounds on performance for constrained linear stochastic control. Our method involves solving a semidefinite program, a convex optimization problem which we can solve efficiently. Numerical experiments show that the lower bound obtained by our method is often close to the performance achieved by suboptimal control policies. As a by-product, our bound yields approximate value functions that can be used as control Lyapunov functions for suboptimal control methods.

3 - Structural Properties of the Value of Information in Single-Stage Ranking and Selection

Peter Frazier, Assistant Professor, Cornell University, Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

Within the Bayesian ranking and selection problem with independent normal priors and independent normal sampling noise, we consider the expected value of information obtained from a non-sequential sampling allocation. This quantity is known to be a non-concave function of the sampling allocation, which makes finding the optimal allocation difficult. Nevertheless, this function possesses a number of structural properties. We discuss these properties and their application.

4 - Optimal Learning On a Graph

Ilya Ryzhov, Princeton University, Princeton, NJ, 08540, United States of America, iryzhov@princeton.edu, Warren Powell

Consider a stochastic path-finding problem on a graph where the distributions of the arc costs are unknown. By sequentially measuring individual edges, we can refine Bayesian estimates of the arc costs. Our goal is to allocate measurements in order to efficiently learn about the optimal solution to the path-finding problem. We propose a knowledge gradient policy that is easy to compute, with certain desirable theoretical properties, and performs competitively against other learning strategies.

■ SA19

C-Room 28D, Upper Level

Advances in Network Flow Models I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Avinash Unnikrishnan, University Texas Austin, Austin, United States of America, avinash@mail.utexas.edu

1 - A Diversity Maximization Algorithm for the Shortest Path Problem with SSD Constraints

Marco Nie, Assistant Professor, Northwestern University, Evanston, United States of America, y-nie@northwestern.edu

This paper studies optimal path problems integrated with second order stochastic dominance (SSD) constraints. An equivalent linear program of the problem can be constructed by transforming the SSD constraint into a finite number of linear constraints. To solve the problem efficiently, an approximation algorithm based on the idea of diversity maximization is proposed. The algorithm is found to be an competitive alternative for large instances of the problem.

2 - Time-dependent Shortest Path Reformulation and Algorithm for Solving Off-line Map Matching Problem

Tao Xing, Graduate Research Assistant, The University of Utah, Civil and Materials Engineering, 122 Central Campus Drive, Rm. 104, Salt Lake City, UT, tao.xing@utah.edu, Xuesong Zhou

Map matching is a core task in converting raw GPS location data to useful traffic information. This research reformulates and solves the off-line map matching problem by a time-dependent shortest path algorithm that can simultaneously estimate the most likely activity tour on a transportation network and the resulting travel time on matched links.

3 - The Capacitated Vehicle Routing Problem with Backhauls on Tree-like Networks

Roshan Kumar, University of Texas at Austin, Ernest Cockrell, Jr. Hall, 6.202, 1 University Station C1761, Austin, TX, 78712, United States of America, roshan@mail.utexas.edu, Avinash Unnikrishnan, Travis Waller

The focus of this work is to solve the vehicle routing problem with backhauls when the underlying network has a tree-like structure. Such networks usually arise in situations where the cost of construction and maintenance of access infrastructure far exceeds the routing costs. A mathematical programming formulation will be provided along with some heuristics. The computational performance of this problem structure will be compared with that of the traditional VRP with backhauls.

■ SA20

C-Room 28E, Upper Level

Heuristics for Vehicle Routing Problems I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Miguel Andres Figliozzi, Assistant Professor, Portland State University, P.O. Box 751, Portland, OR, 97207-0751, United States of America, figliozzi@pdx.edu

1 - The Generalized Location Routing Problem with Profits

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Yue Geng, Olivier de Weck, Jaemyung Ahn

In exploring the surface of a planetary body, a unique routing problem is encountered. It considers profits at sites and resource consumption along routes depends on the selected strategy. We solve the underlying model by branch-and-price. In addition, a novel problem specific heuristic is developed.

2 - Delivering Bagged Cement From a Central Depot in Brazil

Claudio Cunha, Universidade de São Paulo, São Paulo, Brazil, cbcunha@usp.br, Marcos Miura

The problem consists in defining how to assign deliveries to a heterogeneous fleet of vehicles aiming to minimize freight costs which takes into account distance-based cost only when a route comprises deliveries located in different municipalities. Our heuristic is based on solving a bin-packing problem for those vehicles which serve clients located within the same municipality and a VRP problem for those vehicles servicing customers located in different municipalities.

3 - Restricted Dynamic Programming: A Flexible Framework for Solving Realistic Vehicle Routing Problems

Leendert Kok, University of Twente, P.O. Box 217, Enschede, Netherlands, a.l.kok@utwente.nl, Erwin Hans, Marco Schutten

Local search has been very successful in solving large vehicle routing problems (VRPs). However, these approaches are tailor-made for specific VRP types. Next, they are inflexible to deal with common timing restrictions such as time-dependent travel times and driving hours regulations. We propose a restricted dynamic programming (DP) algorithm, which forms a general framework for solving various VRP types. We show that DP is well-suited for including complex timing restrictions within the VRP.

4 - An Algorithm for the Vehicle Routing Problem with Stochastic Travel Times and Customer Deadlines

Miguel Andres Figliozzi, Assistant Professor, Portland State University, P.O. Box 751, Portland, OR, 97207-0751, United States of America, figliozzi@pdx.edu

A new approach based on an iterative and recursive algorithm is used to solve the vehicle routing problem with stochastic travel times and customer deadlines. In this problem customers must be serviced before a known deadline to avoid late or no-show penalties. A modeling approach to evaluate the objective function and represent discrete or continuous travel time distributions is discussed. Solution quality and computational time using real-world travel time data are presented and discussed.

■ SA21

C-Room 30B, Upper Level

Joint Session AAS/TSL: Airport Operations I

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Yoon Jung, Aerospace Engineer, NASA, NASA Ames Research Center, Mail Stop 210-6, Moffett Field, CA, 94035, United States of America, yoon.c.jung@nasa.gov

1 - Airport Configuration Planning under Weather Uncertainties

Leihong Li, Georgia Institute of Technology, leihong.li@gatech.edu, John-Paul Clarke

The set of feasible airport configurations is constrained by rules regarding allowable crosswind and tailwind. Thus, because weather is stochastic and configuration changes result in lost capacity, airports are often stuck in the "wrong" configuration. We present an innovative decision-making approach for airport configuration planning in which the likelihood and cost of being forced to make a configuration change is explicitly considered in the airport configuration decision.

2 - Optimization Techniques and Practical Experiments in Balancing Environmental and Operational Factors
Terence Thompson, Metron Aviation, Dulles, VA, United States of America, terry@metronaviation.com

We discuss recently developed techniques for including environmental effects (noise, air quality, and climate) in planning algorithms for use in control of aircraft movements on the airport surface. We report on experiments applying these techniques to actual operations as recorded in surveillance data, as well as feasibility demonstrations in a simulation environment. We also discuss extensions of these techniques to include airborne activities.

3 - Base Location and Fleet Allocation for Per-seat, On-demand Air Transportation
Gizem Keysan, Senior Analyst, United Airlines, 1200 E Algonquin Road, Elk Grove Township, IL, 60007, United States of America, gizem.keysan@united.com, George Nemhauser, Martin Savelsbergh

We discuss two approaches that capture the information about flight scheduling with different levels of detail while determining the base location and fleet allocation decisions for per-seat, on-demand air transportation. Firstly, we use such information in a traditional facility location problem. The second approach is based on a model that works directly with transportation requests and integrates a simplified version of flight scheduling with the base location and fleet allocation decisions.

4 - Departure Aircraft Metering for Efficient Airport Surface Operations
Waqar Malik, Associate Research Scientist, University Affliliated Research Center, Building 210, MS 210-8, NASA Ames Research Center, Moffett Field, CA, 94035, United States of America, waqar.malik@nasa.gov, Gautam Gupta, Yoon Jung

We develop a model for the automatic metering of departure aircraft at spot/gate. The model runs over two time frames: long term (half hour or more in future) for collaborative decision making, and short term (immediate) for decision regarding the release of aircraft. The purpose is to provide the controller a schedule of spot/gate release times optimized for runway utilization. The model is tested in nominal and heavy surface traffic scenarios, and computational results are provided.

■ SA22

C-Room 30C, Upper Level

Public Transit I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Luca Quadrifoglio, Assistant Professor, Texas A&M University, CE/TTI Bldg., Room 301I, College Station, TX, 77843-3136, United States of America, lquadrifoglio@civil.tamu.edu

1 - Towards the Solution of the Route Design Problem on Bus Rapid Transit Systems
Andrès L. Medaglia, Departamento de Ingenierìa Industrial, Universidad de los Andes, Carrera 1 Este # 19 A- 40, Bogotà, Colombia, amedagli@uniandes.edu.co, Maryory Gomez, Jose L. Walteros

A Bus Rapid Transit (BRT) system is a high-capacity low-cost public transit solution. The BRT Route Design Problem finds a set of routes that minimizes passengers travel time while simultaneously satisfying technical constraints. We propose a decomposition strategy that decouples the route selection decisions (genetic algorithm) from the BRT performance evaluation (network model). To solve a real problem it was necessary to adjust the trip distribution (OD-matrix) using optimization.

2 - Dynamic Transit and Traffic Assignment
Mark Hickman, University of Arizona, Tucson, AZ, mhickman@email.arizona.edu, Yi-Chang Chiu

We consider a dynamic transportation assignment system, including both transit and traffic assignment. Most existing dynamic traffic assignment (DTA) models do not explicitly include transit, which limits their applicability. We describe a dynamic transit assignment model which can work directly within a DTA model, provided that one looks at person assignment in addition to vehicle assignment. The assignment model is described and illustrated with a small a case study.

3 - System-wide Signal Timing Optimization with Transit Priority for Conflicting Bus Routes
Eleni Christofa, PhD Student, Institute of Transportation Studies, U.C. Berkeley, 109 McLaughlin Hall, Berkeley, CA, 94720-1720, United States of America, eleni_christofa@berkeley.edu, Alexander Skabardonis

Existing transit signal priority (TSP) strategies have not addressed the problem of granting priority on transit vehicles traveling in conflicting directions. We developed and tested an adaptive TSP algorithm for a single intersection that incorporates occupancy, schedule adherence and other transit measures. Currently, we are extending the algorithm on networks, accounting for signal coordination and system-related performance measures for autos and transit.

4 - Optimal Cycle Time for a Feeder Transit Service in El Cenizo, TX
Luca Quadrifoglio, Assistant Professor, Texas A&M University, CE/TTI Bldg., Room 301I, College Station, TX, 77843-3136, United States of America, lquadrifoglio@civil.tamu.edu

Colonias along the US-Mexico border are one of the most rapidly growing areas in Texas with inadequate transportation services. The objective of this paper is to determine the optimal cycle time of a potential feeder transit serivice operating in a representative Colonia (El Cenizo, TX) using demand data collected through a travel survey. Results showed that the cycle time between consecutive departures from the terminal should be around 11-13 minutes for best service quality.

■ SA23

C-Room 30D, Upper Level

Impacting Military Policy through Operations Research

Sponsor: Military Applications Society
Sponsored Session

Chair: Elvira Loredo, Researcher, Full, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90404, United States of America, loredo@rand.org

1 - Incorporating Robustness Modeling Into Materiel Management Analyses
Ronald McGarvey, Senior Operations Researcher, RAND Corporation, HQ AMC/A9, 402 Scott Drive, Unit 3M12, Scott AFB, IL, 62225, United States of America, ronm@rand.org

Within this presentation, we quantify some of the costs and benefits associated with establishing centralized management and control for Air Force War Reserve Materiel. We demonstrate how a global manager can establish a robust posture (guarantees support of asset delivery timelines, even in the event of unplanned loss of access to a logistics site) at relatively low additional cost beyond the pure “min-cost solutiondescribing the modeling challenges associated with capturing such robustness.

2 - Assessing Stop-loss Policy Options through Personnel Flow Modeling
Stephan Brady, Assistant Professor of Operations and Supply Chain Management, Penn State Harrisburg, E-355 Olmsted Building, 777 West Harrisburg Pike, Middletown, PA, 17057, United States of America, stephan.brady@psu.edu

The practice of stop-loss retains soldiers who are scheduled to end their voluntary terms of service during an impending or ongoing deployment. It has seen decades of use...and contentious debate. Personnel policy alternatives to stop-loss were examined with a large-scale discrete-event simulator, tracking individual daily global assignment decisions and the resultant effects on unit strengths and cohesion. With data and advice provided by Army staff, the study helped in a recent decision by the Secretary of Defense and President to end stop-loss for current U.S. engagements.

3 - US Army Logistics Innovation Agency Cost to Readiness Model
John Dulin, Concurrent Technologies Corp., 100 CTC Drive, Johnstown, PA, 15904, United States of America, dulinj@ctc.com, Thomas Turner

CTC has created a Decision Support System for the Army Logistics Innovation Agency (LIA) that provides historical, current and forecasted information relating the costs and readiness of the Army’s 16 SORT Systems. It is an interactive tool that provides leaders with data previously found only in disparate sources, and identifies relationships between elements that had previously been unexplored. In the tool are variety of analytic techniques including forecasting, regression, and correlations.

■ SA24

C-Room 30E, Upper Level

OR/MS for Enterprise Transformation I

Sponsor: Military Applications Society
Sponsored Session

Chair: Greg Parlier, SAIC, 255 Avian Lane, Madison, AL, 35758, United States of America, greg.h.parlier@saic.com

1 - UH-60L Operational Availability
John Scales, SAIC, 6725 Odyssey Drive, Huntsville, AL, 35806, United States of America, john.r.scales@saic.com, Jennifer Suckow

Currently the US Army is analyzing the effects of various components of its supply chain on equipment readiness. The initial analysis has concentrated on

the UH-60L Blackhawk helicopter. In order to explore the effects of changes to various policies being considered it must first be understood what processes drive the operational availability of the aircraft on the flight line. The output from extensive data analysis has been distilled into a spreadsheet model.

2 - OR Analysis Role in Shaping Navy ERP Single Supply Solution Implementation

Walt Degrange, US Navy, 5450 Carlisle Pike, P.O. Box 2020, Mechanicsburg, PA, 17055-0788, United States of America, walt.degrange@navy.mil

Navy ERP Single Supply Solution is a major process and system implementation that promises new capabilities for Supply Chain Management, improved forecasting, and better asset visibility. The Naval Inventory Control Point Operations Research Department is tasked with conducting comparative and predictive analysis for ERP. This brief covers the lessons learned over the past few years of development and the analytical challenges of implementing a Commercial Off the Shelf software.

3 - A Center for Innovation in Logistics Systems (CILS)

Greg Parlier, SAIC, 255 Avian Lane, Madison, AL, 35758, United States of America, greg.h.parlier@saic.com

Fully enagaged in the Global War on Terror, the US Army is also committed to a comprehensive and ambitious "Transformation" endeavor. An analytical architecture is presented which consists of several "catalysts for innovation" and four complementary modeling approaches collectively referred to as Dynamic Strategic Logistics Planning. An organizational construct is presented to sustain continual improvement for Army supply chain management - a "Center for Innovation in Logistics Systems".

■ SA25

C-Room 31A, Upper Level

Aviation Applications Section Dissertation Award Finalists

Sponsor: Aviation Applications
Sponsored Session

Chair: Mustafa Akan, Assistant Professor of Operations Management, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue Posner Hall 381C, Pittsburgh, PA, 15213, United States of America, akan@cmu.edu

1 - Aviation Applications Section Dissertation Award Finalists

Mustafa Akan, Professor, Carnegie Mellon, akan@andrew.cmu.edu

The dissertation prize is given annually by The Aviation Applications Section of INFORMS for the best dissertation in any area related to aviation OR (air traffic management OR and airline OR).

2 - Finalist - Tactical and Operational Planning for Per-Seat, On-Demand Air Transportation

Gizem Keysan, 1701 Wildflower Ct., Schaumburg, IL, 60173, gkeysan@isye.gatech.edu, United Airlines

This thesis addresses two planning problems motivated by the operations of per-seat, on-demand air transportation. The first problem focuses on the scheduled maintenance of the fleet that has to be done periodically for safety. The second problem is concerned with selecting locations for bases and determining how many jets to allocate to each base where bases are airports with hangar space to keep jets overnight. Both problems have significant impacts on the profitability of the business.

3 - Finalist - Mitigating Airport Congestion: Market Mechanisms and Airline Response Models

Pavithra Harsha, MIT, 77 Massachusetts Avenue, Room No. 32-D714, Cambridge, MA, 02139, pavithraharsha@gmail.com

We study two demand-management techniques to mitigate airport congestion, strategic and operational techniques. As a strategic initiative, we study slot auctions and focus on two aspects of its design: (1) a strategic decision support tool to help airlines value runway slots; and, (2) activity rules that suppresses strategic behavior and promotes simple, meaningful bidding for airlines in a slot auction. We discuss our models and computational results on data from a real-carrier. We also briefly discuss ways to evaluate different real-time allocation schemes.

■ SA26

C-Room 31B, Upper Level

Certification Process for OR/MS Professionals

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Michael McCoy, The Boeing Company, michael.s.mccoy@boeing.com

1 - INFORMS: "Body of Knowledge"

Jennifer Leong, Senior Consultant, Booz | Allen | Hamilton, Modeling Simulation Wargaming Analysis (

When developing a credential, a "Body of Knowledge" (BOK) is a set of accepted and agreed upon standards in field or profession. In this session, INFORMS Credentialing Committee investigates the demand and the necessary resources to establish and maintain an INFORMS Operations Research & Management Science (ORMS) Body of Knowledge.

2 - Taking into Account Education in Credentialing

René Séguin, Operational Research and Analysis Directorate (ORAD), Defence Research and Development Canada, Centre for Operational Research and Anal, Canada

In examining the credentialing process for OR practitioners one aspect that needs to be addressed is how to take into account the education background of the applicant. Is a degree in OR/MS mandatory or is it just a nice-to-have component? Are all types of degrees equivalent? How much does a Ph. D. buys you? Should education and work experience be combined with some kind of formula? What constitute a valid OR/MS degree? This talk will try to give answers to all these questions.

3 - Single versus Multi-level Certification

Robert L. Simons, Technical Fellow, The Boeing Company

This initiative involves documenting a high-level trade study activity investigating a single versus multi-level certification methodology for the INFORMS Practitioner Community in general, and the Practioner-focused Operations Research certificate in particular. The approach involves identifying supporting rationale, capturing evaluation criteria, establishing acceptance thresholds, and formulating appropriate criteria scoring. Inputs will be sought to strengthen this initial activity and follow-on detailed decision analysis activities.

■ SA27

C-Room 31C, Upper Level

Simulation Approaches for Selecting the Best System

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Sigrun Andradottir, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, sa@gatech.edu

1 - Sequential Procedures for Comparing Systems with Multiple Constraints

Christopher Healey, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, cmheal@gatech.edu, Seong-Hee Kim, Sigrun Andradottir

Consider the problem of selecting the best feasible system with constraints on multiple simulated performance measures. We develop fully-sequential procedures that guarantee a nominal probability of correct selection, taking both feasibility and optimality into account. We also provide a recommended error allocation as a function of the number of constraints for efficient implementation.

2 - Challenges of Optimisation under Risk

Felisa Vazquez-Abad, Professor, Hunter College CUNY, New York, New York, United States of America, felisav@unimelb.edu.au

We study problems of optimization under risk, where the risk is of a qualitative and not quantitative nature. The problem is posed as that of minimizing costs subject to probability constraints. We discuss difficulties of simulation optimization methods and possible solutions. We include examples in various fields, such as finance and the energy sectors.

3 - Is Mean-based Selection Good Enough in Ranking and Selection Procedures?
Demet Batur, Post Doctoral Research Associate, IMSE, University of Nebraska-Lincoln, 175 Nebraska Hall, Lincoln, NE, 68588, United States of America, dbatur2@unl.edu, Fred Choobineh

The legacy simulation approach for the ranking and selection procedures is to compare systems based on a mean performance metric. The best system is most often deemed as the one with the largest (or smallest) mean performance metric. We discuss limitations of the mean-based selection approach and explore the advantages of other decision theoretic approaches that utilize at least part of the distribution function of the performance metric.

4 - Hybrid Probabilistic Search Methods for Simulation Optimization
Alireza Kabirian, Assistant Professor, University of Alaska-Anchorage, College of Business and Public Policy, 3211 Providence Drive, Anchorage, AK, 99508-4614, United States of America, a_kabirian@yahoo.com, Sigurdur Olafsson

Randomness in simulation outputs often challenges the correct selection of the optimum in simulation based optimization. We propose an algorithm that merges Indifference Zone methods with a large subclass of Random Search methods for continuous optimization via simulation. Under a mild assumption, we prove asymptotic convergence of the algorithm to a global optimum. The new algorithm addresses the noise in simulation outputs while benefits the proven efficiency of Random Search methods.

5 - Selecting the Best System: Do Common Random Numbers Help?
Christopher Healey, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, cmheal@gatech.edu, Seong-Hee Kim, Sigrun Andradottir

Inducing positive correlation across systems, usually through the use of common random numbers, is a tool for improving the efficiency of the comparison of stochastic systems. We show how high positive correlation can adversely affect the probability of correct selection, even with normally distributed data, for certain fully-sequential selection procedures. We also suggest an adjustment to achieve the desired probability of correct selection.

■ SA28

H-Room 500, Fifth Floor

Joint Session MIF/ QSR: Applied Environmental, Economic and Social Science Methods

Sponsor: Minority Issues Forum & Quality, Statistics and Reliability
Sponsored Session

Chair: Kobi Abayomi, Asst. Professor - Statistics, Georgia Tech, H. Milton Stewart School of Industrial a, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, kobi@gatech.edu

1 - Indexing Methodology for Millennium Development Goals
Gonzalo Pizarro, Policy Specialist for the MDGs, United Nations Development Programme, 304 East 45th Street, Office 1052, New York, NY, 10017, United States of America, gonzalo.pizarro@undp.org, Yizi Chen, renata rubian, Kobi Abayomi

We develop an index - a linear combination of multivariate data - to assist in evaluation of country by country progress in maternal health: one of the United Nations Millennium Development Goals.

2 - Calibration of Thiel's Index
Kobi Abayomi, Asst. Prof - Statistics, Georgia Tech, H. Milton Stewart School of Industrial a, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, kobi@gatech.edu, William Darity Jr.

Thiel's index, an information theoretic measure of dispersion familiar to economists, can be partitioned as within and across group divergences. This partitioning, however, is skew-sensitive in that within group divergence may outweigh across group divergence. We investigate a calibration of Thiel's index that accounts for this sensitivity.

3 - Price Dispersion in Person-to-Person Lending (P2PL) Markets
Samuel Garman, Carnegie Mellon University, H. John Heinz III College, Pittsburgh, United States of America, sgarman@andrew.cmu.edu, Robert Hampshire

We examine the nascent but growing Person-to-Person Lending (P2PL) markets from a search theoretic perspective. Empirical observations from P2PL data show substantial dispersion in interest rates for similar borrowers, suggesting these markets are far from frictionless. We model and quantify the frictions to better understand market behavior and P2PL's potential. The insights may be useful in analyzing technology, policy, and mechanism changes that can improve the functioning of P2PL markets.

■ SA29

H-Room 501, Fifth Floor

Real Options in the Energy Sector

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Afzal Siddiqui, University College London, Gower Street, London, WC1E 6BT, United Kingdom, afzal@stats.ucl.ac.uk

1 - Using Fuzzy Real Options Valuation for Assessing Investments in CO2-free Power Generation
Reinhard Madlener, Professor, RWTH Aachen Univ, E.ON ERC/FCN, Templergraben 55, Aachen, 52056, Germany, RMadlener@eonerc.rwth-aachen.de, Christian Kraemer

We study the relative advantage of investing in an integrated combined-cycle (IGCC) power plant vs. a conventional coal-fired power plant with and without carbon capture and storage (CCS). For the analysis we apply fuzzy real options theory and consider three price scenarios for fuel input and CO2 emissions. We find some evidence that the IGCC and (to a lesser degree) the conventional hard coal-fired power plant are most economical, followed by the two CCS options 'Oxyfuel' and 'Pre-combustion'.

2 - Irreversible Investment, Depreciation, and Tax Law Uncertainty
Ryuta Takashima, Assistant Professor, Chiba Institute of Technology, 2-17-1 Tsudanuma, Narashino-shi, Chiba, 275-0016, Japan, takashima@sun.it-chiba.ac.jp

We study the investment of the firm under uncertainties of both cash flows and tax law. The uncertainty of tax law which is considered in this paper is the switching between the different depreciation methods. We analyze the effect of new depreciation method, which has been introduced in Japan's nuclear policy, on the investment decision of nuclear power plants. It is shown that how regal durable years and construction times of nuclear power plants affect the investment threshold.

3 - Are Real Options Exercised Rationally? Evidence From Small Hydropower Plants
Stein-Erik Fleten, Professor, NTNU Norway, Department Industrial Econ and Technology Mgmt., Trondheim, NO-7491, Norway, stein-erik.fleten@iot.ntnu.no, Hans Petter Wenngren, Johan Sollie, Jussi Keppo

In Norway there are many good sites for small hydropower, and many of these have been developed during the last few years. Having access to such a site is viewed as holding a real option to invest. Using data from 225 such projects we study the investment behavior of the developers. Profitability depends on expectations regarding long-term prices, and information on this is available at Nord Pool's electricity forward market.

4 - Optimal Investment and Operational Decision-Making under Risk Aversion and Uncertainty
Afzal Siddiqui, University College London, Gower Street, London, WC1E 6BT, United Kingdom, afzal@stats.ucl.ac.uk, Michail Chronopoulos, Bert De Reyck

Real options addresses investment under uncertainty assuming a risk-neutral decision-maker. Investment and operational thresholds may be obtained by solving nested optimal stopping time problems. However, for decision-makers with undiversifiable risks, e.g., in the renewable energy R&D sector or in nascent energy markets, risk aversion needs to be taken into account. We find that risk aversion lowers the probability of investment, which may be mitigated by operational flexibility.

■ SA30

H-Room 502, Fifth Floor

Green Energy I

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Panos Pardalos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, pardalos@ufl.edu

Co-Chair: Niko Iliadis, EnerCoRD, Plastira Street 4, Nea Smyrni, Athens, 171 21, Greece, niko.iliadis@enercord.com

Co-Chair: Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu

1 - Do More Batteries Make a Plug-in Hybrid Better?
CS Norman Shiau, PhD Candidate, Carnegie Mellon University, Mechanical Engineering, Scaif Hall, Pittsburgh, PA, 15213, United States of America, cshiau@cmu.edu, Constantine Samaras, Jeremy Michalek

Large battery packs in plug-in hybrid electric vehicles (PHEVs) allow greater distances to be traveled on electric power alone, but batteries are heavy and

expensive. We simulate PHEV systems to model the effects of additional batteries and to optimize vehicle design and allocation. We find that for drivers who can charge frequently, PHEVs with small battery packs have lower life cycle cost, petroleum consumption and greenhouse gas emissions than comparable alternatives.

2 - Modeling Energy Efficiency

Emily Bartholom Fisher, Johns Hopkins University, 3400 N. Charles St, Ames Hall 313, Baltimore, MD, 21218, United States of America, ebartho3@jhu.edu

End-use energy efficiency (a.k.a. the "fifth fuel") has been identified as a critical tool for meeting carbon reduction targets, but major challenges still exist for incorporating it into traditional energy modeling frameworks. In this talk I will review how energy efficiency is being modeled now, and outline how we might move forward to represent it better.

3 - Real Time Stability Monitoring and Control in the Smart Power Grid

M.A. Pai, Professor Emeritus, Univ of Illinois at Urbana-Champaign, Department of Electrical and Computer En, Urbana, IL, 61801, United States of America, mapai@illinois.edu

The addition of a wide spectrum of renewable resources with Wind Power as a major resource introduces a new set of complexities in the emerging smart grid. Wide Area Measurement Systems (WAMS) using GPS system will be the key component at the T and D level. In this paper we will focus on some aspects of this exciting new smart grid as related to real time stability monitoring and integration of wind power with the current grid.

4 - Demand Subsidies Versus R&D: Purely Organic Solar Cells

Erin Baker, University of Massachusetts, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu, Gregory F. Nemet

We combine an expert elicitation and a bottom-up manufacturing cost model to compare the effects of R&D and demand subsidies. We model their effects on the future costs of a low-carbon energy technology that is not currently commercially available, purely organic photovoltaics. We find that R&D generally dominates subsidies, but that subsidies provide a hedge against failure in the R&D program.

5 - Enhanced Wind Farm Layout Optimization

Michele Samorani, Leeds School of Business - University of Colorado at Boulder, Bldg #4, UCB 419, Boulder, CO, 80309-0419, United States of America, michael.samorani@colorado.edu, Harald Reinertsen, Manuel Laguna

Optimally placing wind turbines in a given site is an important problem arising during the design of a wind farm. Existing approaches consider only few possible positions, which typically correspond to the vertices of a coarse square grid. We show that solution methods that can handle more positions and denser grids obtain higher quality solutions, corresponding to more efficient wind farms. A computational study on real sites shows the merit of our approach.

■ SA31

H-Room 503, Fifth Floor

Revenue Management and Pricing in Practice

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Tugrul Sanli, SAS Institute Inc., SAS Campus Dr, Cary, NC, 27513, United States of America, tugrul.sanli@sas.com

1 - Demand Modeling for Retail Price Optimization

Alex Chien, SAS Institute Inc., SAS Campus Dr., Cary, NC, 27513, United States of America, alex.chien@sas.com

The full benefit of price optimization simply cannot be capitalized on without an appropriate underlying demand model. This session will address the modeling and calibrating techniques of the following demand drivers commonly considered in retail price optimization: * Price elasticity and promotion effects * Cannibalization and halo effects * Psychological price effects * Seasonality * Product lifecycle effect * Competitors' price effect * Assortment and inventory effects.

2 - Automated Revenue Optimization for the Airport Parking Industry

Linda Hatfield, VP Product Management and Marketing, IDeaS - A SAS COMPANY, 8500 Normandale Lake Blvd, Suite 1200, Minneapolis, MN, 55437, United States of America, linda.hatfield@ideas.com

Automated pricing and revenue optimization is gaining a must-have status in many sectors, but both the organization and its customer base must be ready to embrace this new pricing approach for it to be effective. To capture the revenue potential and take advantage of the benefits of revenue optimization, the airport parking business needed a major change in its commercial approach. This session will describe the application of automated revenue optimization and the unique challenges faced.

■ SA32

H-Room 504, Fifth Level

Finance and Stochastics

Cluster: Financial Engineering
Invited Session

Chair: Erhan Bayraktar, Assistant Professor, University of Michigan, Department of Mathematics, 530 Church Street, Ann Arbor, MI, 48109, United States of America, erhan@umich.edu

1 - Optimal Stopping for Strict Local Martingales

Hao Xing, Post-doctoral Fellow, Boston University, United States of America, haoxing@umich.edu, Kostas Kardaras, Erhan Bayraktar

When the discounted price process is a strict local martingale, it is known that exercising the American call option at the terminal time is not optimal. In this talk, we will present a complete characterization of optimal stopping times for problems with strict local martingales. A necessary and sufficient condition for the existence of the optimal stopping times is also derived. We will discuss the implications of these results on the American call problem.

2 - Bond and Stock Market Equilibrium with Heterogeneous Agents Receiving Unspanned Income

Kasper Larsen, Assistant Professor, Carnegie Mellon, kasperl@andrew.cmu.edu

We provide the first closed-form solution for the equilibrium risk-free rate and the equilibrium stock price in a dynamic economy where agents have heterogeneous preferences and unspanned labor income risk. Due to the unspanned income risk investors will increase their demand for the risk-free asset, leading to a lower equilibrium risk-free rate than in a corresponding economy without unspanned income risk.

3 - Asymptotic Analysis of Utility-based Prices for Utilities Defined on the Whole Real Line

Mihai Sirbu, Assistant Professor, University of Texas at Austin, 1 University Ave C 1200, Austin, United States of America, sirbu@math.utexas.edu

We perform an asymptotic expansion of utility-based prices and hedging strategies for small number of contingent claims, in the framework of optimal investment with general utilities defined on the whole real line. Conceptually, this follows previous joint work with Dmitry Kramkov and relies on using the risk-tolerance wealth processes.

4 - Optimal Stopping for Nonlinear Expectations

Erhan Bayraktar, Assistant Professor, University of Michigan, Department of Mathematics, 530 Church Street, Ann Arbor, MI, 48109, United States of America, erhan@umich.edu, Song Yao

We develop a theory for solving continuous time optimal stopping problems for non-linear expectations. Our motivation is to consider problems in which the stopper uses risk measures to evaluate future rewards.

■ SA33

H-Room 505, Fifth Floor

Flexible Technology Management

Sponsor: Technology Management
Sponsored Session

Chair: Yingxia Yang, Massachusetts Institute of Technology, 550 Memorial Dr, Apt.11b3, Cambridge, MA, 02139, United States of America, yingxia@mit.edu

1 - Characterizing the Value of Technology Choice under Demand Uncertainty

Thomas Rand-Nash, PhD Student, MIT, 292 Main Street, e38-435, cambridge, ma, 02142, United States of America, trand@MIT.EDU, Richard Roth, Randolph Kirchain

Characterizing demand uncertainty over time may change the competitive position of new technologies. This work seeks to define how demand distribution characteristics impact the production volume at which multiple technologies reach revenue parity as a function of technological revenue structure. A case study is presented to model the value tradeoffs of two competing technologies used to produce the automotive body-in-white under demand uncertainty and over time.

2 - Multiple Sources of Manufacturing Flexibility and Their Interactions under Demand Uncertainty
Yingxia Yang, Massachusetts Institute of Technology, 550 Memorial Dr, Apt.11b3, Cambridge, MA, 02139, United States of America, yingxia@mit.edu, Randolph Kirchain, Richard Roth

This research studies multiple sources of flexibility to respond to demand uncertainty for manufacturing systems through a simple and hypothetical case. The impact of considering multiple sources of flexibility on strategic planning decisions is demonstrated and the trade-offs and interactions between multiple sources of flexibility are studied.

3 - ETK Model: Effects on Higher Education Faculty Satisfaction
Jorge Cardenas, Doctoral Student, Alliant International University, 5315 Triana St., San Diego, CA, 92117, United States of America, jcardenas@alliant.edu

This paper is a literature review and an analysis of a research study that implemented the ETK model. The ETK model and survey instrument recognizes and measures emotional human (E), technology (T), and knowledge (K) skills, abilities, and competencies that affect an organizations performance. The literature review condenses previous academic research and publications done on these skills, abilities, and competencies.

4 - Considering the Role of Labor Learning in the Value of Manufacturing Flexibility
Randolph Kirchain, Associate Professor, MIT, 77 Massachusetts Ave, E38-432, Cambridge, MA, 02139, United States of America, kirchain@mit.edu, Marie-Claude Nadeau, Richard Roth

Evaluation of manufacturing flexibility has largely assumed labor to be inherently flexible and irrelevant. However, learning effects lead to both costs and benefits associated with labor flexibility. Decision-tree models were applied to an automotive assembly case to illustrate the impact of labor learning on the value of flexibility. Results suggest that learning effects can notably increase this value. This effect grows with learning rate, demand volatility, and probability of demand growth.

■ SA34

H-Room 520, Fifth Floor

Closed-Loop Supply Chains

Cluster: Green Supply Chain
Invited Session

Chair: Michael Galbreth, University of South Carolina, Moore School of Business, Columbia, SC, 29208, United States of America, galbreth@moore.sc.edu

1 - Investing in Reusability and Collection: The Impact of Quality Condition Uncertainty
Tamer Boyaci, McGill University, 1001, Rue Sherbrooke Ouest, Montreal, QC, H3A 1G5, Canada, tamer.boyaci@mcgill.ca, Andreas Robotis, Vedat Verter

We study the effects of uncertainty in the quality condition of EOU products for an OEM who invests in (a) increasing the reusability level of a product and (b) in collecting EOU products. We consider a 2-period setting where in Period 1 the OEM makes investment decisions, and in Period 2 it collects, remanufactures and sells EOU products along with new ones. We show that the effect of quality condition uncertainty depends on the inspection capabilities, and is not always detrimental.

2 - Delayed Differentiation for Mutiple Lifecycle Products
Daniel Guide, Associate Professor, Penn State University, 464 Business Building, University Park, PA, 16802, United States of America, dguide@psu.edu, James Abbey, Gilvan Souza

Multiple lifecycle problems arise when a firm upgrades the performance of a base model over time via new modules. The end product is a blend of new and remanufactured components. The multiple lifecycle strategy requires an evolutionary approach to delayed differentiation design whereby the firm evolves their offerings from a single product configuration to n product configurations. This research model uses a delayed differentiation approach with a distinct push-pull boundary.

3 - Alternative Replenishment Policies under CO2-emission Restrictions
Kristel Hoen, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600MB, Netherlands, K.M.R.Hoen@tue.nl, Tarkan Tan, Geert-Jan van Houtum, Jan Fransoo

In this talk we describe a method which can be used to determine the replenishment policy for items under CO2-emission restrictions. In this model we consider the transportation of items from a supplier to a production facility. Alternative modes of transportation are available for items and are used to reduce emissions. The method balances CO2-emissions and penalty, holding and transportation costs.

4 - Managing the Trade-off Between Remanufacturing and Product Innovation
Michael Galbreth, University of South Carolina, Moore School of Business, Columbia, SC, 29208, United States of America, galbreth@moore.sc.edu, Raul Chao

When a manufacturer introduces a new generation of a product, it is often able to acquire some fraction of the previous generations sales. This creates the opportunity for components from the acquired items to be reused in the new generation product. Component reuse across generations can lower production costs, but it also reduces innovativeness. We examine this tradeoff between component reuse and innovation in new product design across multiple product generations with used product returns.

■ SA35

H-Sapphire A, Fourth Floor

Capacity Management and Scheduling in Health Care Facilities

Sponsor: Health Applications
Sponsored Session

Chair: Xiuli Qu, Assistant Professor, North Carolina A&T State University, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, xqu@ncat.edu

1 - Multilevel Techniques for Quality Control Charts of Recovery Outcomes
Linda Laganga, Director of Quality Systems & Operational Excellence, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States of America, Linda.Laganga@mhcd.org, CJ McKinney, Antonio Olmos, Kate DeRoche

Early detection and response to change promotes effective resource utilization and capacity management. We use statistical quality control charts in the continued evaluation of mental healthcare services, and demonstrate that multilevel statistical techniques can improve the function of quality control charts in these settings. We apply multilevel techniques to the recovery outcome tools we developed and implemented to measure and communicate change in consumers of mental health services.

2 - Modeling the Arrival of Batch Appointments Within an Open-Access Scheduling System
Husniyah Abdus-Salaam, Graduate Student, North Carolina A&T State University, 400 McNair Hall, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, husniyah@gmail.com, Lauren Davis, Daniel Mota

Current research in open-access scheduling considers single provider models, where demand arrivals are independent among patients. We consider a multiple-provider model and study the impact of dependent demand arrivals on an open-access scheduling system. We develop a preliminary MDP model to determine when batch appointments should be accepted in a pediatric dental clinic, given there is an associated risk of no-shows for pre-scheduled appointments.

3 - Optimal and Approximate Algorithms for Sequential Clinical Scheduling with No-show
Ji Lin, Purdue University, Weldon School of Biomedical Engineering, West Lafayette, IN, 47907, United States of America, lin35@purdue.edu, Mark Lawley, Kumar Muthuraman

A significant problem in clinical operations is patient no-show. Random overbooking can compensate the revenue loss but results in longer patient waiting time and physician overtime. The myopic scheduling does not consider the future call-in pattern. To use this important information, we propose an MDP model. The optimal policy which selectively overbooks patients can be solved by Dynamic Programming Methods. Approximation algorithms are introduced to overcome the high computational complexity.

4 - Sustaining the Medical Home: A Game Theoretic Approach
Ping Huang, Research Scientist, Regenstrief Center for Healthcare Engineering, Purdue University, West Lafayette, IN, 47907, United States of America, huang74@purdue.edu, Mark Lawley, Fei Pan

One solution to rescue U.S.A.'s ailing health care system is to restructure primary care practices to incorporate principles of the patient-centered medical home (PCMH)delivery model. Such reengineering requires a payment approach that rewards good health outcome. However, none of the current payment methods will sustain PCMH. We show that our approach that includes FFS, capitation and incentive would sustain the PCMH structure, provided that PCMH can in fact improve care and reduce cost.

■ SA36

H-Sapphire B, Fourth Floor

Patient Management -Scheduling

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - Outpatient Appointment Scheduling
Song Chew, Assistant Professor, Southern Illinois University Edwardsville, Edwardsville, Edwardsville, IL, 62026, United States of America, schew@siue.edu

Outpatient appointment scheduling methodologies have been an active research area with plentiful significant results for the last few decades. It is however irrefutable that excessive costs incurred by patient waiting and staff workload are today still prevalent in clinics. Therefore, much more research is needed to bridge the gap between theory and practice. In this work, we seek to determine optimal interappointment times for outpatient schedules so that the total cost is minimized.

2 - Emergency Room Patient Scheduling
Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

Scheduling the emergency room patients is part of a comprehensive patient management system. Due to the nature of mixed patient arrivals at random, various urgency levels in medical needs of each patient, available service time at the facility, and cross-trained medical staff stationed in the emergency room, the emergency room scheduling is quite different with the appointment scheduling for other part of the healthcare. Analysis on model constructed will be carried out over a public database.

■ SA37

H-Sapphire C, Fourth Floor

Consumer-driven Operations Management

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Rachel Zhang, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong, Hong Kong - ROC, rzhang@ust.hk

Co-Chair: Qian Liu, Assistant Professor, Hong Kong University of Science and Technology, HKUST, Hong Kong, Hong Kong - ROC, qianliu@ust.hk

1 - The Impact of Counterfeits on Brand Name Products
Jie Zhang, The Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong, Hong Kong - ROC, jiezh@ust.hk, L. Jeff Hong, Rachel Zhang

This paper investigates the impact of counterfeits on the price, market share and profitability of brand name products and the strategies for them to fight counterfeiting. We first study how a non-deceptive counterfeit affects a brand name product in competitive markets and markets with two consumer segments each with different utilities. We then extend our analysis to different markets with a deceptive counterfeit and devise strategies for brand name companies to protect their products.

2 - Selling to Strategic Consumers with Consumption Externalities
Fuqiang Zhang, Assistant Professor, Washington University in St. Louis, FZhang22@WUSTL.EDU, Jiong Sun

It has been widely acknowledged that many products exhibit consumption externalities. That is, the utility a consumer derives from the consumption of a product may depend on the number of other users who consume the same product. This paper studies a firm's strategies when selling to strategic consumers with the presence of consumption externality effects.

3 - Selling to Heterogeneous Customers with Uncertain Valuations under Returns Policies
Qian Liu, Assistant Professor, Hong Kong University of Science and Technology, HKUST, Hong Kong, Hong Kong - ROC, qianliu@ust.hk, Wenqiang Xiao

We consider a firm that sells a product with a finite inventory to customers whose valuation consists of an intrinsic value which is privately known before purchase, and product fitness which is ex ante uncertain and revealed after purchase. We show that the established result - a menu of returns policies - may not be optimal with inventory constraints. We analyze how the results depend on customer heterogeneity, ex ante valuation uncertainty, inventory level and procurement cost.

■ SA38

H-Sapphire D, Fourth Floor

Advances in Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Murat Kaya, Assistant Professor, Sabanci University, Sabanci Universitesi MDB Fakultesi, Orhanli Tuzla, Istanbul, 34956, Turkey, mkaya@sabanciUniversityedu

1 - Non-cooperative Joint Replenishment Games
Alper Sen, Bilkent University, Industrial Engineering, Bilkent, Ankara, 06800, Turkey, alpersen@bilkent.edu.tr, Kemal Guler, Evren Korpeoglu

We consider the jointly replenishing n asymmetric firms that operate under an EOQ like setting using two non-cooperative games. In the first game, each firm bids how much he is willing to pay per unit of his replenishment and an intermediary determines the frequency of the joint orders that will recover his costs. In the second game, the intermediary sets the order frequency to maximize his revenues and the firms are able to opt out consequently. We characterize the equilibrium of both games.

2 - Assortment-based Cooperation Among Make-to-stock Producers
Yalcin Akcay, Asst. Professor of Operations Management, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, Turkey, yakcay@ku.edu.tr, Baris Tan

We consider the cooperation of two independent producers offering a combined assortment of products. We model the manufacturing facility of each producer as a make-to-stock system with dedicated servers. Producers use independent base stock policies to manage their own inventories and adopt discounted price contracts for the exchange of products. We investigate the impact of key problem parameters on the potential benefit from an assortment-based cooperation through a computational study.

3 - Sourcing From Multiple Unreliable Suppliers for Price-Dependent Demands
Ruixia Shi, University of Richmond, 1 Gateway Road, Richmond, VA, rxs048100@utdallas.edu, Annabelle Feng

This paper analyzes the combined pricing and ordering decisions under both supply and demand uncertainties. We prove that it is optimal to price low for a high inventory level, and the optimal replenishment strategy is a near re-order point policy. We further quantify and compare the implications of dynamic pricing and supplier diversification in the model.

4 - A Dynamic Inventory Model with the Right of Refusal
Sreekumar Bhaskaran, Asst. Professor, SMU-Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, sbhaskar@cox.smu.edu, John Semple, Karthik Ramachandran

We consider a dynamic inventory model with general convex order costs and excess demand that can be backordered or refused by the firm. We show that the optimal policy is characterized by an optimal buy up to level that increases with the initial inventory level and an order quantity that decreases with the initial inventory level. More importantly, we show the optimal sales strategy is characterized by a critical threshold, a backorder limit, that dictates when to stop selling.

■ SA39

H-Sapphire E, Fourth Floor

Strategic Sourcing and Supplier Improvement

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Cuihong Li, University of Connecticut, 2104 Hillside Rd, Storrs, United States of America, Cuihong.Li@business.uconn.edu

1 - Supplier Diversification Strategies in the Presence of Yield Uncertainty and Buyer Competition
Yu Tang, Miami University, School of Business Administration, Coral Gables, FL, 33124, ytang@exchange.sba.miami.edu, Panos Kouvelis

In our paper we investigate the supplier diversification benefits in the presence of competition among sourcing firms (buyers) for multi-sourcing duopolists. We consider a two-stage supply chain with suppliers selling components to buyers producing and selling substitutable products. The suppliers' output processes are uncertain and modeled as having a proportional random yield. Buyers engage in a quantity-based Cournot competition. We study a two stage game between buyers where a sourcing strategy (supply structure) game is followed by a quantity game (output to the market).

2 - Mitigating Supply Risk: Dual Sourcing or Process Improvement?
Brian Tomlin, Dartmouth College, Tuck School of Business, Hanover, NH, 03755, United States of America, brian.tomlin@tuck.dartmouth.edu

We explore two strategies for managing supply risk: (i) sourcing from multiple suppliers and (ii) exerting effort to improve supplier reliability. For both random capacity and random yield types of uncertainty, we characterize the firm's optimal improvement and procurement decisions and provide insights regarding the desirability of each strategy and the value of deploying both strategies in unison.

3 - Incentives to Collaborate in a Supply Chain Partnership
Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu, Serguei Netessine

We model partnership formation between a supplier and a manufacturer, who assembles the intermediate parts and sells the end product in the market. Among many reasons for close relationships cited in practice, in this paper we focus on possible production cost reduction through information sharing. We study how the uncertainties in both production cost and demand impact the integration decision.

4 - Supply Base Design for Supplier Competition and Investment under Cost and Demand Uncertainties
Cuihong Li, University of Connecticut, 2104 Hillside Rd, Storrs, United States of America, Cuihong.Li@business.uconn.edu

We analyze supply base design on both the number and capacities of suppliers, considering its effects on supplier competition and suppliers' investment of cost-reduction effort. We investigate the buyer's choice of the supply base structure under different environments, as well as when the buyer should pre-commit to prices or postpone capacity investment and with which supply base structure.

■ SA40

H-Sapphire H, Fourth Floor

Financial Services Student Paper Competition

Sponsor: Financial Services
Sponsored Session

Chair: Aparna Gupta, Assistant Professor, Lally School, RPI, 110 8th Street, Troy, NY, 12180, United States of America, guptaa@rpi.edu

1 - Estimating Expected Shortfall with Stochastic Kriging
Ming Liu, Ph.D. Candidate, Northwestern University, 2145 Sheridan Road, Room C231, Evanston, IL, 60208, United States of America, ming-liu@northwestern.edu, Jeremy Staum

We present an efficient two-level simulation procedure which uses stochastic kriging, a metamodeling technique, to estimate expected shortfall. The outer level simulates financial scenarios and the inner level of simulation estimates the portfolio value given a scenario. Because expected shortfall involves the scenarios that entail the largest losses, our procedure allocates more computational effort to inner-level simulation of those scenarios, which also improves computational efficiency.

2 - On Forecasting Volatility on Financial Markets
Ming Ye, Graduate Student, Johns Hopkins University, 3400 North Charles Street, Baltimore, MD, 21218, United States of America, mye@ams.jhu.edu, Shih-Ping Han

In this paper we present a method based on the combination of the Implied Volatility method and the GARCH model for forecasting the volatility of a stock price. In the method the volatility values obtained from the Implied Volatility method are incorporated into the GARCH model to compute the parameters of the model, which are, in turn, used to estimate the future volatility. Preliminary testings show very promising results.

3 - Extracting Implied Correlation From Index Options: A Statistical Approach
Romain Deguest, Columbia University, 500 W.112th Street, New York, NY, 10027, United States of America, rd2304@columbia.edu, Rama Cont

Starting from a prior distribution on correlation matrices, calibrated single-name dynamics and index vanilla prices, we propose a probabilistic construction yielding arbitrage-free prices that are consistent with both index and stock vanilla prices. A simple Monte Carlo algorithm is used for pricing and assessing model uncertainty of basket options. Sensitivities to vanilla option prices are used to built static hedging portfolios that minimize the risk of mispricing any exotic basket options.

4 - Timer Options: Pricing, Hedging and Implementation
Chenxu Li, PhD Student, Columbia University, 362 Riverside Drive 8A5, New York, NY, 10025, United States of America, cxli@math.columbia.edu

In this paper we investigate the pricing, hedging and implementation of timer call options, which are first traded in 2007 by Societe Generale as an interesting financial innovation. Under Heston's stochastic volatility model, we derived an explicit option pricing formula which can be regarded as a meaningful extension of Black-Scholes. We first formulate the problem of pricing timer option as a first hitting time problem. By conditioning, stochastic time change and other core techniques from stochastic analysis, we find that the variance process running on a variance clock, as advocated by H. Geman in [24], is equivalent to a Bessel process with constant drift in distribution. A closed form formula is thus derived via Bessel process theory and double Laplace transform etc. We designed an rotation counting algorithm to correctly evaluate the modified Bessel functions which appear in the Laplace transform formula. We also compare the implementation of quadrature with other methods including Monte Carlo simulation and numerical partial differential equations ADI schemes. We also propose a method to dynamically hedge timer call options using an auxiliary sequence of fixed maturity variance swap.

5 - Optimal Stopping Time Problem in House Investment Strategy
Qi Wang, Graduate Student, The Johns Hopkins University, Applied Math and Statistics, Baltimore, United States of America, qwang29@jhu.edu

Many people are interested in buying a second house as investment purpose. This paper will consider the optimal stopping time problem of the house investment strategy. Regime switching and connectivity of belief communication network will also be considered in this problem. Under special conditions, the analytical solution will be solved and numerical result will be given for regime switching and belief communication network property.

■ SA41

H-Sapphire L, Fourth Floor

Manufacturing

Contributed Session

Chair: David Shallcross, Telcordia Technologies, One Telcordia Drive, Piscataway, NJ, 08854, United States of America, davids@research.telcordia.com

1 - Predicting Demand Distribution if a Brand Is Removed From a Set of Available Brands
Henry Amato, Professor of Supply Chain Management, University of Nevada Reno, 1664 N. Virginia St, MS 028, Reno, NV, 89557, United States of America, hna@unr.edu, Igor Makienko

Although most shoppers have a preference for a particular brand, many will switch to another brand when their preferred brand is not displayed in a self-service setting. A model is presented for predicting the redistribution of demand among the remaining displayed brands when one of the brands has been removed from the shelf.

2 - A Multiobjective Evolutionary Computation Approach to Hazards Mitigation Design for Water Systems
Lufthansa Kanta, Graduate Teaching Assistant, Texas A&M University, WERC Building, Room 205R, 3136 TAMU, College Station, TX, 77843, United States of America, lufthansa_kanta@neo.tamu.edu, Emily Zechman, Kelly Brumbelow

A novel evolutionary computation-based multi-objective optimization algorithm is developed to design effective mitigation strategies for urban fire events for water distribution systems. Implementation of this methodology generates Pareto-optimal solution surfaces that express the trade-off relationship between fire damage, water quality, and least cost objectives.

3 - "Green" Modular Automotive Production Methods for Improved Efficiency and Profits
Todd Matsubara, Undergraduate, California State University Dominguez Hills, 1847 W 179th St., Torrance, CA, 90504, United States of America, tmatsubara1@cp.csudh.edu, j15Hamid Pourmohammadi

Revolutionary modular automotive production methods with integrated 'green' reverse logistics supply chain procedures. These environmentally friendly methods also significantly improve supply chain efficiency, profits, quality, production time, and after-sale customer satisfaction.

4 - Adapatively Distributed Fault Diagnosis
David Shallcross, Telcordia Technologies, One Telcordia Drive, Piscataway, NJ, 08854, United States of America, davids@research.telcordia.com, Hanan Luss, K. R. Krishnan, Arnold Neidhardt

We look at the problem of determining the set of faults responsible for an observed set of symptoms for large systems where the set of symptoms that would result from any single fault is known. We propose a method of adaptively partitioning the problem according to the set of observed symptoms, solving the resulting subproblems in parallel, and combining the results. We report on test results both for randomly generated problems and for problems generated for a wireless ad-hoc network model.

■ SA42

H-Sapphire P, Fourth Floor

Economics of Queues

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Costis Maglaras, Professor, Columbia Business School, New York, United States of America, c.maglaras@gsb.columbia.edu

1 - Optimal Price-Lead Time Menus for Queues with Customer Choice: Priorities, Pooling, Strategic Delay

Philipp Afeche, University of Toronto, Rotman School, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, afeche@rotman.utoronto.ca, Michael Pavlin

We consider service provision over an M/M/1 facility to customers with heterogeneous and unobservable lead time preferences. Our customer model relaxes some standard assumptions from existing studies. We characterize the properties of the optimal price-lead time menu and the corresponding scheduling policies. We further specify how these properties depend on the capacity and on demand attributes.

2 - Service Rate Selection when Rational Customers do not Know the Service Value and Cost

Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu

In this talk, I will address the following question: How does a firm strategically select the service rate in a market with rational customers for whom the value and the cost of the service are unknown?

3 - Revenue Maximization in a Market with Social Learning

Bar Ifrach, Doctoral Candidate, Columbia Business School, 3022 Broadway, Uris Hall, PhD office, New York, NY, 10027, United States of America, bi2118@columbia.edu, Costis Maglaras

We study the revenue maximization problem of a monopolist seller in a market with heterogeneous customers that learn the quality of the offered product by observing the sequential decisions of the customers that decided whether to buy the product earlier in time. We explore how this social learning aspect affects the seller's pricing decision, which, in turn, controls the revenue rate and the customers' learning speed.

4 - Pay-Per-Click Pricing in Advertising Networks: A Queuing Systems Approach

Sami Najafi-Asadolahi, PhD candidate, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, snajafi@london.edu, Kristin Fridgeirsdottir

Online advertising has become an important problem in recent years. We consider a web publisher that generates revenues from displaying advertisements on its website in an advertising network. The advertisers approach the web publisher, request their ads to be displayed in the website until clicked a certain number of times, and are charged according to the so-called pay-per-click pricing scheme. A key feature of advertising networks is that they only deal with immediate inventories. Hence, the operation of the web publisher can be modeled as a queuing system with no waiting spaces (loss system) where the advertising slots correspond to servers. This is a quite new queuing system. In particular, what distinguishes this system from other known multi-server systems is its special service mechanism; the service rate of each server constantly changes over time, which depends on the other active servers in the system. We derive a closed-form solution for the steady state probabilities of the number of advertisers in this system and determine the optimal price. We also show that imposing more complex conditions than the ones considered in this paper does not almost change the results from the pay-per-click system we consider. As a result our simplified system is a relatively accurate approximate for the behavior of more complicated real systems. In the end, our model provides managers of a publisher's advertising operation with insights on how to price base on, e.g., the number of slots on the website, the web traffic and the number of clicks that advertisers request.

■ SA43

H-Room 400, Fourth Floor

Spare Parts Supply Chains

Cluster: Supply Chain Models
Invited Session

Chair: Geert-Jan van Houtum, Professor, Eindhoven University of Technology, P.O. Box 513, 5600 MB, Eindhoven, Netherlands, G.J.v.Houtum@tm.tue.nl

1 - Inventory Planning for Spare Parts Networks with Delivery Time Requirements

Ingrid Reijnen, PhD Student, Eindhoven University of Technology, P.O. Box 513, Pav E.13, Eindhoven, 5600 MB, Netherlands, I.C.Reijnen@tue.nl, Tarkan Tan, Geert-Jan van Houtum

Motivated by real-life, we introduce an inventory model for spare parts where we take delivery time requirements into account. Demand of a customer can be satisfied from multiple warehouses, but only if the customer can be reached from a warehouse within a time limit specified in its service contract. We develop a fast and accurate approximate algorithm to evaluate the performance of the network under given base stock levels and propose a fast and effective heuristic to set base stock levels.

2 - Integrating the Level of Repair Analysis (LORA) and Spare Parts Stocking Problems

Rob Basten, University of Twente, Fac. MB / OMPL, P.O. Box 217, Enschede, 7500 AE, Netherlands, r.basten@utwente.nl, Marco Schutten, Matthieu van der Heijden, Erhan Kutanoglu

When deciding how to maintain a capital good, a LORA determines which components to repair upon failure and which to discard, where in the repair network to do this, and where to place resources (e.g., test equipment). Then, we determine the amount of spare parts that guarantees a certain availability of the product. This sequential approach often leads to high spare parts costs. Using an integrated model, we achieve cost reductions of upto 15% on theoretical problem instances and a case study.

3 - Customer-centric Service Levels in Integrated Service Parts Logistics Problems

Erhan Kutanoglu, The University of Texas at Austin, ORIE Graduate Program, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, erhank@me.utexas.edu, Mehmet Candas

We analyze customer-centric time-based service levels in integrated service parts network design and inventory stocking problems. After introducing a non-linear mixed integer model that captures the interdependency between network design and inventory stocking, we provide two linearized integer formulations used to solve small and medium size problems. We then develop a Lagrangian-relaxation approach providing tight lower and upper bounds.

4 - A Distribution Inventory Model with Transshipments From a Support Warehouse

Johan Marklund, Associate Professor, Production Management, Lund University Box 118, Lund, SE-22100, Sweden, Johan.Marklund@iml.lth.se, Sven Axsater, Christian Howard

We consider a multi-echelon inventory model of a distribution system consisting of N retailers and a regional support warehouse, both being replenished from a central warehouse. In case of stockouts, the retailers receive transshipments from the support warehouse at an extra cost. Our model evaluates the system costs and optimizes the reorder points to achieve target fillrates for the end customers. The model results from collaboration with a large spare parts distribution company.

■ SA44

H-Room 402, Fourth Floor

Workforce Management in Service Operations

Sponsor: Service Science
Sponsored Session

Chair: Sheneeta White, University of St. Thomas, Opus College of Business, 1000 LaSalle Ave, Minneapolis, MN, 55403, United States of America, whit6237@stthomas.edu

1 - A Multi-objective Decision Support System for Workforce Training and Assignment

Gerald Evans, Professor, University of Louisville, Department of Industrial Engineering, University of Louisville, Louisville, KY, 40292, United States of America, gwevan01@louisville.edu, Gail W. DePuy

This presentation describes an interactive decision support system for determining workforce training and workforce job assignment for a large governmental facility. The system addresses three objectives: minimization of training costs, maximization of achievement of worker preferences with respect to desired training, and maximization of achievement of required skills for workers. The system allows for the input of preference information from the decision maker/manager involving his/her tradeoffs among the objectives.

2 - Assigning Professional Service Workers to Teams: A Mathematical Optimization Model

Vincent Hargaden, PhD Student, UCD Michael Smurfit Graduate Business School, Centre for Doctoral Research, Blackrock, Dublin, Ireland, vincent.hargaden@ucd.ie, Jennifer Ryan

We develop a mathematical model for professional service firms in which the employees of a firm are assigned to teams which deliver projects for customers. The model takes into consideration issues such as the technical (hard) and socio-cultural (soft) skills mix, geographical location and multiple team membership by workers. The output of the model is to recommend optimal team formation rules on an individual firm basis.

3 - Dynamic Service System Resource Management
Ray Strong, IBM Almaden Research, strong@almaden.ibm.com, Ruoyi Zhou, Isaac Councill, Toby Lehman

Service System Resources include, e.g., (1) geographic and skills based aggregations of people and (2) service business offerings. Each such set of resources constitutes a service portfolio. Cost and other risk characteristics of these portfolios vary with time at a pace significantly slower than that of, e.g., stock market equities. We discuss new techniques based on correlation trends for managing such portfolios to reduce risk.

4 - The Impact of Co-Production on Workforce Planning Decisions
Sheneeta White, University of St. Thomas, Opus College of Business, 1000 LaSalle Ave, Minneapolis, MN, 55403, United States of America, whit6237@stthomas.edu, Ralph Badinelli

This research investigates the effects of client intensity on planning decisions made by service firms. Dynamic programming is used to find optimal workforce and client intensity levels. Results show that for different types of service firms, different types of optimal policies exist.

■ SA45

H-Room 410, Fouth Floor

Product, Project and Process Management

Cluster: New Product Development
Invited Session

Chair: Nitin Joglekar, Boston University, School of Management, Boston, United States of America, joglekar@bu.edu

1 - Optimal Product Introduction for Multiple Generations with Dynamic Pricing
Janice Carrillo, Associate Professor, University of Florida, P.O. Box 1171769, Gainesville, FL, 32611-7169, United States of America, janice.carrillo@cba.ufl.edu, Michelle Seref

When planning for the introduction of a stream of new products into the marketplace, managers must consider both the timing and dynamic pricing decisions to determine an appropriate entry strategy. In this paper, we consider multiple generations of a single product with sales as a function of both price and diffusion. In addition to solving for the optimal pricing policy for each generation, we find the optimal number of generations that the firm should produce within a finite planning horizon.

2 - Current Practices in Videogame Project Management
Edward G. Anderson Jr., Associate Professor, University of Texas at Austin, 1 University Station B6500, CBA 3.430, Austin, TX, 78712, United States of America, Edward.Anderson@mccombs.utexas.edu, Geoffrey G. Parker, John Paul Macduffie

We present results from interviews with project managers at 12 different firms in the videogame industry, which is notorious for late and over-budget projects. Using qualitative data, we seek to answer the following questions: (1) Is managing videogame projects different from managing other software projects? (2) What are the implications of these differences—if they exist—for managing the videogame software supply chain? (3) and how are these practices evolving over time?

3 - Production and Process Investment Decisions for a Startup
Nitin Joglekar, Boston University, School of Management, Boston, United States of America, joglekar@bu.edu, Fehmi Tanriserver, Sinan Erzurumlu

We examine the long-term process investment and short-term production decisions of a startup under bankruptcy risk and a debt constrain. We show that bankruptcy risk may either induce aggressive or conservative investment behavior, along with a deviation from monopoly production quantity depending on market conditions, compared to the case with no bankruptcy risk. On the other hand, a tight debt capacity always reduces the propensity to invest and leads to more conservative production decisions.

4 - Exploring Core-Periphery Structures in Complex Software Products
Alan MacCormack, Visiting Associate Professor, MIT Sloan School of Management, 50 Memorial Drive, E52, Cambridge, MA, 02142, United States of America, alanmac@mit.edu

Prior work argues that technical systems possess a "Core-Periphery" structure, in which tightly-coupled "Core" components are surrounded by loosely-coupled "Peripheral" components. However, little work has explored if such structures are observed in practice, or what factors dictate the size and growth of the core. We examine these questions using data from over 1,000 software systems. We show that Core-Periphery structures dominate, and reveal data on the size and composition of the cores.

■ SA46

H-Room 411, Fourth Floor

Knowledge Transfer Across Product, Individual, and Organizational Boundaries

Sponsor: Technology Management
Sponsored Session

Chair: Erica Fuchs, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 131E, Pittsburgh, PA, 15213, United States of America, erhf@andrew.cmu.edu

1 - Knowledge Transfer Across Individuals and Products in Offshore Manufacturing
Carolyn Denomme, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 131E, Pittsburgh, PA, 15213, United States of America, cdenomme@cmu.edu, Linda Argote, Dennis Epple, Erica Fuchs

This talk provides new insights into the significance of product mix and turnover rates on organizational learning. Analysis draws on three years of detailed production data on one facility's 1,339 optoelectronic product variations and 7 years of human resource data of the same facility's 11,742 employees.

2 - Generative Mechanisms of Inter-Firm Knowledge Access, Mobility, and Organizational Ties
Rafael Corredoira, Assistant Professor, University of Maryland, Robert H. Smith School of Business, 4557 Van Munching Hall, College Park, MD, 20742, United States of America, rcorredo@rhsmith.umd.edu

This paper explores whether two generative mechanisms (enduring personal ties and attention-focusing routines) facilitate access to knowledge across firm boundaries that result in a form of innovation: technical solutions granted patents. It departs from extant literature on inter-organizational knowledge transfer by actually testing and providing evidence supporting both generative mechanisms underlying the knowledge access through inventor mobility phenomenon.

3 - Intellectual Human Capital and Strategic Alliances: Complements or Substitutes?
Kwanghui Lim, Assistant Professor, k@kwanghui.com, Annapoornima Subramanian, Pek-hooi Soh

We examine how firm and network-level factors shape innovation. At the firm level we categorize human capital into (1) pure scientists (2) bridging scientists and (3) pure inventors. At the network level, university alliances are distinct from inter-firm alliances. Using patent, publication and alliance data on 435 biotechnology firms, we show that pure and bridging scientists substitute university alliances, whereas bridging scientists and pure inventors complement firm alliances.

4 - Uncertainty, Learning, and the Termination of Bad Projects
Oliver Baumann, University of Munich, Dirk Martignoni

Organizations often fail to terminate bad projects. Traditionally, this phenomenon has been framed as a problem of escalation of commitment, suggesting that bad projects should be terminated sooner than later. We use a simulation model of organizational learning to explore the robustness of this argument. We show that under conditions of high uncertainty, it can actually become rational to pursue projects that have a low or even negative estimated value, if an organization does not want to prematurely abandon too many (potentially good) ideas. This result arises as the value of new ideas is often underestimated, and errors of underestimation may be hard to correct in experiential learning processes.

■ SA47

H-Room 412, Fourth Floor

Applications in Evacuation and Emergency Management

Cluster: OR/MS with Societal/ Humanitarian Impact
Invited Session

Chair: Eva Regnier, Associate Professor, Naval Postgraduate School, 699 Dyer Road, Monterey, CA, 93943, United States of America, eregnier@nps.edu

1 - Investment Decision between Infrastructure and Forecasting in the Face of Hurricane Risk
Seong Dae Kim, Ph.D. Candidate, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843, United States of America, sdkim@tamu.edu, J. Eric Bickel

In planning for the hurricane, society must decide whether to invest in the ability to evacuate more speedily or in improved forecasting technology to better predict the track and intensity of the event. We use DP and Markov processes to

model the interaction between the emergency response system and the emergency forecasting system. Modeling changes in the speed of evacuation and in the accuracy of forecasting allows the determination of an optimal mix of these two investments.

2 - Ensayo: A Virtual Emergency Operations Center for Training and Research

Gregory R. Madey, University of Notre Dame, 384 Fitpatrick Hall, College of Engineering, Notre Dame, IN, 46556, United States of America, gmadey@nd.edu, Irma Becerra-Fernandez, Michael Prietula, Cynthia Nikolai

We describe Ensayo: a socio-cognitive-technical simulator and training facility for upper level emergency managers and a tool for cognitive scientists to study the decision making process under emergency conditions. In particular, we describe how the underlying architecture accommodates the various learning requirements inherent in a dynamic, evolving, and unique organizational structure situated in a highly variable complex threat environment.

3 - Impact of Improving Intensity Forecasts

Eva Regnier, Associate Professor, Naval Postgraduate School, 699 Dyer Road, Monterey, CA, 93943, United States of America, eregnier@nps.edu

Improving intensity forecasts - which have been stalled for 20 years - is one of the top priorities for the tropical-cyclone research community. How much would likely reductions in hurricane intensity forecast error reduce the rate of casualties and unnecessary evacuations?

4 - A Plan for Evacuation of Disabled People in the Face of a Disaster

Aruna Apte, Assistant Professor, Naval Postgraduate School, 555 Dyer Rd, Monterey, CA, 03043, United States of America, auapte@nps.edu, Susan Heath

We investigate the problem of evacuation of the disabled for short-notice disasters with traversable roads. The developed optimization model generates routes in an optimal sequence to maximize evacuees within the constraints. The routes assign each disabled person to a vehicle that will accommodate their level of disability and complete the evacuation within the allotted time. The problem assumes the existence of a list of disabled people needing evacuation with their location and disability.

■ SA48

H-Sapphire Green Room, Fourth

Research Advances in the Service Science and Service-Oriented Solutions

Sponsor: Service Science
Sponsored Session

Chair: Haluk Demirkan, Assistant Professor, Arizona State University, P.O. Box 874606, Tempe, AZ, 85287, United States of America, Haluk.Demirkan@asu.edu

1 - The Role of Private Health Records in Healthcare Technology Adoption

Subhajyoti Bandyopadhyay, Assistant Professor, University of Florida, 351 Stuzin Hall, P.O. Box 117169, Gainesville, FL, 32611, United States of America, shubho.bandyopadhyay@cba.ufl.edu, Zafer Ozdemir

The 2009 stimulus bill provides significant incentives for providers to digitize their records, but unless the records are made interoperable, the full potential of EHR will never be realized. The emergence of the independent PHR platforms is a major development towards the cause of interoperable health records. Not only do these platforms have a vested interest in facilitating interoperability, but they also can help promote the adoption of EHR among healthcare providers.

2 - From Green Computing to Sustainable IT Services: Exploring the Dimensions of a New Discipline

Robert Harmon, Professor of Marketing and Technology Management, Portland State University, P.O. Box 751, Portland, OR, 97207, United States of America, harmonr@pdx.edu, Haluk Demirkan

Reducing energy costs and carbon footprints of large data centers is the driving force for green computing. Computing resources are used more efficiently while productivity is maintained or improved. However, green computing is only one dimension of a much larger concept. This paper surveys the literature on the emerging discipline of sustainable IT services, defines its dimensions, and offers insights on its role as an essential enabler of effective corporate sustainability strategy.

3 - Sustainability in Logistics Services: Trends and Issues

Bülent Catay, Associate Professor, Sabanci University, FENS, Tuzla, Istanbul, 34956, Turkey, catay@sabanciUniversityedu

Environmental concerns in today's developed societies force organizations to measure, monitor, and control the environmental impact of their activities. Governments are considering targets for reduced carbon emission and energy consumption, better traceability, reduced traffic congestion, and other environmental measures in logistics services. A "green evolution" is in force. We will review recent trends and issues in green logistics services.

4 - Leveraging the Capabilities of Adaptive Service Ecosystems

Haluk Demirkan, Assistant Professor, Arizona State University, P.O. Box 874606, Tempe, AZ, 85287, United States of America, Haluk.Demirkan@asu.edu

For service-orientation, companies must co-create their offerings with customers, break siloed business processes into modular services that can be reused on-the-fly in loosely-coupled dynamic business processes or out-tasked to external service providers, and executed by service oriented architectures and infrastructures. It is difficult to predict the organizational and technical impacts, understand the critical issues, or perform rigorous research on the service-oriented-computing.

■ SA49

H-Room 300, Third Floor

Managing Complex Projects

Cluster: Project Management
Invited Session

Chair: Ted Klastorin, Professor, University of Washington, Department of ISOM, Box 353200, Seattle, WA, 98195-3200, United States of America, tedk@u.washington.edu

1 - On the Value of Flexibility in Multi-stage Projects

Mohsen Sharifanni, ISOM Department, University of Washington, Box 353200, Seattle, WA, 98195-3200, United States of America, mohsens@u.washington.edu, Gary Mitchell, Issariya Sirichakwal, Ted Klastorin

In this paper, we compare a purely reactive schedule to a fixed baseline schedule in a two-stage project with stochastic task durations. Specifically, we study the difference between these different types of schedules and show what factors are most critical in determining the value of flexibility offered by a purely reactive schedule. We extend our results to more complex projects and discuss the managerial implications.

2 - Optimal Strategies for New Product Development Projects in a Duopoly Market

Aysun Ozler, PhD Student, University of Washington Business School, Mackenzie Hall Box 353200, Seattle, WA, 98195-3200, United States of America, aysun@u.washington.edu, Yong-Pin Zhou, Ted Klastorin

We study the duopoly competition where each firm develops a new product competing with each other. Moreover, each firm has to determine the design level and the price of its product. One firm is the leader and the other one is the follower. We also consider the possibility of information leakage to the market before the leader firm releases their product and study the impact of the information leakage on each firm's decisions and profit outcomes.

3 - A Real Option Model for Evaluating New Drug Discovery Projects

Yu-Ting Li, BA, NTU, 1, Sec. 4, Roosevelt Road, Taipei, Taiwan - ROC, r96741017@ntu.edu.tw, Jy Yu

Real options approach is frequently used for evaluating R&D projects. This paper aims to apply real options approach to aid the decision-making at the end of new drug discovery process. External and internal factors influencing the value of a pharmaceutical research project, including market competition, growth opportunity of the project, and probability of success of clinical trials, are investigated. Options to invest, to suspend, and to abandon are simulated under different scenarios.

4 - A Joint Optimization Framework for IT Portfolio and Program Management

Robert Chiang, Associate Professor, Fordham University, 441 E. Fordham Road, Bronx, NY, 10458, United States of America, ichiang@fordham.edu, Manuel Nunez

Firms increasingly are using application portfolio management to maximize returns from IT investment while ensuring alignment with the overall strategic vision. Projects of similar characteristics and objectives are then grouped to share resources and to minimize architecture and development risks. We propose a procedure to yield the highest risk-adjusted benefits while ensuring that project sequence and personnel assignment satisfy schedule dependencies and resource constrains.

■ SA51

H-Room 303, Third Floor

Computational Optimization Methods and Applications

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Jiawang Nie, UCSD, 9500 Gilman Drive, La Jolla, CA, United States of America, njw@math.ucsd.edu

1 - An Affine-scaling Interior-point Method for Continuous Knapsack Constraints

Hongchao Zhang, Department of Mathematics, Louisiana State University, Baton Rouge, LA, hozhang@math.lsu.edu

A gradient based affine-scaling algorithm for continuous knapsack constraints will be presented. This algorithm has the property that each iterates lie in the interior of the feasible set and is more suitable for large dimensional optimization problems where the Hessian of the objective function is a large, dense, and possibly ill-conditioned matrix. Global and local linear convergence of the algorithm will be discussed. Numerical results will be also reported.

2 - Solving Graph Bisection Minimization Problems Using Convex Quadratic Relaxations

Dzung Phan, University of Florida, 358 Little Hall, P.O. Box 118105, Gainesville, FL, 32611-8105, United States of America, dphan@ufl.edu, William Hager

We present an exact algorithm for solving the node and edge weighted graph partitioning problem. The algorithm is based on a continuous quadratic formulation of the problem. Necessary and sufficient optimality conditions for a local minimizer of the quadratic program are introduced. Lower bounds for the branch and bound algorithm are obtained by replacing the concave part of the objective function by the best affine underestimator. Numerical results show the effectiveness of our method.

3 - A Convergence Theorem for Solving the SQP System in SSM

Ning Guo, Student, University of Florida, Gainesville, FL, guoning@ufl.edu, William Hager

SSM(sequential subspace method) is an iterative method used to solve the trust region subproblem. A convergence theorem is developed concerning how precisely we should solve the SQP(sequential quadratic programming) system in each iteration in order to obtain an at least linear convergence for the non-degenerate case. We shall look at some numerical results.

■ SA52

H-Room 304, Third Floor

Marketing Strategies and Tools

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Rachel Chen, Assistant Professor, University of California at Davis, rachen@ucdavis.edu

1 - Overselling in a Competitive Environment: Boon or Bane?

Lim Wei Shi, Associate Professor, NUS Business School, 1 Business Link, National University of Singapore, Singapore, Singapore, weishi@nus.edu.sg

We study the practice of overselling in a competitive environment where late arriving consumers value the good higher than early arriving ones but the formers arrival is uncertain. We show that overselling is a dominant strategy. However, it can lead to a prisoners dilemma situation in which all firms are worse off overselling unless demand from the late consumers far exceeds the supply and there is a sufficiently high profit margin from reselling.

2 - Optimal Pricing and Referral Reward Programs under Competition

Run Niu, Webster Universtiy, Business Department, St. Louis, United States of America, runniu68@webster.edu, Paul Messinger

Pricing has been well known as an effective way of managing demand. Referral reward programs are an increasingly popular way to manage consumer referrals with incentives. This paper examines joint optimal pricing and referral reward programs for two competing firms selling substitutable products/services to a common customer pool. The paper provides managerial insights to help managers to determine optimal price and the timing strategy and the level of a reward.

3 - Discount Pricing and Market Segmentation for Source Reduction via Consumer Reuse

Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Decision Sciences Department, Eugene, OR, 97403, United States of America, tolga@uoregon.edu, Michael Pangburn

We focus on the use of source reduction via customer input reuse in conjunction with associated product price and discount decisions. Our demand model reflects rational consumers who are heterogeneous with respect to reservation prices and their assessment of the inconvenience associated with input reuse. We found that the optimal policy can be used not only to reduce input costs, but also to increase revenues by invoking demand from the consumers who would not purchase the product otherwise.

4 - Group Buying of Competing Retailers

Rachel Chen, Assistant Professor, University of California at Davis, rachen@ucdavis.edu, Paolo Roma

Under group buying, quantity discounts are offered based on the buyers' aggregated, rather than individual quantity. While previous studies focus on the benefits buyers enjoy from aggregating their demand, we show that buyers might get hurt from such cooperation. We consider a two-level distribution channel, with a single manufacturer and two retailers who compete for end customers. We show that under competition, retailers may not always prefer cooperation in purchase.

■ SA53

H-Room 305, Third Floor

Mixed Integer Programming: Applications

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Alper Atamturk, Professor, UC Berkeley, 4175 Etcheverry Hall MC 1777, Berkeley, CA, 94720, United States of America, atamturk@berkeley.edu

1 - Mixed Zero-One Linear Programs under Objective Uncertainty: A Cross Moment Model

Karthik Natarajan, National University of Singapore, Department of Mathematics, Singapore, 117543, Singapore, matkbn@nus.edu.sg, Zheng Zhichao

We develop a cross moment model based on completely positive programs for mixed 0-1 linear programs under objective uncertainty. The model captures mean-covariance information without assuming the exact probability distribution. The usefulness of the model is explored in several applications including order statistics, project management and newsvendor networks. The generality of the model opens up an interesting dimension for research in stochastic optimization models.

2 - 1.5-Dimensional Rectangle Packing and its Applications in the Semiconductor Industry

Ali Ekici, PhD Student, Georgia Institue of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, aekici@isye.gatech.edu, Bulent Basaran, Pinar Keskinocak

Motivated by the chip design problem in the semiconductor industry, given a set of rectangles with specified horizontal positions, we need to decide about the vertical positions of the rectangles to minimize the total height of the resulting placement. We show that the problem is NP-hard and propose an integer programming formulation. We also develop heuristics that are efficient and effective, finding near-optimal solutions.

3 - A Benders Approach to a Transportation Network Design Problem

Ben Peterson, PhD Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15232, United States of America, benp@cmu.edu, Michael Trick

We apply a Benders decomposition technique to a truck routing and delivery problem, in which our master problem iteratively generates minimum-cost sets of routes, and our subproblem finds sets of deliveries for which the current route set does not have capacity. We find that by iteratively adding constraints to the master problem which ensure capacity for such a delivery set of minimum size, we generate optimal solutions much faster than comparable algorithms for many problem instances.

4 - The Maximum Weight Triangle-free Simple 2-matching Problem in Subcubic Graphs

Yanjun Li, Purdue University, 403 W. State Street, West Lafayette, United States of America, li14@purdue.edu, David Hartvigsen

A simple 2-matching in a graph is a subgraph all of whose vertices have degree 1 or 2. For graphs with degree at most three, we give a complete description of the convex hull of incidence vectors of triangle-free simple 2-matchings and a strongly polynomial time algorithm for finding a triangle-free simple 2-matching with maximum weight. Our system uses a generalized blossom inequality with {0, 1, 2}-coefficients. This problem is related to the travelling salesman problem.

■ SA54

H-Room 306A, Third Floor

Random Sampling and Convex Optimization

Sponsor: Optimization/Networks
Sponsored Session

Chair: Santosh Vempala, Distinguished Professor of Computer Science, Georgia Tech, Atlanta, United States of America, vempala@cc.gatech.edu

1 - Random Walks on Polytopes and an Affine Interior Point Method for Linear Programming

Hariharan Narayanan, Graduate Student, University of Chicago, 1100 E 58th Street, Chicago, 60637, United States of America, hari@cs.uchicago.edu, Ravi Kannan

Let K be an n dimensional polytope defined by m linear inequalities. We give a new Markov Chain algorithm to draw a nearly uniform sample from K. The underlying Markov Chain is the first to have a mixing time that is strongly polynomial when started from a ``central" point. Using related ideas, we develop a randomized affine algorithm for linear programming that produces an approximately optimal point in polynomial time with high probability.

2 - Sampling Harmonic Concave Functions

Karthekeyan Chandrasekaran, Georgia Institute of Technology, 2115 KACB, 266, Ferst Drive, Atlanta, GA, 30332, United States of America, karthe@cc.gatech.edu

Efficient algorithms for sampling rely on good isoperimetry which is known to hold for arbitrary logconcave densities. In this talk, we will characterize convexity-like conditions on the density function that imply good isoperimetry. Further, we will present an efficient algorithm for sampling according to density functions satisfying this condition, over a convex set. As a consequence, we obtain an efficient algorithm to sample according to the Cauchy distribution function over a convex set.

3 - Towards Practical Sampling of Convex Bodies in High Dimensional Spaces

Merrick Furst, Professor of Computer Science, Georgia Tech, United States of America, merrick@cc.gatech.edu, Santosh Vempala

We report on progress towards a practical method for sampling convex bodies in n-space when such bodies are given via linear and semi-definite constraints. Sampling is the basic step in algorithms for volume computation and convex optimization. Remarkable breakthroughs have reduced the complexity of sampling to n^4. However, convergence is dominated by big constants and is not practical. We describe an intriguing new algorithm together with promising evidence that it leads to practical sampling.

■ SA55

H-Room 306B, Third Floor

Local Search in Combinatorial Optimization

Sponsor: Optimization/Networks
Sponsored Session

Chair: Renato F. Werneck, Researcher, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, renatow@microsoft.com

1 - Fast Local Search for Steiner Trees in Graphs

Renato F. Werneck, Researcher, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, renatow@microsoft.com, Eduardo Uchoa

We present efficient algorithms that implement four local searches for the Steiner problem in graphs: vertex insertion, vertex elimination, key-path exchange, and key-vertex elimination. In each case, we show how to find an improving neighboring solution (or prove that none exists) in O(m log n) time on graphs with n vertices and m edges. Besides the theoretical interest, our results have practical impact: these local searches have been shown to find good-quality solutions in practice.

2 - GRASP with Evolutionary Path-relinking for the Antibandwidth Problem

Mauricio G. C. Resende, Lead Member of Technical Staff - Research, AT&T Labs Research, 180 Park Avenue, Room C241, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com, Abraham Duarte, Rafael Marti, Ricardo M. A. Silva

We propose an integer programming (IP) formulation and several heuristics based on GRASP and path-relinking for the antibandwidth problem (AP). In the AP, one is given an undirected graph with N nodes and must label the nodes such that each node receives a unique label from the set (1, 2, ..., N), where among all adjacent node pairs, the minimum difference between the node labels is maximized. We present computational results using a commercial IP solver and the heuristics.

3 - Local Searches for PBX Telephone Migration Scheduling

Diogo Andrade, Software Engineer, Google Inc., 76 Ninth Ave, 4th Floor, New York, NY, 10011, United States of America, diogo@google.com, Mauricio G. C. Resende

The PBX telephone migration problem consists of migrating telephone numbers from an old PBX system to a newer one over a time horizon. A penalty, assigned to the each connected pair of phones, is incurred if the pair is migrated in different time periods. The objective is to assign phones to time periods such that no more than a given number of phones is assigned to any period and the total penalty is minimized. We present three local search heuristics for this problem.

■ SA56

H-Room 307, Third Floor

Applications in Mixed-integer Nonlinear Programming

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Carl Laird, Assistant Professor, Texas A&M University, MS 3122, TAMU, College Station, TX, 77843, United States of America, carl.d.laird@gmail.com

1 - Globally Optimizing an Extended Pooling Problem

Christodoulos Floudas, Stephen C. Macaleer '63 Professor in Engineering and Applied Science, Princeton University, Department of Chemical Engineering, Princeton University, Princeton, NJ, 08540, United States of America, floudas@princeton.edu, Ruth Misener

The extended pooling problem appends the nonconvex, piecewise-defined Environmental Protection Agency (EPA) Complex Emissions constraints to the problem of maximizing profit given a network of input feed streams, intermediate nodes, and final products. We demonstrate the superior tightness of problem relaxations using piecewise-linear and edge-concave underestimators. We also integrate the relaxations into a global optimization algorithm and present extensive computational results.

2 - Using Redundancy to Strengthen the Relaxation of Nonconvex MINLPs

Juan Ruiz, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, United States of America, jpruiz@andrew.cmu.edu, Ignacio Grossmann

In this paper we present a strategy to improve the relaxation for the global optimization of nonconvex MINLPs. The main idea consists in recognizing that each constraint or set of constraints in the model carries information. When these constraints are relaxed some of this information is lost. Adding redundant constraints that recover that information will strengthen the relaxation. We propose a methodology to find such redundant constraints based on engineering knowledge and physical insight.

3 - A New Framework for Solving Nonlinear Programs

Ashutosh Mahajan, PhD Candidate, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, asm4@lehigh.edu, Sven Leyffer

We describe a new solver for nonlinear programs that deploys as its components both active set and interior point methods. Computational results on benchmark instances are also provided.

4 - An MINLP Formulation for Estimating On-Off Seasonal Transmission in Infectious Disease Models

Carl Laird, Assistant Professor, Texas A&M University, United States of America, carl.laird@tamu.edu

Seasonal drivers of infectious disease spread appear to be correlated with school terms. Here, we present an MINLP formulation and solution approach for estimating on-off seasonal transmission patterns for nonlinear infectious disease models. This approach is tested using childhood disease data for measles and chickenpox.

■ SA57

H-Room 308, Third Floor

OR Models in Health Care Planning

Sponsor: Health Applications
Sponsored Session

Chair: Steven Shechter, University of British Columbia, 2053 Main Mall, Vancouver, Canada, steven.shechter@sauder.ubc.ca

1 - Flexibility in Primary Care

Hari Balasubramanian, Assistant Professor, University of Massachusetts at Amherst, 160 Governors Drive, Amherst, MA, United States of America, hbalasubraman@ecs.umass.edu, Ana Muriel, Jan Hippchen

Timely access and continuity of care are two key measures for any primary care practice, and they are often in conflict. Timely access refers to the ability of practices to provide patients an appointment as soon as possible, while continuity refers to the ability of patients to see their personal physician as often as possible. We present a stochastic dynamic programming framework to evaluate the benefits of physician flexibility in a practice and its implications for timeliness and continuity.

2 - Incentive-based Surgery Scheduling: Determining Optimal Number of Surgeries

Mehmet Begen, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. N., London, ON, N6A 3K7, Canada, mbegen@ivey.uwo.ca, Christopher Ryan

We study the problem of determining number of surgeries for an operating room (OR) block where surgery durations are random, there are significant idle and overtime costs for an OR and the incentives of the parties involved (hospital and surgeon) are not aligned. We adapt a game theoretical setting, present some empirical findings and suggest, under reasonable assumptions, a payment scheme that the hospital may offer to the surgeon to reduce its (idle and especially overtime) costs.

3 - Strategic Planning of Radiation Therapists at the BC Cancer Agency

Greg Werker, University of British Columbia, greg.werker@sauder.ubc.ca, Martin Puterman, Mike Darud

The Vancouver Centre of the British Columbia Cancer Agency (BCCA) employs 80 radiation therapists who work in a number of different areas. Our integer programming (IP) model is used to create a five-year plan for all therapists, balancing experience against various scheduling considerations. We use additional techniques to handle variability to create a more robust plan. While the focus of this presentation is on the BCCA, it could be extended to other staff planning applications in health care.

4 - A Simulation Optimization Model for Long Term Residential Care Capacity Planning

Yue Zhang, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, yue.zhang@sauder.ubc.ca, Martin Puterman, Derek Atkins, Matthew Nelson

This talk concerns optimizing capacity levels in our study of residential capacity planning for the Vancouver Island Health Authority (VIHA) for a long time period. The problem is described in a parallel talk, in this talk we focus on how we used the simulation to determine capacity levels that meet service criteria.

■ SA58

H-Room 309, Third Floor

Scheduling and Logistics

Cluster: Scheduling
Invited Session

Chair: Xiangtong Qi, Professor, HKUST, HKUST Academic Building 5540, Kowloon, Hong Kong, Hong Kong - PRC, ieemqi@ust.hk

1 - Stochastic Programming Approach to Process Flexibility Design

Ho-Yin Mak, The Hong Kong University of Science and Technology, Department of IELM, HKUST, Clear Water Bay, Hong Kong, Hong Kong - PRC, hymak@ust.hk

Service and manufacturing firms often attempt to mitigate demand-supply mismatch risks by deploying flexible resources that can be adapted to serve multiple demand classes. It is critical to evaluate the trade-off between the cost of investing in such resources and the resulting benefits. In this paper, we show that the heavily advocated "chaining" heuristic can perform badly when resources are not perfectly flexible, and propose an alternative stochastic programming heuristic.

2 - Scheduling of Operations in Emergence Room with Different Classes of Patients

Guohua Wan, Professor, Shanghai Jiao Tong University, Shanghai, Shanghai, China, ghwan@sjtu.edu.cn

We consider a scheduling problem of operations in emergence room with two classes of patients and the processing time of a patient is time dependent. We model the problem with two-agent scheduling framework, and consider the models with single machine and parallel machines, and with the regular objectives. We analyze the computational complexity of the models and develop polynomial time algorithms or heuristic algorithms for such models.

3 - Pickup and Delivery Network Segmentation Using Contiguous Geographic Clustering

Ahmad Jarrah, Associate Professor, The George Washington University, Department of Decision Sciences, School of Business, Washington, DC, 20052, United States of America, jarrah@gwu.edu, Jonathan Bard

We address the problem of partitioning a service region into disjoint work areas with pickups and deliveries made throughout the day. For a fleet of homogeneous vehicles, a given set of customers, and expected demand for service, the objective is to find the least number of clusters that satisfy geometric and capacity constraints. The problem is modeled using a set-covering formulation, and solved with a column generation heuristic. Results are presented for data sets from a major carrier.

4 - Vehicle Scheduling with Combinable Delivery and Pickup

Xiangtong Qi, Professor, HKUST, HKUST Academic Building 5540, Kowloon, Hong Kong, Hong Kong - PRC, ieemqi@ust.hk, Chung-Yee Lee

Motivated by the logistics operations in an express delivery company, we develop and study a new scheduling model where each job needs two operations, delivery and pickup. The two operations can be processed either separately or in combination. The objective is to minimize the total weighted completion time of the delivery subject to a time buffer constraint on the pickup. The work is partially supported by Hong Kong RGC and NSFC joint research scheme (project No. N-HKUST612/6).

■ SA60

H-Room 311, Third Floor

Interior-point Methods

Cluster: Large Scale Optimization (In Honor of Jean-Louis Goffin)
Invited Session

Chair: Samir Elhedhli, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, elhedhli@uwaterloo.ca

1 - Bi-parametric Convex Quadratic Optimization

Tamas Terlaky, Professor, Chair, Lehigh University, Department ISE, H. Mohler Lab, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, terlaky@lehigh.edu, Alireza Ghafari Hadigheh, Oleksandr Romanko

We consider the Convex Quadratic Optimization problem with simultaneous perturbation in the right-hand-side of the constraints and the linear term of the objective function with different parameters. The regions with invariant optimal partitions are investigated as well as the behavior of the optimal value function on the regions. Identifying these regions can be done in polynomial time in the output size. An algorithm for identifying all invariancy regions is presented.

2 - Interior-Point Methods for Integer Programming: The ACCPM Approach

Samir Elhedhli, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, elhedhli@uwaterloo.ca

This talk highlights the use of interior point methods in solving integer programming through the Analytic Centre Cutting Plane Method (ACCPM). Heuristic, Branch-and-price, branch-and-cut, and Benders decomposition algorithms will be presented that compete with LP-based approaches.

3 - An L1 Elastic Interior-Point Method for MPCCs

Zoumana Coulibaly, PhD Student, Ecole Polytechnique de Montreal and GERAD, 2500, chemin de Polytechnique, Montreal, Qc, h2e2g5, Canada, zoumana.coulibaly@polymtl.ca

Our interior-point algorithm consist of an elastic formulation of the L1-penalty merit function for mathematical programs with complementarity constraints. The method naturally converges, at a sub-quadratic local convergence rate, to a strongly stationary point or delivers a certificate of degeneracy without recourse to second-order intermediate solutions. Numerical results on a standard test set illustrate the efficiency and robustness of the approach.

4 - Solving Unconstrained Nonlinear Programs with ACCPM

Ahad Dehghani, McGill University, 1001 Sherbrooke west, Montreal, H3A 1G5, Canada, ahad.dehghani@mcgill.ca, Jean-louis Goffin, Dominique Orban

ACCPM and proximal ACCPM are well known techniques for convex programming problems. We propose a sequential convex programming method based on ACCPM and convexification techniques to tackle unconstrained problems with a non-convex objective function.

■ SA61

H-Room 312, Third Floor

Location Analysis Applications

Sponsor: Location Analysis
Sponsored Session

Chair: Rajan Batta, Professor, University at Buffalo (SUNY), Department of Industrial & Systems Engineering, 410 Bell Hall, Buffalo, NY, 14260, United States of America, batta@eng.buffalo.edu

1 - Location Reliability Problems - Linear Case
Mozart Menezes, Professor, MIT-Zaragoza Logistics Center, Avda Gomez Laguna 25, 1a Planta, Zaragozza, Spain, mmenezes@zlc.edu.es, Oded Berman, Dmitry Krass

We analyze the problem of locating two facilities prone to failure on a line. A variety of objectives is analyzed both under independent and correlated failure scenarios. The total cost is decomposed into informational, reliability and locational components. Interesting insights about optimal location patterns under different scenarios are obtained.

2 - Resizing, Opening, and Closing Rural Schools in Chile
Robert Dell, Professor and Chair, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93940, United States of America, dell@nps.edu, Pedro Donoso, Andres Weintraub, Fernando Araya, Consuelo Zuniga, Francisco Martinez, Vladimir Marianov

This talk describes a linear integer program embedded in a geographically information system developed for the Chilean Ministry of Education. There are over 4500 rural elementary and secondary schools located throughout Chile. Are these schools correctly located and sized, should new schools be opened, what schools should be closed? These are some of the questions the Ministry uses the system to address. We report computational experience, challenges, and insights gained during implementation.

3 - Determining Optimal Loiter Paths for UAVs
Noah Bednowitz, University at Buffalo (SUNY), 339b Bell Hall, Buffalo, NY, 14260, United States of America, NHB@Buffalo.edu, Rakesh Nagi, Rajan Batta

We consider a system of unmanned aerial vehicles (UAVs) assigned to respond to future surveillance requests. Idle UAVs are repositioned on a loiter path so as to minimize the expected time to respond to the next target. Solution algorithms based on dynamic programming approximations are developed and tested for a variety of algorithmic and system factors.

■ SA62

H-Room 313, Third Floor

Potpourri of Behavioral Operations

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Kenneth L. Schultz, Associate Professor, University of Alberta School of Business, Business Building, Edmonton, AB, T6G 2R6, Canada, klschult@bus.ualberta.ca

1 - An Empirical Investigation of the Depth of Adoption of the LEED Green Building Standards
Suresh Muthulingam, Acting Assistant Professor, Cornell University, 401P Sage Hall, Johnson Graduate School of Management, Ithaca, NY, 14853-6201, United States of America, suresh.muthulingam.2010@anderson.ucla.edu, Charles Corbett

We examine four issues related to the depth of adoption of the LEED standards for green buildings, using a database of 721 LEED certified buildings. First, we find that depth of adoption is influenced by the certification levels in the standards. Second, we find that depth of adoption increases over time. Third, we find that nonprofit organizations adopt it more deeply than other types of organizations. Finally, we find that deeper adoption is associated with longer project completion times.

2 - The Effect of Consumer Perceptions of Remanufactured Products on Competitive Strategies
Vishal Agrawal, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, GA, 30308, United States of America, vishal.agrawal@mgt.gatech.edu, Atalay Atasu, Koert Van Ittersum

We experimentally investigate the effect of consumer perceptions of remanufactured products and analytically study its impact on an OEM's competitive strategies. We find that the perceived value of new products decreases when the OEM sells remanufactured products, but increases when a third-party remanufacturer sells them. We show that an OEM may not always benefit from remanufacturing or preemption and may want to allow third-party competitors to remanufacture its products.

3 - Filtering on the Factory Floor: Shaping Organizational Knowledge at its Root
John Hanson, Assistant Professor, University of San Diego, Alcala West, Durango Suite A, 5998 Alcala Park, San Diego, CA, 92110, United States of America, hansonj@sandiego.edu

Study of Kaizen events shows that process improvements are shaped by what participants choose to bring forward. This filtering is not simply a screen, but a more complex process of connecting data elements that are compatible with the participant's understanding of the precise nature of the problem to be solved. The findings are important because they shed light on how ideas do or don't get into practice and because they show the mechanisms needed for unlearning.

4 - An Example and a Proposal Concerning the Correlation of Worker Processing Times in Parallel Tasks
Kenneth Schultz, Associate Professor, University of Alberta, School of Business Building, Edmonton, Ab, T6G2R6, Canada, klschult@ualberta.ca, Tobias Schoenherr, David Nembhard

We use archival data from a manufacturing line to study sources of variance in processing speeds. We show that workers react to the speed of their coworkers, but that individual reactions vary widely. Since workers are different both in speed and reaction, managerial implications are not straightforward. We model an optimal and an heuristic rearrangement of workers, and suggest a modified heuristic that performs well for increasing throughput.

■ SA64

H-Room 202A, Second Floor

Tutorial: Exploring Best Practices in the Teaching of OR/MS

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Jill Hardin, VCU, 1015 Floyd Ave., P.O. Box 843083, Richmond, VA, 23284-3083, United States of America, jrhardin@vcu.edu

1 - Exploring Best Practices in the Teaching of OR/MS
Jill Hardin, VCU, 1015 Floyd Ave., P.O. Box 843083, Richmond, VA, 23284-3083, United States of America, jrhardin@vcu.edu

This tutorial explores pedagogical techniques in the teaching of operations research and management science. We begin with an overview of best practices presented in the OR/MS literature, and place them in the context of the broader literature on teaching and learning. Discussion and examples of effectively implementing such practices in the OR/MS classroom follow, and various resources will be presented.

■ SA75

C-Room 32A, Upper Level

Student Paper Competition Session

Sponsor: Railroad Applications
Sponsored Session

Chair: Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

1 - Student Paper Contest Submissions
Michael Gorman, Associate Professor, University of Dayton, 300 College Park, Dayton, OH, 45469-2130, United States of America, michael.gorman@udayton.edu

This session will feature papers from the RAS Student Paper Contest. The papers will be chosen in August, and Abstracts supplied then. Please keep this session open and in place, as we have had this contest for 5 years without ever having fewer than three papers, but the timing of their submission cannot meet the INFORMS deadlines.

2 - Integrated Service Network Design for Freight Rail Transportation
Endong Zhu, CIRRELT / Université de Montréal, Canada, endong@crt.umontreal.ca, Teodor Crainic, Michel Gendreau

The research aims to produce a good operating plan at the tactical level for freight rail transportation. The service network design problem is studied, as we consider the scheduled service selection, blocking policy, train make-up policy and car distribution together. A 2-layer time-space network is proposed to model the car flow as well as the decisions on both blocks and services. The mixed-integer programming model is difficult and a tabu search heuristic is developed to provide good feasible solutions within reasonable solving effort. Numerical results show the proposed method is robust, and capable to provide near-optimal solutions for rather large instances.

3 - Exact and Heuristic Algorithms for the Curfew Planning Problem
Ashish Nemani, University of Florida, Department of Industrial and Systems, Engineering, Gainesville, FL, 32611, United States of America, aknemani@ufl.edu, Suat Bog

In this paper, we study the Curfew Planning Problem (CPP) encountered by railroads for the maintenance of their railway tracks. The CPP is to design an optimal annual timetable to complete a given set of repairs and replacement jobs (rail-work and tie-work) on the railway tracks for a set of crews specialized in rail-work (rail-crew) or tie-work (tie-crew). We develop the work schedule for each crew such that the disruptions in train routes due to subdivision curfews are minimized. A subdivision is said to be under curfew if any crew is working in it. The solution to the problem must also satisfy several operational and regulatory requirements such as the crew continuity, time windows, the maximum inter-project distance travelled by crews, etc. Our paper presents several solution approaches for the CPP: (i) time-space network model, (ii) duty-generation model, (iii) column-generation model, (iv) decomposition-based heuristics, and (v) optimization-based iterative algorithms. We solve each model using CPLEX and present the computational results based on real-life instances.

4 - SAPI: Statistical Analysis of Propagation of Incidents. A New Approach for Rescheduling
Rodrigo Acuna-Agost, Université d'Avignon et des Pays de Vaucluse, Laboratoire Informatique díAvignon, F-84911, Avignon, France, rodrigo.acuna-agost@univ-avignon.fr, Philippe Michelon, Dominique Feillet, Serigne Gueye

We present a new approach called SAPI (Statistical Analysis of Propagation of Incidents) to repair a disturbed railway timetable after incidents. The method estimates the probability of propagation of incidents to reduce the search space defined by a MIP formulation, obtaining very good solutions in a short time. We tested several versions of this method in two different networks located in France and Chile, showing that our procedure is viable in practice.

Sunday, 11:00am - 12:30am

■ SB01

C-Room 21, Upper Level

Joint Session DA/ENRE: Environmental Decision Analysis

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

Chair: Melissa A. Kenney, Postdoctoral Researcher, Environmental Decision Analysis, Johns Hopkins University, 3400 N. Charles St., 313 Ames Hall, Baltimore, MD, 21218, United States of America, m.a.kenneyphd@gmail.com

1 - River Basin Management in Hungary: Stakeholder Decision Making in a Newly Democratizing Nation
Elizabeth Albright, Duke University, 807 Englewood Avenue, Durham, NC, 27701, United States of America, eaa8@duke.edu

The political transition in Central and Eastern Europe (CEE) has been characterized by trends towards democratization and governmental decentralization. During this period of democratic transition, CEE nations that have joined the European Union are increasingly required to include stakeholders in environmental decisionmaking. I examine how stakeholder processes perform in the context of weakened local capacity and newly restructured national and regional environmental management institutions.

2 - Adaptive Environmental Decision Framework
Melissa A. Kenney, Postdoctoral Researcher, Environmental Decision Analysis, Johns Hopkins University, 3400 N. Charles St., 313 Ames Hall, Baltimore, MD, 21218, United States of America, m.a.kenneyphd@gmail.com, Benjamin Hobbs

We present a multistage, multiattribute Bayesian adaptive environmental management framework to address Mississippi River Delta restoration decisions. First we discuss a two-attribute study comparing the scale economies/diseconomies in land building and project cost. Then we present a study, using a subset of objectives, to quantify tradeoffs between learning and action.

3 - The Effect of Environmental Uncertainty on The Tragedy of The Commons
Sam Aflaki, Doctoral Student, INSEAD, Blvd de Constance, Fontainebleau, 77305, France, Sam.AFLAKI@insead.edu

We model a common pool resource game under environmental uncertainty. The existing paradigm regarding increased uncertainty about the sustainable resource size is that it leads to overconsumption. We show that while this is true for increased risk (uncertainty about the states of the environment) independent of the individuals' level of risk aversion, increased ambiguity (uncertainty about the probability of each state) may lead to less consumption when individuals are ambiguity averse.

4 - Uncertainty and Tradeoffs in Urban Water Resources Decision Making: The Case of Phoenix, Arizona
Craig Kirkwood, Professor, Arizona State University, Department of Supply Chain Management, Tempe, AZ, 85287-4706, United States of America, Craig.Kirkwood@asu.edu

Phoenix, Arizona, a rapidly growing large desert city, illustrates the complexity of urban water resources decision making when there is uncertainty about future water supplies and disagreement about tradeoffs among competing objectives. This presentation addresses the impacts of uncertainty and tradeoffs on policy development for urban water resources in this environment, with emphasis on issues associated with global climate change.

■ SB02

C-Room 22, Upper Level

Applications of Problem Structuring Approaches for Decision Modeling

Sponsor: Decision Analysis
Sponsored Session

Chair: Adiel Teixeira Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, PE, 50.630-970, Brazil, almeidaatd@gmail.com

1 - Using Soft System Methodology to Manage Leakage in Water Supply System
Danielle Morais, Dr, Federal University of. Pernambuco, Recife, PE, Brazil, daniellemorais@yahoo.com.br, Adiel Teixeira Almeida

The leakage problem in water supply is complex and requires co-ordinated actions in different areas of management. Many different alternatives to reduce the problem are known, however the managers do not have a structured process to analyze them. A problem structuring model for improvement of water infrastructure by reducing water losses based on Soft System Methodology is presented. It was useful to facilitate in sharing information and to formalize the integration among the group members.

2 - Increasing Satisfaction of Water Utility Customers by Applying Value-Focused Thinking
Adiel Teixeira Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, PE, 50.630-970, Brazil, almeidaatd@gmail.com, Danielle Morais

Water supplier companies need to supply water to their customers without supply interruption, with adequate amount, within acceptable quality, with an adequate pressure and at reduced fares. Value-focused thinking approach was used to support decision makers of a Brazilian Water Utility area to understand and modeling their decision problem by considering their values and objectives and also by stimulating to search new decision opportunities.

3 - Achieving Strategic Alignment between IT and Business Using Value-Focused Thinking
Ana Paula Cabral, Dr, Federal University of Pernambuco, Rua Dourtor Pedro Luiz Osrio, 108 JSP, Recife, PE, 50910470, Brazil, apcabral@hotmail.com, Adiel Teixeira Almeida, Danielle Morais

Information Technology (IT) has the function to help the organization to achieve success. Nevertheless, to meet this function, it is essential that IT strategies are aligned with business strategies, establishing a cooperative atmosphere between them. This paper presents a case study in a Brazilian Public Electric Power-Generating Company, using the Value-Focused Thinking to create alternatives through the objectives of the IT managers to attain the strategic alignment between IT and business.

4 - The Plaster Waste Destination Problem in Building Sites: A VFT Application
Luciana Hazin, Federal University of Pernambuco, Rua Manoel Bezerra, 197 Madalena, Recife, Brazil, alencarlh@gmail.com, Caroline Mota, Marcelo Alencar

Since the growing concerned with the environment becomes each time more important,it is each time greater the interest to find solutions that attend the professionals and, at the same time, that decrease the impact in the environment originated by the plaster wasted. In this way, with the aim of identify desirable decision opportunities and create alternatives for the plaster waste problem, the VFT methodology is applied.

■ SB03

C-Room 23A, Upper Level

Game Theory and Computational Economics II

Cluster: Game Theory
Invited Session

Chair: Gabriel Weintraub, Columbia Business School, 402 Uris, New York, United States of America, gweintraub@columbia.edu

Co-Chair: Nicolas Stier-Moses, Columbia Business School, 418 Uris, New York, United States of America, stier@gsb.columbia.edu

1 - Sufficient Conditions for Computability of Nash Equilibrium in Random Games
Théophane Weber, MIT, Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, United States of America, theo_w@mit.edu

Graphical games are a succinct representation of a game which takes place between players who interact with only a few of their neighbors in a network. It is a well-known fact that computing Nash Equilibrium is NP-hard, even when considering sparse networks. We investigate conditions under which the Nash Equilibria of randomized graphical games can be computed efficiently using naturally distributed algorithms.

2 - Social Network Learning with Heterogeneous Preferences
Ilan Lobel, MIT, 77 Mass Ave, Cambridge, MA, United States of America, lobel@mit.edu, Daron Acemoglu, Munther Dahleh, Asu Ozdaglar

We analyze the equilibrium of a model of learning and decision-making over a social network where agents have diverse preferences. Each individual receives some signal about an underlying state, observes the actions of a neighborhood of individuals, and chooses an action. We characterize conditions on the network topology and the utility functions of the agents that lead to efficient aggregation of information.

3 - Dynamic Oligopoly Models for Concentrated Industries
Gabriel Weintraub, Columbia Business School, 402 Uris, New York, United States of America, gweintraub@columbia.edu, Bar Ifrach

We study large-scale dynamic oligopoly models that are subject to the "curse of dimensionality". We introduce approximation methods for industries with a few dominant firms and many small firms. This is a relevant and commonly observed market structure in industry data.

4 - Multiple Equilibria in Empirical Pricing Games
Che-Lin Su, The University of Chicago Booth School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, che-lin.su@chicagobooth.edu, Jean-Pierre Dube

Recent demand estimation literature has modelled the data-generation process as an equilibrium outcome from a pricing game between firms facing discrete choice demands. In this talk, we show that many models, such as Bertrand oligopoly with random coefficients logit demand, need not generate a unique price equilibrium. We formulate the estimation problem as a constrained optimization and demonstrate the computational feasibility and efficiency of this approach.

■ SB04

C-Room 23B, Upper Level

Clock Auctions and Related Applications

Cluster: Auctions
Invited Session

Chair: Robert Day, University of Connecticut, OPIM Department, 2100 Hillside Road, Storrs, CT, 06269, United States of America, Bob.Day@business.uconn.edu

1 - Advances in Core-selecting Combinatorial Auctions
Robert Day, University of Connecticut, OPIM Department, 2100 Hillside Road, Storrs, CT, 06269, United States of America, Bob.Day@business.uconn.edu

Auctions in which outcomes are in the core with respect to submitted preferences offer competitive revenues to the seller and arguably fair payments for bidders. This paradigm has recently been adopted for several European spectrum auctions, and is being studied for government applications in the U. S. In this talk I will discuss some of the subtleties of applying this approach in practice, with a focus on algorithmic implementation and the math programming that underlies the process.

2 - A Clock Auction Market for Grid Computing
Sanjukta Smith, Assistant Professor, SUNY Buffalo, 325 Jacobs Management Center, Buffalo, NY, 14260, United States of America, sdsmith4@buffalo.edu, Robert Day, Ravi Bapna, Robert Garfinkel, Jan Stallaert

We develop a customized clock auction that is able to allocate grid resources and discover separate prices for the different computing resources under the condition that buyers do not know with certainty how much of these resources they will need. The proposed clock auction facilitates the discovery of unit prices for the resources in each time period in a finite-horizon market.

3 - Efficiency with Linear Prices? The Combinatorial Clock Auction and its Extensions
Martin Bichler, TU München, Boltzmannstr. 3, Garching, 85748, Germany, martin.bichler@in.tum.de, Pasha Shabalin, Georg Ziegler

We will introduce the CC+ auction, an extension of the CC auction with a modified price update rule, and show that powerset bidding always leads to efficient outcomes. We will also show that with a strong price update rule and a Vickrey payment rule, powerset bidding is an ex-post Nash equilibrium. Computational experiments suggest that the format is robust against restrictions in the number of bids submitted in each round.

■ SB05

C-Room 23C, Upper Level

Panel Discussion: Information and Messages from Editors of QSR Journals

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yong Chen, University of Iowa, 2138 Seamans Center, Iowa City, United States of America, yongchen@engineering.uiowa.edu

1 - Information and Messages From Editors of QSR Journals
Moderator: Yong Chen, University of Iowa, 2138 Seamans Center, Iowa City, United States of America, yongchen@engineering.uiowa.edu, Panelists: Douglas Montgomery, Jianjun Shi, David Steinberg, Awi Federgruen, Dan Apley, Susan Albin

Editors of several top journals on quality, statistics, and reliability (QSR) areas are invited for this panel discussion. The editors will briefly present the basic information of their journals and their visions on the future directions, including promising topics and how the QSR researchers can contribute to the journals better. A Q&A session and open discussion with the audience will be held following the editors' presentations.

■ SB06

C-Room 24A, Upper Level

Multi-Objective Optimization and Data Mining

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu

1 - Dual Multicast in Telecommunication with Shared Risk Resource Group Diverse Constraints
Zhe Liang, Rutgers University, Piscataway, NJ, United States of America, liangzhe@eden.rutgers.edu, W. Art Chaovalitwongse

We address a multicast problem with Shared Resource Risk Group (SRRG) diverse constraints. An SRRG is a group of resources in a network sharing a common risk. Our problem is to design two multicast trees from two sources with minimum total cost, and guarantee two SRRG-Diverse paths from two sources to every destination. We develop a new tree-based MIP model for the problem and compare it with an edge-based model. Both models provided similar results for the real world test cases.

2 - A Rule Induction Method for Optimizing a Multistage Manufacturing Process with Missing Values
Doh-Soon Kwak, Ph.D Candidate, POSTECH, Industrial and Management Engineering, Pohang, KB, 790-784, Korea, Republic of, dskwak@postech.ac.kr, Kwang-Jae Kim

We propose a method for optimizing a multistage manufacturing process, where a significant portion of the data set has missing values. The proposed method is based on a data mining technique, called Patient Rule Induction Method (PRIM). The performance of the proposed method is demonstrated using a case study on a semiconductor manufacturing process.

3 - Enhanced GRASP with 2-step Local Search for Reconstructing Sibling Relationships Using Genetic Data

Chun-An Chou, Department of Industrial and Systems Engineering, Rutgers, The State University of New Jersey, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, joechou@rci.rutgers.edu, Bhaskar DasGupta, W. Art Chaovalitwongse, Tanya Berger-Wolf, Mary Ashley, Isabel Caballero, Saad Sheikh

We propose an enhanced GRASP with a two-step local search for solving the sibling reconstruction problem. A greedy approach with randomized perturbation produces diverse sibling groups. Afterwards a two-step local search is designed particularly to enhance the solution quality of constructed sibling groups by evaluating similarity likelihood. This approach is implemented on real and simulated datasets, respectively, and results show effectiveness compared with other remarkable approaches.

4 - A Probabilistic Framework Utilizing Snapshots Formed From WASM Data

Marc Fridson, Student, Rutgers University, 24 Firethorn Drive, Edison, NJ, 08820, United States of America, mfridson@gmail.com, W. Art Chaovalitwongse, Zhe Liang

A battle space composed of multiple WASMs is an extremely difficult scenario to model, let alone predict. Typically multiple targets are detected at different times. We can assume the entire battle space is scanned in entirety after some predetermined period of time. In this study we attempt to establish some probability framework that can be used to predict future snapshots of a targets position in real time, by analyzing snapshots of time that have already elapsed.

■ SB07

C-Room 24B, Upper Level

Joint Session QSR/MIF: Operational and Logistical Maintenance Decisions

Sponsor: Quality, Statistics and Reliability & Minority Issues Forum
Sponsored Session

Chair: Alaa Elwany, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, United States of America, elwany@gatech.edu

Co-Chair: Nagi Gebraeel, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, nagi@isye.gatech.edu

1 - Value of Monitoring for Replacement under Proportional Hazards with Continuous-time Degradation

Xiang Wu, Iowa State University, Industrial & Mfg Sys Eng., Ames, IA, United States of America, xiangwu@iastate.edu, Sarah Ryan

We investigate the value of perfect monitoring information for optimal replacement of deteriorating systems in the proportional hazards model. To accurately compare costs of policies based on more or less frequent monitoring, we account for transitions among states of the covariate process between observation epochs. Results from a numerical example illustrate monitoring cost relationships under which continuous, discrete, or no monitoring minimizes the overall cost.

2 - Simultaneous Optimization of Maintenance and Production Planning Decisions

Sakine Batun, University of Pittsburgh, Pittsburgh, PA, 15260, sab79@pitt.edu, Lisa Maillart

We consider the problem of determining maintenance and production policies in a multi-product setting under deterioration-state dependent random yield and product mix requirements. We formulate the problem as a MDP and explore the value of simultaneous planning, as opposed to sequential planning, and deterioration state dependent production policies, as opposed to FCFS policies.

3 - Investing for Availability: When to Invest in Redundancy?

Kurtulus Baris Oner, PhD Student, Eindhoven University of Technology, Technische Universiteit Eindhoven, Postbus 513, Eindhoven, 5600 MB, Netherlands, K.B.Oner@tue.nl, Gudrun Kiesmuller, Geert-Jan van Houtum, Alan Scheller-Wolf

We consider a user who buys a number of multi-component systems with a serial structure. For each of the components, she can decide to build in a redundant component. She keeps spare parts on stock and applies repair-by-replacement. Redundancy and spare parts inventory levels are the decision variables. We set our objective as the minimization of the total costs of the systems and analyze the optimal values of the decision variables for varying availability constraints.

4 - Sequential Replacement and Inventory Ordering Policies for Systems with Complex Degradation

Alaa Elwany, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, United States of America, elwany@gatech.edu, Nagi Gebraeel, Lisa Maillart

We propose a framework to sequentially determine optimal replacement and spare parts ordering policies for single-unit systems subject to condition monitoring using dedicated sensors. A random coefficients degradation model is first used to update the evolution of the system's future degradation based on real-time signals. The updated predictive distribution of the future signal is then used to establish structural properties of the optimal replacement policy using Markov decision processes.

■ SB08

C-Room 24C, Upper Level

A Tutorial in Simulation and Surveillance of Infectious Disease

Sponsor: Data Mining
Sponsored Session

Chair: Kwok Tsui, Professor, Georgia Institute of Technology, 765 Ferst Drive, ISyE, Atlanta, GA, 30332, United States of America, ktsui@isye.gatech.edu

1 - A Tutorial in Infectious Disease and Public Health Surveillance

Kwok Tsui, Professor, Georgia Institute of Technology, 765 Ferst Drive, ISyE, Atlanta, GA, 30332, United States of America, ktsui@isye.gatech.edu, Dave Goldsman

Due to various outbreaks of influenza and continuing bioterrorism threat, research efforts on infectious disease and public health surveillance have become very important worldwide. In this tutorial, we will explain and classify the various types of health surveillance problems. We review the latest research in surveillance systems, monitoring methods, and performance measures. We also discuss the research challenges and illustrate them with various problems and examples. In particular, we will compare the performance of Scan, CUSUM, and EWMA charts for temporal, spatial, and spatiotemporal surveillance.

2 - A Tutorial in Simulation Modeling of Influenza Pandemic

Dave Goldsman, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, sman@isye.gatech.edu, Kwok Tsui

Due to various outbreaks of influenza and continuing bioterrorism threat, research efforts on infectious disease simulation and its impact in public health have become very important worldwide. In this tutorial, we will discuss basic SIR simulation models for influenza pandemic transmission. In particular, we will discuss generic simulation models that can be customized to specific population distributions, including age, household size and household composition distributions. We will also investigate the impact of various medical and non-medical intervention strategies under our models.

■ SB09

C-Room 25A, Upper Level

Many-server Heavy-traffic Approximations

Sponsor: Applied Probability
Sponsored Session

Chair: Itai Gurvich, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu

1 - "c mu / theta" Rule for General Service Time and Exponential Abandonments

Gennady Shaikhet, Postdoc, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, shaikhet@cmu.edu, Kavita Ramanan

Consider an overloaded queueing network with several customer classes and one service pool. For class i customers we have generally distributed service time with rate mu_i and exponential abandonments with rate theta_i. Let also c_i be a holding cost per unit time for class i. We introduce "c mu / theta" type policy that asymptotically minimizes overall long run average holding cost.

2 - Two-Parameter Heavy-Traffic Limits for Infinite-Server Queues with Delayed Feedbacks

Guodong Pang, Columbia University, IEOR Department, New York, NY, 10027, United States of America, gp2224@columbia.edu, Ward Whitt

We prove FWLLN and FCLT limits for queue-length processes, including remaining service times, for non-Markovian infinite-server queues with delayed feedback, where both the arrivals and the feedback are allowed to be time varying. We are motivated by call centers in which customers may not initially receive adequate service, and so often need to call back later, which adds to the system load and changes time-varying arrival patterns.

3 - Heavy-Traffic Limits Via an Averaging Principle; Convergence and Stability Analysis

Ohad Perry, Columbia University, New York, NY, United States of America, op2105@columbia.edu, Ward Whitt

We consider a parallel-server system with two customer classes and two server pools operating under a Fixed-Queue-Ratio with Thresholds (FQR-T) routing rule. We prove a functional law of large numbers via an averaging principle and analyze properties of the limit, such as stability and interchange of limits. Building on the fluid limit we establish convergence to diffusion limits via state-space collapse.

4 - Some Piecewise Linear SDE's Driven by Levy Processes

Josh Reed, Leonard N. Stern School of Business, New York University, New York, NY, jreed@stern.nyu.edu, Bert Zwart

We investigate a class of Levy-driven SDE's arising as the limits of multi-servers queues with heavy-tailed interarrival times and with service interruptions. We study the case of spectrally negative Levy processes and obtain expression for the Laplace transforms of the stationary distribution. Next, we study the time dependent distributions and the case in which the Levy process may have jumps in both directions.

■ SB10

C-Room 25B, Upper Level

Computational Methods in Revenue Management and Economics

Sponsor: Applied Probability
Sponsored Session

Chair: Sunil Kumar, Stanford University, Graduate School of Business, Stanford, CA, 94305-5015, United States of America, Kumar_Sunil@gsb.stanford.edu

1 - Repeated Resolves Policy for Network Revenue Management

Stefanus Jasin, Stanford University, 1030 El Monte Ave # 215, Mountain View, CA, 94040, United States of America, stf48198@stanford.edu, Sunil Kumar

Many popular heuristics for Network RM involve repeatedly resolving deterministic Linear Program (RDLP). We study an RDLP heuristic in a model where demand arrives according to Poisson processes. We give a performance guarantee that depends on the choice of re-solving times and show that with frequent re-solving the regret of this heuristic does not scale with the size of the problem. It is also possible to incorporate learning of parameters and still maintain excellent performance.

2 - Dynamic Pricing to Learn and Earn: Promise and Pitfalls of Myopic Bayesian Policies

N. Bora Keskin, PhD Student, Stanford University, 121 Campus Dr, Apt 3403A, Stanford, CA, 94305, United States of America, bkeskin@stanford.edu, Assaf Zeevi, J. Michael Harrison

Motivated by applications in financial services, we consider a seller who offers prices sequentially to a stream of potential customers, observing either success or failure in each sales attempt. The parameters of the underlying demand model are initially unknown, so each price decision involves a trade-off between learning and earning. We analyze the performance of a myopic Bayesian policy (MBP), and propose ways of tweaking the MBP to guard against poor performance.

3 - Asymptotic Analysis of Large Scale Dynamic Stochastic Games

Ramesh Johari, Stanford University, Terman Engineering Center, Stanford, CA, 94305, United States of America, rjohari@gmail.com, Sachin Adlakha, Gabriel Weintraub, Andrea Goldsmith

We study stochastic games with a large number of players who are coupled via their payoff functions. We study "oblivious equilibrium"ù (OE), where each player reacts only to the average behavior of other players. We characterize a set of conditions on model primitives under which OE approximates Markov perfect equilibrium.

■ SB11

C-Room 25C, Upper Level

Homeland Security Applications

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Rajan Batta, Professor, University at Buffalo (SUNY), Department of Industrial & Systems Engineering, 410 Bell Hall, Buffalo, NY, 14260, United States of America, batta@eng.buffalo.edu

1 - Assessing the Impact of Alternate Objectives on the Spatial Properties of Solutions in CIKR Defense

Justin Yates, Assistant Professor, Texas A&M University, 237D Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States of America, jtyates@tamu.edu, Sujeev Sanjeevi

Years of focus on the problem of protecting critical infrastructure and key resources (CIKR) has led to the development of a plethora of models for optimizing the allocation and usage of defense resources in such tasking. This presentation examines how differences in modeling these problems affect the spatial distribution/utilization of resources within an area-of-interest and discusses how spatial properties may be exploited in the development of new solution techniques.

2 - Navy Officer Manpower Optimization Incorporating Budgetary Constraints

Javier Salmeron, Associate Professor, Naval Postgraduate School, 1411 Cunninham Rd., Monterey, CA, 93943, United States of America, jsalmero@nps.edu, David Clark

This work develops the Requirements-Driven Cost-Based Manpower Optimization (RCMOP) model to guide monthly values for officer inventory, promotions, accessions, designator transfers, and forced and natural losses. RCMOP minimizes unmet manpower requirements while meeting the Navy's fiscal constraints. Resulting costs fall within 10% of budget estimates, and promotion metrics approximate the values expected by law and policy. The model indicates a need to increase OCS accessions by 11%.

3 - Software Assistants for Real Patrol Planning

Fernando Ordonez, Associate Professor, Daniel J. Epstein Department of Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089-0193, United States of America, fordon@usc.edu, Milind Tambe

Limited security resources prevent 24/7 coverage of locations of interest, allowing adversaries to exploit patterns in patrolling. Effective patrols therefore should also be unpredictable. We use Stackelberg game models to obtain effective random patrols. This has lead to the development of software assistants that are currently used in planning real patrols. Here we describe the overall process of developing these applications.

4 - A Mathematical Model for Immobile Entity Search on a Network

Wanyan Yu, University at Buffalo, Buffalo, United States of America, wanyanyu@buffalo.edu, Rajan Batta

We consider the problem of searching for a single, uniformly distributed immobile entity on an undirected network. The objective is to minimize the expected search time to find the entity. We formulate it as a MIQCP (mixed integer quadratic constrained problem) and solve it using CPLEX for a small-size network. Then we revise the model as a mixed integer problem and introduce a heuristic algorithm integrated with the CPLEX solver to provide a better solution for a larger network.

■ SB12

C-Room 26A, Upper Level

Urban Planning

Contributed Session

Chair: Takamori Ukai, Nanzan University, 27 Seirei-cho, Seto, Japan, ukai@nanzan-u.ac.jp

1 - Providing Services to the World: Optimizing with Respect to Multiple Concentric Zones of Population

Baris Hasdemir, UMASS Amherst, 121 Presidents Drive, Amherst, MA, 01003, United States of America, hasdemir@som.umass.edu, Agha Iqbal Ali

Improved access to centers that provide a service or commodity is relevant in both the public and private sectors. A center provides better access if it is located so as to serve maximal populations within successive concentric rings. This paper presents a location model that seeks to maximize served populations within multiple concentric rings. The model is applied to a variety of scenarios in different geographical regions using data for populated places in the USA, Europe, India and Africa.

2 - Optimal Location of Facilities with Limited Capacity
Takamori Ukai, Nanzan University, 27 Seirei-cho, Seto, Japan, ukai@nanzan-u.ac.jp

At the facility which has limited capacity, users can not always be provided service, but be passed around. In the situation that the total number of servers is constant, more facilities reduce servers of individual facility. Therefore though the distance from users to facility decreases, the loss probability increases. We consider the number of facilities and their location which minimizes total distance, taking account of the loss probability which depends on their capacity and demands.

■ SB13

C-Room 26B, Upper Level

Algorithms and Tools for Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Michael Ferris, Professor, University of Wisconsin, Department of Computer Sciences, 1210 W. Dayton Street, Madison, WI, 53706-1685, United States of America, ferris@cs.wisc.edu

1 - Signal Reconstruction Algorithms on Graphical Processing Units
Sangkyun Lee, University of Wisconsin-Madison, Computer Sciences, Madison, United States of America, sklee@cs.wisc.edu, Stephen Wright

Several highly effective algorithms for compressed sensing and image reconstruction applications can be efficiently implemented on modern graphical processing units (GPUs). The properties of the algorithms and applications are discussed, and computational results are presented to show large speedups over CPU implementations.

2 - A Large-scale Affine Variational Inequality Solver Based on a Path-following Method
Qian Li, University of Wisconsin-Madison, Department of Mathematics, 480 Lincoln Dr, Madison, 53706, United States of America, qli@math.wisc.edu, Michael Ferris

PathAVI is an implementation of a path-following method for solving affine variational inequalities (AVIs). It exploits the special structure of the underlying polyhedral set and employs a pivotal scheme to solve a class of models (formulated as AVIs), whose equivalent linear complementarity reformulations cannot be processed by existing complementarity solvers. PathAVI is capable of processing large-scale AVIs by incorporating sparse linear system packages and updating schemes.

3 - GDXMRW: Exchanging Data between GAMS and Matlab
Steven Dirkse, Director of Optimization, GAMS Development Corporation, 1217 Potomac Street NW, Washington, DC, 20007, sdirkse@gams.com, Michael Ferris

We discuss GDXMRW (GDX-Matlab Read/Write), a tool for moving data between GAMS and Matlab. This data exchange gives MATLAB users the ability to use all the optimization capabilities of GAMS, and allows visualization of GAMS data directly within MATLAB. The tool is based on GDX (GAMS Data eXchange), a well-established and public API for exchanging data with GAMS.

4 - Facebook Friend Wheels and Quadratic Assignment
Michael Ferris, Professor, University of Wisconsin, Department of Computer Sciences, 1210 W. Dayton Street, Madison, WI, 53706-1685, United States of America, ferris@cs.wisc.edu, Cody Bredendick

A friend wheel is an image used on Facebook to provide a visual representation of the relationships between the friends any one person may have. We outline a tool, based on the solution of quadratic assignment problems, that generates such a wheel. The tool uses the Facebook API to gather data, the GRASP heuristic to solve the model, and GraphViz to generate the visualization.

■ SB14

C-Room 27A, Upper Level

Computational Issues in Stochastic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Pascal Van Hentenryck, Professor, Brown University, Box 1910, Providence, RI, 02912, United States of America, pvh@cs.brown.edu

1 - Approximation Algorithms for Stochastic Combinatorial Optimization with Risk
Evdokia Nikolova, MIT, Cambridge, MA, United States of America, enikolova@csail.mit.edu

We provide general-purpose fully-polynomial approximation algorithms for a framework of stochastic optimization that incorporates risk. The stochasticity is specified via arbitrary independent distributions. We assume access to a solver for the underlying deterministic problem, which may be exact or approximate. Our algorithms are based on a new methodology for approximating low-rank nonconvex optimization.

2 - Parallel Generation and Solution of Stochastic Programs Using COIN-OR Utilities
Alan King, IBM Research, P.O. Box 218, Yorktown Heights, United States of America, kingaj@us.ibm.com, Sheng Yuan Chen

To solve truly large stochastic programs requires parallelization not only of the solver but also of the generation and report-writing phases. The COIN-OR packages FlopC++ and SMI have been adapted to generate stochastic programming data from a modeling language. Furthermore there exists a new interior point decomposition solver for SMI. In this talk we show how the packages can be combined for the parallel generation, solution, and report-writing for stochastic programs.

3 - Amsaa: A Multistep Anticipatory Algorithm for Online Stochastic Combinatorial Optimization
Pascal Van Hentenryck, Professor, Brown University, Box 1910, Providence, RI, 02912, United States of America, pvh@cs.brown.edu

This talk proposes Amsaa, an anytime multi-step anticipatory algorithm for online stochastic optimization. Amsaa uses the sampling average approximation method to approximate the problem which is then solved using a search algorithm for MDPs. Amsaa was evaluated on a stochastic project scheduling application and it outperforms state-of-the art algorithms.

4 - Scalable Heuristics for Stochastic Programming with Scenario Selection
Jean-Paul Watson, Principal Member of Technical Staff, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185-1318, United States of America, jpwatson@sandia.gov, Roger Wets, David Woodruff

We describe computational procedures to solve a wide-ranging class of stochastic programs with chance constraints where the random components of the problem are discretely distributed. Our procedures are based on a combination of Lagrangian relaxation and scenario decomposition, solved using a novel variant of progressive hedging. Experiments demonstrate the ability of the algorithm to quickly find near-optimal solutions to difficult and large chance constrained stochastic programs.

■ SB15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - AMPL Optimization LLC - Attacking Hard Mixed-Integer Optimization Problems through the AMPL Modeling Language
Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu, David M. Gay

There are many tricks for formulating complex optimization models by use of integer variables, but what's to be done when even the most advanced solvers can't produce results in reasonable time? A series of examples show how substantial improvements in performance can be achieved through carefully focused troubleshooting and experimentation facilitated by the power and flexibility of the AMPL modeling language and its solver interfaces.

2 - GAMS Development Corporation - Rapid Application Prototyping with GAMS
Lutz Westermann, GAMS Development Corp., 11217 Potomac Street, NW., Washington, DC, 20007, United States of America, lwestermann@ 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.

■ SB16

C-Room 28A, Upper Level

Monetizing Online Social Networks

Sponsor: Information Systems
Sponsored Session

Chair: Param Singh, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, United States of America, psidhu@cmu.edu

1 - How Valuable are Online Social Networks? Evidence From Online P2P Lending Markets

Siva Viswanathan, Associate Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States of America, sviswana@rhsmith.umd.edu, Mingfeng Lin, Nagpurnanand Prabhala

This study examines the role of social networks in mitigating information asymmetry in a decentralized online marketplace. Using a comprehensive dataset from an online peer-to-peer lending marketplace, we find that the relational aspects of networks create value for the marketplace by exerting peer pressure and increasing the verifiability of ties.

2 - Economics of User-Generated Content: Text Mining, Image Classification and Demand for Hotels

Anindya Ghose, Assistant Professor, NYU Stern, 44 West 4th Street, New York, United States of America, aghose@stern.nyu.edu, Beibei Li, Panos Ipeirotis

Using structural modeling techniques, we estimate demand for hotels as a function of their internal (service) and external (locational) characteristics. We have a unique dataset of hotel reservations from Travelocity. Further, we have data from: (i) textmining of reviews on Travelocity and Tripadvisor, (ii) social tags identifying different locational attributes of hotels, (iii) user-contributed opinions on hotel characteristics from Amazon Mechanical Turk, and (iv) satellite images of the area.

3 - Consumer Choice in an Online Community: Impact of Social Influence on Music Consumption

Jui Ramaprasad, University of California-Irvine, Paul Merage School of Business, Irvine, CA, 92697, jui.ramaprasad@mcgill.ca, Sanjeev Dewan

We examine the impact of online social influence on consumption, in the illustrative context of an online music community. We look at social influence through aggregate "bandwagon" influence and local network influence. Exploiting a unique natural experiment, we find that the ability to observe aggregate peer decisions impacts individual choices (the bandwagon effect). We also find that adoption decisions of local network neighbors significantly influence a focal actor's choices.

4 - Size Doesn't Matter: Network Externalities Vs. Information Cascades

Eric Walden, Texas Tech University, 19th Street, Lubbock, TX, 79409, United States of America, ewalden@andrew.cmu.edu, Jaeki Song

In this paper we compare network externality theory and information cascade theory as predictors of adoption. Making use of experimental economics we design a laboratory experiment where individuals receive cues consistent with both network externality theory and information cascade theory. We find that the network externality cues have no effect on the willingness to adopt, while the information cascade cues have strong impacts on the willingness to adopt.

■ SB17

C-Room 28B, Upper Level

Panel Discussion: NeuroIS: What are the Opportunities and Challenges of Using Decision Neuroscience in Information Systems

Sponsor: Information Systems
Sponsored Session

Chair: Angelika Dimoka, Assistant Professor - Director, Center for Neural Decision Making, Temple University, 510 Alter Hall, 1801 Liacouras Walk, Philadelphia, PA, 19122, United States of America, angelika@temple.edu

1 - NeuroIS: What are the Opportunities and Challenges of Using Brain Imaging in Information Systems?

Moderator: Paul Pavlou, Associate Professor of Information Systems, Marketing, and Management, Temple University, 1810 N. 13th St., Philadelphia, PA, United States of America, pavlou@temple.edu, Panelists: Izak Benbasat, Richard Bagozzi, Alok Gupta

Cognitive neuroscientist have been examining the functionality of brain areas that underlie higher-order human functions and processes using functional neuroimaging tools to derive interesting insights by opening the "black box" of the brain. This talk discusses the opportunities and challenges of applying cognitive neuroscience theories and methods to inform IS research (termed "NeuroIS") to supplement, complement, and even challenge existing IS theories, methods, and data.

■ SB18

C-Room 28C, Upper Level

Stochastic Optimization in Energy

Sponsor: Computing Society
Sponsored Session

Chair: Robert Entriken, Senior Manager, EPRI, 3420 Hillview Avenue, Palo Alto, CA, 94306, United States of America, rentrike@epri.com

1 - Optimal Control and Valuation of Wind Energy Storage under Advance Commitments

Jae Ho Kim, Princeton University, Princeton, NJ 08544 jaek@Princeton.EDU, Warren Powell

We solve the problem of making advance energy commitments for wind farms in the presence of a storage device with conversion losses. We derive the optimal policy for making advance commitments for the case in which the forecast of electricity generated from the wind farm is uniformly distributed. The stationary distribution of the storage level corresponding to the optimal policy is obtained, from which the economic value of the storage is computed.

2 - SMART: Stochastic, Multiscale Energy Policy Model

Warren Powell, Professor, Princeton University, Sherrerd Hall 230, Princeton, NJ, 08544, United States of America, powell@princeton.edu, Abraham George, Alan Lamont, Jeffrey Stewart

SMART is a model that plans over a dozen types of energy investments over a multidecade horizon, while also modeling hourly variations in wind, solar and energy demands. It can handle uncertainty in wind, demand and prices, seasonal variations in rainfall, and uncertainty in technology, policy and climate. Approximate dynamic programming is used to make storage decisions on an hourly level, and investment decisions on a yearly level. We report on experimental tests validating the ADP algorithm.

3 - A Stochastic Optimization Model for Robust Power Network Design

Nikita Boyko, PhD Student, University of Florida, Department of Industrial and Systems Eng, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, nikita@ufl.edu, Panos Pardalos, Stan Uryasev, Vladimir Boginski

We propose a stochastic formulation of minimum cost flow problem aimed at finding network design and flow assignments subject to uncertain factors, such as network component disruptions/failures. In order to quantify the uncertain loss caused by network failures we utilize CVaR risk measure.

4 - Reserve Determination with Stochastic Optimal Power Flow

Robert Entriken, Senior Manager, EPRI, 3420 Hillview Avenue, Palo Alto, CA, 94306, United States of America, rentrike@epri.com, Taiyou Yong, Pei Zhang

This paper presents a methodology to determine the energy and reserve schedules with consideration of power system uncertainties using a reserve requirement that is generated to meet both the system reliability and economic efficiency under system uncertainties. This study emphasizes the impact of the intermittent generation on the energy schedule and reserve determination, and so provides a new methodology for addressing emerging system issues with the emergence of renewable energy.

■ SB19

C-Room 28D, Upper Level

Network Signal Optimization

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Lihui Zhang, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States of America, zhanglh0@ufl.edu

1 - A Corridor Signal Optimization Model Based on the Enhanced Cell Transmission Model

Zichuan Li, University of Maryland, College Park, Dept of Civil & Environmental Engineerin, 1173 Glenn L. Martin Hall, College Park, MD, 20705, United States of America, lizichuan@gmail.com, Gang-Len Chang

This study presents a signal optimization model based on the enhanced cell transmission model. Some new features are proposed to the original Cell Transmission Model (CTM) model. Based on the proposed model, a signal optimization model is formulated. A Genetic Algorithm based solution method is proposed and a real site case study with light, moderate, and congestion traffic demands are provided with performance comparison using a third part simulation package, CORSIM.

2 - Domain Partitioned Hierarchical Network Traffic Management Concept and Methodology

Ying-Ying Ma, Tongji University, 4800 Cao'an Road, Department of Traffic Engineering, Shanghai, 201804, China, yingyma@email.arizona.edu, Xiao-Guang Yang, Yi-Chang Chiu

Urban network traffic management is a complex real-time system, especially signal control and route guidance. It is hard to get a global optimal solution in real-time in these systems. In this talk, we decompose the traffic network into sub-networks in a hierarchical structure to simplify the system and improve the reliability and flexibility of the management. Spectral method was used in domain partitioning and tested on a case study in a network of Guangzhou in China.

3 - A Simplified Shockwave-based Arterial Traffic-flow Model for Congested Signalized Networks

Xinkai Wu, PhD Candidate, Department of Civil Engineering, University of Minnesota, 500 Pillsbury Drive S.E., Minneapolis, MN, 55455, United States of America, wuxxx273@umn.edu, Henry Liu

We present a shockwave-based arterial traffic-flow model (SWAT). Unlike conventional models which discretize space into small intervals, SWAT treats links as sections, with traffic states simplified into free-flow, saturated, and jammed conditions. Traffic dynamics are analytically described by integrating flow conservation over a shockwave profile. SWAT significantly improves numerical efficiency, making it appropriate for large-network signal optimization and traffic assignment problems.

4 - Robust Signal Timing for Arterials under Day-to-Day Demand Variations

Lihui Zhang, University of Florida, 365 Weil Hall, Box 116580, Gainesville, FL, 32611, United States of America, zhanglh0@ufl.edu, Yingyan Lou, Yafeng Yin

This paper formulates a scenario-based stochastic programming model to optimize the timing of pre-timed signals along arterials with day-to-day demand variations. Based on a cell-transmission representation of traffic dynamics, cycle length, green splits and offsets are determined to minimize the expected delay incurred by high-consequence demand scenarios. A simulation-based genetic algorithm is proposed to solve the model. A numerical example is presented to verify and validate the model.

■ SB20

C-Room 28E, Upper Level

Heuristics for Vehicle Routing Problems II

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Frederic Semet, Professor, LAGIS, Ecole Centrale de Lille, Cité Scientifique - BP 48, Villeneuve d'Ascq, 59651, France, frederic.semet@ec-lille.fr

1 - Vehicle, Location, and Inventory Routing for Disaster Relief

Russell Bent, Scientist, Los Alamos National Laboratory, Mail Stop K488, P.O. Box 1663, Los Alamos, NM 87545, Los Alamos, NM, 87545, United States of America, rbent@lanl.gov, Pascal Van Hentenryck, Carleton Coffrin

Recent natural disasters such as the Indonesian tsunami and Hurricane Katrina have demonstrated a need for better disaster preparedness and response. We develop a new constraint-based local search that tightly integrates preparedness (supply pre-positioning) with distribution (routing). We demonstrate its effectiveness on location and inventory routing benchmarks with several improvements on the existing upper bounds. We apply the approach to the problem of potable water distribution.

2 - Routing Trucks in a Multi-Depot Snow Emergency Network: Formulation and Heuristic

Ali Haghani, Professor and Chairman, Department of Civil & Environmental Engineering, 1173 G Glenn Martin Hall, University of Maryland, College Park, MD, 20742, United States of America, haghani@umd.edu, Shahab Toobaie, Masoud Hamedi

This paper proposes a mathematical model and a Genetic Algorithm solution to multi-depot multiple-size truck snow routing problem. The objective is to minimize the number of trucks and deadhead miles subject to truck capacity, workload balancing and route continuity constraints. Numerical results of a real world problem are presented.

3 - The Multi-Period Multi-Zone Vehicle Routing Problem with Time Windows

Michel Gendreau, Professor, CIRRELT/Université de Montréal, C.P. 6128, succ. Centre-ville, Montréal, QC, H3C 3J7, Canada, michel.gendreau@cirrelt.ca, Teodor Crainic, Yuvraj Gajpal

We introduce a new variant of the Vehicle Routing Problem in which customers are divided into a number of zones. The customers of each zone must be served within tight time windows by dedicated routes originating at a specified zone depot. A key feature of the problem is that a vehicle can be used to cover routes in different zones at different times. The main objective is to minimize the overall number of vehicles required to serve all customers. Heuristics and bounds will also be presented.

4 - Hybrid Heuristics for the Capacitated Location-Routing Problem

Frederic Semet, Professor, LAGIS, Ecole Centrale de Lille, Cité Scientifique - BP 48, Villeneuve d'Ascq, 59651, France, frederic.semet@ec-lille.fr, Celia Boulanger

The capacitated location-routing problem (CLRP) consists of determining locations for depots from which customers are served on routes with the objective of minimizing the overall cost. In the CLRP capacity restrictions for the depots and the vehicles are imposed. We propose hybrid heuristics in which location problems and routing problems are solved repeatedly. Computational results show that the most efficient approaches compete favorably with the best heuristic previously described.

■ SB21

C-Room 30B, Upper Level

Air Traffic Management 2

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: David Lovell, Associate Professor, University of Maryland, Department of Civil Engrg., 1173 Martin Hall, College Park, MD, 20742, United States of America, lovell@umd.edu

1 - A Dynamic Stochastic Model for the Air Traffic Flow Management Problem

Yudong Chen, University of Texas at Austin, 1 University Station, C0806, Austin, TX, 78712, United States of America, ydchen@mail.utexas.edu

We describe a dynamic stochastic integer program for the general Air Traffic Flow Management problem. In our model, arrival capacities, departure capacities and air sector capacities are subject to uncertainty, and ground and airborne holding decisions are made sequentially based on updated information. We also develop computational techniques which enable us to solve large scale instances with several thousand flights, demonstrating feasibility to practical problems.

2 - Comparison of Strategies for Collaborative Rerouting in the Airspace Flow Program

Amy Kim, Student, UC Berkeley, 109 McLaughlin Hall, Berkeley, CA, 94720, United States of America, amy_kim@berkeley.edu, Mark Hansen

The Airspace Flow Program addresses demand/capacity imbalances due to constraints in en route airspace. The program is currently set up such that the FAA controls delayed departure times but does not initially control rerouting. As demands increase, it will be beneficial to centralize rerouting allocations to maximize use of available capacity. This research attempts to the most effective methods of minimizing user costs in an AFP initiative that employs both rerouting and ground delays.

3 - Stochastic National Airspace System (NAS) Flow Analysis Model
Nastaran Coleman, Sr. Operations Research Analyst, Federal Aviation Administration, 800 Independence Ave, SW, Washington, DC, 20591, United States of America, nastaran.coleman@faa.gov

Combining Monte Carlo simulation and linear programming, modeled NAS including all its airports, fixes and routes as a network. Determined average NAS capacity. This model can be used to evaluate potential benefits or disadvantages of various natural and artificial interventions more accurately compared to the previous deterministic model. Examples include reducing en-route separation standards, increasing airport capacities, smoothing traffic, and disruptive weather phenomena

4 - Modeling the Impact of Super Heavy Transport on Surface Movement
Shin-Lai Tien, Graduate Research Assistant, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, alextien@umd.edu, David Lovell

Aircraft like A380 super heavy transports (SHT) are expected to increase complexity in airport surface operations and induce additional taxiing delay to flights operating in their time proximity. Statistical analyses confirm the impact of A380 operations on taxiing activities at U.S. airports. To simulate the next generation air traffic control environment, several cases where an SHT could potentially influence other surface movements are identified and their modeling approaches are proposed.

■ SB22

C-Room 30C, Upper Level

Public Transit II: Equity, Availability and Assignment

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Nicholas Lownes, Assistant Proessor, University of Connecticut, 261 Glenbrook Rd, Unit 2037, Storrs, CT, 06268, United States of America, nlownes@engr.uconn.edu

1 - Incorporating Environmental Justice & Equity Metrics in Transit Network Design
Erin Ferguson, Graduate Researcher, University of Texas at Austin, Department of Civil, Arch., & Env. Engin., 1 University Station C1761, Austin, TX, 78712, United States of America, ferguson.em@gmail.com, Jennifer Duthie, Avinash Unnikrishnan, Travis Waller

The focus of this work is to develop a mathematical programming formulation, which incorporates equity and environmental justice metrics into the transit network design problem. The formulation will be able to accommodate several different optimization goals addressing equity issues such as access to services based on distance and travel time and access to multiple service options. Heuristics will be developed to solve the problem and the performance will be compared on realistic test networks.

2 - Integrated Control Strategies of Vehicle Holding and Boarding Limits with Real Time Information
Felipe Delgado, Pontificia Universidad Catolica de Chile, Vicuña Mackenna 4860, Macul, Casilla 306, Santiago, Chile, fadelgab@ing.puc.cl, Aldo Cipriano, Ricardo Giesen, Juan Carlos Muñoz

This work discuss the conditions under which limiting the maximum number of passengers to board a bus can be more beneficial by extending a real time mathematical programming model of buses, developed by Delgado et al (2009), to allow for only holding strategy. The results show that, in scenarios of high passenger demand and short bus headway operations, strategies that combine holding and boarding limits perform significantly better than just holding.

3 - The Social Accessibility of Transit Network Design
Nicholas Lownes, Assistant Proessor, University of Connecticut, 261 Glenbrook Rd, Unit 2037, Storrs, CT, 06268, United States of America, nlownes@engr.uconn.edu

The social impacts of transit network design go beyond providing service to captive users. Transit systems influence the way people interact, the choices they make regarding employment and residence location and how they view their community. This paper takes a look at several social accessibility metrics in the context of transit network design and contrasts their results with the traditional network design paradigms focusing on operator costs and travel time.

4 - Emergency Transportation for Low-Mobility Groups
Mark Hickman, University of Arizona, Tucson, AZ, mhickman@email.arizona.edu, Chi Pak Chan

During emergencies, low-mobility groups face greater risk and exposure. It is important to consider their needs in assigning vehicles to pick them up and transport them to safe locations. This is formulated as a combination of a static location problem and a dynamic vehicle routing problem. We present these models and illustrate how they might be used to support decisions in providing emergency mobility.

■ SB23

C-Room 30D, Upper Level

Business Mission Area - Process Improvement

Sponsor: Military Applications Society
Sponsored Session

Chair: Tim Elkins, Department of Systems Engineering, United States Military Academy, Bldg 752, 422 Mahan Hall, West Point, NY, 10996, United States of America, timothy.elkins@usma.edu

1 - Data Quality Management for the U.S. Army
Doug Matty, LTC, MIT / US Army, dmatty@mit.edu, Richard Wang

Principles to achieve business transformation are grounded on the integration of business processes and process replication. This requires data quality. This paper presents management principles as part of the MIT Information Quality Program. The principles include identification of stakeholder roles, data quality metrics and a maturity assessment framework. These data quality approaches provide the necessary data for enterprise analytics to enable transformation efforts.

2 - End-to-End Business Processes as a Measure for Cost and Performance
Thomas Lennox, Business Transformation Agency, Department of Defense, 1851 South Bell St., Alexandria, VA, thomas.lennox@bta.mil

In today's DOD stove pipe world where we develop multiple function specific ERP's, the use of these processes as an analysis tool identifies gaps in implementation strategies and the potentiall significant costs incurred as a result of creating interfaces to close the gaps in the process. Using these processes in the analysis of ERP implementations, measurable probabilities of successful system implementation both from a sustainment cost and performance standpoint are obtained.

3 - Lean Six Sigma Methodology Being Taught to Cadets at the United States Military Academy
Donna Korycinski, Asst. Professor / EM Program Dir., USMA, Bldg 752, Dept of Sys Eng, West Point, NY, 10996, United States of America, donna.korycinski@usma.edu

In 2005, the U.S. Army mandated the implementation of Lean Six Sigma to realize process efficiency and to reap monetary savings. This methodology is taught to interested cadets in the Department of Systems Engineering at the United States Military Academy during the year-long capstone experience; the cadets receive U.S. Army Green Belt certification upon project completion. Teams of cadets have assisted the Deployed Warrior Medical Management Center in Landstuhl, Germany for the past two years.

4 - Injection of RAM Modeling & Assessment into Armored Combat System Optimization Modeler (ACSOM)
Steve Rapp, General Dynamics Land Systems, 38500 Mound Road, Sterling Heights, MI, 48310, United States of America, rapps@gdls.com, Greg Hartman, Ratna Babu Chinnam, Alper Murat

ACSOM mathematically optimizes system models using multi-criteria mathematical optimization. Prior to this study subsystem reliability estimates were used in a series structure assuming constant hazard rate and mature technology. However, RAM is inherently non-linear and needs to be assessed with Growth Potential and Lifecycle Cost. In this study, we improved ACSOM's RAM modeling by injecting DFR earlier into the PD cycle.

■ SB24

C-Room 30E, Upper Level

Manpower Modeling I

Sponsor: Military Applications Society
Sponsored Session

Chair: Mary Lou Hall, Lieutenant Colonel, ORSA, Army Deputy Chief of Staff for Personnel, G-1, Plans and Resources Directorate, Military Manpower Plans and Analysis Division, Enlisted Program Branch, 4760 N 40th Street, Arlington, VA, 22207, United States of America, marie.hall@us.army.mil

1 - System Dynamics Modeling of Army Officer Lifecycle Management
Daniel McCarthy, Lieutenant Colonel, US Army, Director, Systems Engineering and Operations Research Program, United States Military Academy, Dept of Systems Engineering, Department of Systems Engineering, Mahan Hall, Rm 419, West Point, NY, 10996, United States of America, Daniel.McCarthy@usma.edu

With the transition of the Army to the Brigade Combat Team (BCT) concept, the requirement for Captains and Majors grew significantly. The Army has made changes to the officer accession program and the officer retention program in an effort to close this gap. This research effort uses a System Dynamics approach to model the life cycle of an officer's career at the individual and aggregate level in order to better understand the short and long term impact of these changes.

2 - Personnel Friction in the Army Manning System

Mary Lou Hall, Lieutenant Colonel, ORSA, Army Deputy Chief of Staff for Personnel, G-1, Plans and Resources Directorate, Military Manpower Plans and Analysis Division, Enlisted Program Branch, 4760 N 40th Street, Arlington VA 22207, United States of America, marie.hall@us.army.mil, Jake LaPorte

If the Army has more people than it has spaces, how can units in the field be experiencing shortages at particular grades and specialties? Friction is defined as the misalignment of personnel inventory to the authorized force structure by grade, specialty and location. The purpose of this study is to measure the historical friction levels in order to determine the factors that affect these levels and produce a model that will predict friction subject to certain policy decisions.

3 - Modeling the Army Officer Manpower Program in an Evolving Environment

Andrew Hall, Assistant Professor, United States Military Academy, Department of Mathematical Sciences, 4760 N 40th Street, Arlington VA 22207, United States of America, andrew.o.hall@us.army.mil, Kerry Moores, Dan Shrimpton

Officer strength forecasts are critical to the Army for programming resources, predicting readiness, and analyzing policy. The officer manpower model factors in historical accessions, attrition, promotions, as well as laws and policies that impact officer strength. This research details the changing composition of the officer corps, model adaptations and impact on analysis in order to most accurately forecast officer strength.

4 - Retention Modeling Mechanisms to Prescribe Optimal Retention Targets by Skill, Grade and Expiration

Jay April, Chief Development Officer, OptTek Systems, Inc., 1919 Seventh Street, Boulder CO 80302, United States of America, april@opttek.com, Jose Ramirez

The Army's Personnel Inventory Program is currently developed by projecting losses based on historic retention behavior and optimally scheduling accessions and promotions. This approach largely assumes Retention behavior is a constraint. However, due to the state of the nation's economy, the Army has experienced lower than expected Losses . Here we develop a formulation that determines optimal retention targets by skill, grade and ETS Cohort.

■ SB25

C-Room 31A, Upper Level

Advances in Material Handling and Storage Systems

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Kevin Gue, Associate Professor, Auburn University, Department of Industrial and Systems Eng, Auburn, AL, 36849, United States of America, kevin.gue@auburn.edu

1 - Shared Storage Assignment Policy in a Compact Storage System

Nima Zaerpour, PhD Candidate, T10-46- RSM Erasmus University, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, NZaerpour@rsm.nl, Rene De Koster, Yugang Yu

This paper studies how to store pallets in a compact storage system in order to minimize the makespan for retrieving pallets. The system stores pallets multi deep. In practice, dedicated storage is used; every storage lane in the system stores only one product type to avoid reshuffling. This paper proposes a mathematical model considering a shared storage policy. The policy allows different product types to share the same lanes. A heuristic algorithm is proposed to solve large-scale problems.

2 - Decentralized Control for Material Handling Systems

Kai Furmans, Kai.Furmans@ifl.uni-karlsruhe.de, Frank Schönung, Stephan Mayer

Material Handling Systems are currently controlled by one or more layers of Controllers. This makes it tedious and risky to change those system in a running system. A new approach will be presented, which proposes a modular system of conveyors which are coordinated by a new protocol. This protocol ensures the necessary functionality by maintaining the decentralized character of the material handling system and providing the necessary informattion for topology and traffic.

3 - Flexible Bay Facility Layout by Ant Colony Search

Sadan Kulturel-Konak, Associate Professor, Penn State Berks, Management Information Systems, Reading, PA, 19610, United States of America, sadan@psu.edu, Abdullah Konak

An ant colony optimization (ACO) approach is proposed to solve the Facility Layout Problem (FLP) with unequal area departments and flexible bays which is a very common layout in many manufacturing and retail facilities. Optimal approaches to the FLP can only solve problems with a limited number of departments. The proposed ACO approach was tested on problems from the literature with up to 62 departments, and results are compared with the previously best known solutions.

4 - A Warehouse Without Aisles

Kevin Gue, Associate Professor, Auburn University, Department of Industrial and Systems Eng, Auburn, AL, 36849, United States of America, kevin.gue@auburn.edu, Kai Furmans

We describe a new high-density storage and material movement scheme that forms and collapses aisles as needed to retrieve or store items. The design effectively reduces the overall space devoted to aisles, but without the normal drawbacks of deep lane storage. We also provide some promising comparisons with traditional rack-in-aisle automated storage and retrieval systems.

■ SB26

C-Room 31B, Upper Level

Joint Session AAS/RM/TSL: Alliances, Revenue Management, and Robust Scheduling

Sponsor: Aviation Applications, Revenue Management & Transportation Science and Logistics
Sponsored Session

Chair: Milind Sohoni, Indian School of Business, India, milind_sohoni@isb.edu

1 - A Revenue Management Model for Joint Capacity Allocation and Overbooking over an Airline Network

Sumit Kunnumkal, Indian School of Business, AC4, Level 1, 4116, Hyderabad, AP, 500032, India, sumit_kunnumkal@isb.edu, Huseyin Topaloglu

We describe a revenue management model to jointly make the capacity allocation and overbooking decisions over an airline network. Our solution approach is based on building a approximation to the penalty cost that is separable by the numbers of reservations for the different itineraries. We present computational experiments that compare our approach with some standard benchmarks.

2 - Code Sharing

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu

In this paper we develop an optimization model the helps an airline decide on which flights in its network to code-share with its partner airlines. In this optimization model we consider demand cannibalization across the entire network, i.e., across all the markets served, when the airline opens a set of flights for codesharing. We use real data from a large airline to test our model and derive insights.

3 - Capacity-price Competition in Networks

Roger Lederman, Columbia Business School, New York, United States of America, rlederman13@gsb.columbia.edu, Nicolas Stier-Moses, Garrett van Ryzin

We model competition in markets with overlapping products, as in the case of airline flight legs included in multiple itineraries. The intensity of competition depends on the interactive effects between connected markets, as well as between each firm's product offerings. We analyze the flexibility of capacity across products, and study the equilibrium prices.

4 - An Empirical Investigation of Airline Flight Schedule Robustness

Mazhar Arikan, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States of America, marikan@purdue.edu, Milind Sohoni, Vinayak Deshpande

Flight delays have come under increased scrutiny lately, with on-time performance at one of its worst levels in 2007. In the first part of this study, we combine data published by BTS, with the newsvendor framework from the OM literature to examine the impact of the scheduled block time on overall service level. Specifically, we analyze the impact of flight block-times and aircraft turn-times on the schedule's robustness based on aircraft routings.

■ SB27

C-Room 31C, Upper Level

Joint Session Simulation/QSR: Quality and Reliability Methods in Simulation

Sponsor: INFORMS Simulation & Quality, Statistics and Reliability Sponsored Session

Chair: K. Preston White, Jr., Professor, University of Virginia, P.O. Box 400747, 151 Engineers' Way, Charlottesville, VA, 22904-4747, United States of America, kpwhite@virginia.edu

1 - Verification of Design Requirements Using Monte Carlo Simulation and Variables Acceptance Sampling

K. Preston White, Jr., Professor, University of Virginia, P.O. Box 400747, 151 Engineers' Way, Charlottesville, VA, 22904-4747, United States of America, kpwhite@virginia.edu

Attributes acceptance sampling has been adapted to develop sampling plans for the verification of probabilistic design requirements using Monte Carlo simulation. While this approach has many advantages, attributes plans prescribe a large number of trials when requirements demand both high system reliability and high statistical confidence. In this paper we report on continuing research to develop smaller plans by adapting a related technique called acceptance sampling by variables.

2 - "Selection of the Best" Highly Reliable Simulation Model

Roy Creasey, Assistant Professor, Longwood University, College of Business and Econ, 201 High Street, Farmville, VA, 23909, United States of America, creaseyrr@longwood.edu, K. Preston White, Jr., Linda Wright, James Haug

SOTB problems are frequently encountered in Discrete Event Simulation. While much of the work has focused on expected performance analysis methods, their use for highly reliable models can lead to biased results. Also, a large number of observations in a replication or many replications are necessary. This research uses concepts from binomial theory to determine which of k>1 highly reliable models best meet the standard with a user-defined indifference zone and probability of correct selection.

3 - Risk Informed Resource Allocation for Navy Fire and Emergency Services

Ronald Woodaman, Principal Analyst, Innovative Decisions, Inc., 1945 Old Gallows Road, Suite 207, Vienna, VA, 22182, United States of America, rwoodaman@innovativedecisions.com, Carl Glover, Robert Liebe

The U.S. Navy Fire and Emergency Services Program expends over $300M a year to sustain a force of 420 apparatus and 3600 personnel in 185 fire stations and 56 fire departments around the globe. The Navy requires all budget submissions to be supported by accredited models, which must link requirements to resources at varying levels of risk tolerance. The authors describe the FESPOM model, which resources the Navy's fire departments by inherent risk levels and level of risk tolerance.

4 - Risk-Based Requirements and Resourcing for the Navy's Fire and Emergency Services Program

Ronald Woodaman, Operations Research Analyst, C4I Center, George Mason University, 4400 University Dr, Fairfax, VA, 22030, United States of America, rwoodama@gmu.edu, Carl Glover, Robert Liebe

The U.S. Navy Fire and Emergency Services Program expends over $300M a year to sustain a force of 420 apparatus and 3600 personnel in 185 fire stations and 56 fire departments around the globe. The Navy requires all budget submissions to be supported by accredited models, which must link requirements to resources at varying levels of risk tolerance. The authors describe the FESPOM model, which resources the Navy's fire departments by inherent risk levels and level of risk tolerance.

■ SB28

H-Room 500, Fifth Floor

Behavioral Issues in Revenue Management

Sponsor: Revenue Management and Pricing Sponsored Session

Chair: Yuri Levin, Queen's University, Queen's School of Business, Kingston, ON, K7L 3N6, Canada, ylevin@business.queensu.ca

1 - Dynamic Pricing in the Presence of Strategic and Loyal Consumers

Benny Mantin, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L3G1, Canada, bmantin@engmail.uwaterloo.ca, Daniel Granot

We study a two-period dynamic pricing in the presence of both myopic and strategic consumers, where each type could be either loyal or opportunistic. While loyal consumers revisit the same retailer in the second period, opportunistic consumers switch to a competing retailer. We characterize the pricing scheme and the conditions under which strategic consumers purchase is deferred to the second period. We find that opportunistic behavior is not always the preferred outcome by strategic consumers.

2 - Speculative Behavior in a Queue

Andres Catalan, Doctoral Candidate, The Wharton School, University of Pennsylvania, 3730 Walnut St, #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, andresc@wharton.upenn.edu, Gerard Cachon, Senthil Veeraraghavan

Not all the customers waiting for a service actually want the service: sometimes people queue solely to make a profit from customers. We analyze the behavior of a speculator in a single queue that sells his position to the arriving customers. We find the price he will request and derive different thresholds in terms of queue length, system utilization and the speculator's waiting costs that lead him to behave speculatively (i.e. to hold his position and wait) to maximize his profit.

3 - Selling an Asset with Unknown Quality to Partially Informed Potential Buyers

Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu

In this talk, I characterize the optimal pricing strategy for selling one asset (like a house) whose true value is unknown, to a stream of potential buyers that all have some noisy information about the true value and observe the full price history.

4 - Why Incorrect Models Forecast Better and Price Worse

Steven Shugan, Russell Berrie Eminent Scholar and Professor, University of Florida, 201 Bryan Hall Campus Box 117155, Gainesville, FL, 32611, United States of America, Steven.Shugan@cba.ufl.edu

This paper shows that incorrect models will provide better demand forecasts. Hence, over time, revenue management systems will favor incorrect models when systems are judged based on predictive accuracy. However, because the underlying model does not reflect true buyer price sensitive, pricing decisions will be incorrect. Consequently, predictive accuracy alone is insufficient to judge whether one system is better than another.

■ SB29

H-Room 501, Fifth Floor

Transmission Expansion Planning in Power Systems

Sponsor: Energy, Natural Res & the Environment/Energy Sponsored Session

Chair: Enzo Sauma, Dr., Pontificia Universidad Catolica de Chile, Santiago, Chile, esauma@ing.puc.cl

1 - A Two-tier Matrix Game Approach for Obtaining Joint Bidding Strategies in FTR and Energy Markets

Tapas Das, Professor, University of South Florida, Department of Industrial Eng, Tampa, FL, 33620, United States of America, das@eng.usf.edu, Patricio Rocha, Ehsan Salimi

Financial transmission rights (FTRs) allow the ISO to redistribute congestion revenue. Generators and loads bid for FTRs to hedge against congestion charges. Since the revenues from the FTR and energy markets are interdependent, each generator/load should have a joint bidding strategy for FTR and energy markets to maximize its total payoff. This paper presents a two-tier matrix game model to obtain these joint bidding strategies. We conduct a numerical validation by analyzing a 3 node network.

2 - Market-Driven Dynamic Transmission Expansion Planning
Javier Contreras, Associate Professor, Universidad de Castilla-La Mancha, E.T.S. de Ingenieros Industriales, Ciudad Real, Spain, Javier.Contreras@uclm.es, José A. Aguado, Sebastiàn de la Torre, Alvaro Martìnez

Transmission expansion plays a key role in successful electricity markets because flawed expansion plans may create inefficiencies and dampen competition. One important aspect in the formulation of transmission expansion problems is the consideration of dynamic constraints that link decisions over different periods of the planning horizon. This presentation analyzes an efficient formulation of a dynamic transmission expansion problem in competitive pool-based electricity markets.

3 - Transmission Investment under Uncertainty: The Case of Germany-Norway
Ane Marte Heggedal, PhD-Student, Norwegian University of Science and Technology (NTNU), Alfred Getz vei 3, Trondheim, 7491, Norway, ane.m.heggedal@iot.ntnu.no, Afzal Siddiqui, Stein-Erik Fleten

Price differences between neighboring regions and countries motivate in part the construction of large transmission lines. Analysis of such investment are complicated the fact that we have uncertainty in prices and exchange rates, and also by the fact that the price differences between the regions become smaller after the transmission line has been put into operation. We perform a real options analysis of a merchant investor holding an exclusive license to build.

4 - Transmission Expansion under Uncertainty in Generation
Enzo Sauma, Dr., Pontificia Universidad Catolica de Chile, Santiago, Chile, esauma@ing.puc.cl, Jorge Vera, Fernando Traub

Power transmission systems may present many kinds of uncertainties that make hard a long-term planning of investments. These uncertainties are not only concerning demand, but also prices, generation capacities, faults, losses and operation system timing, among others. In this research work, we propose a grid planning methodology that considers generation capacity uncertainty. Specifically, we consider the uncertainty in the time when a power generator is plugged into the grid.

■ SB30

H-Room 502, Fifth Floor

Green Energy II

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Panos Pardalos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, pardalos@ufl.edu

Co-Chair: Niko Iliadis, EnerCoRD, Plastira Street 4, Nea Smyrni, Athens, 171 21, Greece, niko.iliadis@enercord.com

Co-Chair: Steffen Rebennack, PhD Candidate, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, steffen@ufl.edu

1 - Optimization of Conventional and Renewable Generator Dispatch
Jennifer Van Dinter, Graduate Student, Colorado School of Mines, 1500 Illinios Street, Golden, CO, 80401, United States of America, jvandint@mines.edu, James Milford, Donal O'Sullivan, Alexandra Newman

One challenge of integrating solar and wind energy into the electric grid is overcoming the intermittency of wind and solar resources by optimally dispatching conventional generating units and electricity storage devices. We develop a mixed integer program to minimize the insular system's fuel costs, while considering ramping limitations of conventional generators, the need for scheduled preventive maintenance outages, and the curtailment of solar and wind generators.

2 - Energy Policy Optimization Using Dirichlet Process Mixtures of Generalized Linear Models
Lauren Hannah, Princeton University, Department of ORFE, Sherrerd Hall, Charlton St., Princeton, NJ, 08540, United States of America, lhannah@Princeton.EDU, Warren Powell

Often, energy providers must make decisions when the optimal decision depends on a large, exogenous state variable. We use an online learning, Bayesian nonparametric framework to model the response (observed cost or revenue) as function of the decision and state. We apply our methods to an hourly wind supply commitment problem, where the commitment must be made using previous wind levels and spot market prices.

3 - Game Theoretic Analysis of Research Consortia for Tackling Climate Change
Gireesh Shrimal, Assistant Professor, Indian School of Business, Hyderabad, India, Gireesh_Shrimali@isb.edu

We look at industry consortia to develop technology where only a firm can utilize the technology, and characterize three regions. In the first, all firms join the consortia, whereas no firms join in the second. In the third both of these outcomes are possible. Second, we look at nation consortia, where even a non-member benefits, and again characterize three regions. Though the first two regions are the same as before, only a fixed number of nations join in the remaining one.

4 - Expert Judgments on Prospects for Cellulosic Biofuel Technology
Jeff Keisler, Associate Professor, UMass Boston, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, Jeff.Keisler@umb.edu, Erin Baker

A promising direction in energy technology is to create fuels from cellulosic biomass feedstock. We elicited judgments from experts on the likelihood of achieving various performance targets with biofuels under a range of research funding scenarios. A methodological challenge was structuring these elicitations in a way that would lead to meaningful results for purposes of modeling economic value of the technology portfolio.

■ SB31

H-Room 503, Fifth Floor

Tutorial on Interfaces of Revenue Management with Operations and Marketing

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Yossi Aviv, Professor of Operations Management, Washington University in St. Louis, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States of America, AVIV@WUSTL.EDU

1 - Tutorial on Interfaces of Revenue Management with Operations and Marketing: Strategic Consumer Behavior
Yossi Aviv, Professor of Operations Management, Washington University in St. Louis, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States of America, AVIV@WUSTL.EDU

Dynamic pricing and revenue management practices are gaining increasing popularity in the retail industry, and have engendered a large body of Management Science research. When applying dynamic pricing systems, retailers must account for the fact that, often, strategic customers may time their purchases in anticipation of future discounts. Such strategic consumer behavior might lead to severe consequences on the retailers' revenues and profitability. In recent years, researchers have developed mathematical models to explore various approaches for mitigating the adverse impact of this phenomenon. We will survey this body literature in this talk.

■ SB32

H-Room 504, Fifth Level

Risk Management: Models and Analysis

Cluster: Financial Engineering
Invited Session

Chair: Jeremy Staum, Northwestern University, Department of IEMS, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, j-staum@northwestern.edu

1 - Exact Simulation of Point Processes with Stochastic Intensities
Kay Giesecke, Assistant Professor, Stanford University, Management Science and Engineering, Stanford, CA, United States of America, giesecke@stanford.edu

Point processes with stochastic intensities can be simulated from standard Poisson arrivals by time-scaling with the cumulative intensity, whose path is typically generated with a discretization method. However, discretization introduces bias into the simulation results. This paper proposes a projection method for the exact simulation of point processes with stochastic intensities. It is illustrated for a point process whose intensity follows an affine jump-diffusion process.

2 - Too Interconnected to Fail: Contagion and Systemic Risk in Financial Networks
Rama Cont, Associate Professor, Columbia University, 500 W. 120th Street, New York, NY, 10027, Rama.Cont@columbia.edu

The financial crisis has underlined the importance of systemic risk and the lack of adequate indicators for quantifying it. We propose an indicator for the systemic importance of a financial institution which combines default correlation from common factors with direct contagion via counterparty exposures. We study the impact of network structure, leverage ratios and the role of credit default swaps in systemic risk.

3 - Implied Copula CDO Pricing Model: Entropy Approach
Alex Veremyev, PhD Student, University of Florida, 303 WEIL HALL, Gainesville, FL, 32611, United States of America, averemyev@ufl.edu, Tyrrell Rockafellar, Alex Nakonechnyi, Stan Uryasev

A so-called implied copula CDO pricing model is considered for calibrating obligor hazard rates. To find the probability distribution of the hazard rates we propose an entropy approach to the implied copula model. The distribution is found by maximizing entropy with no-arbitrage constraints based on bid and ask prises of CDO tranches. To reduce the noise a new class of CCC distributions is introduced. A case study shows that the entropy approach has a stable performance.

4 - Estimating Expected Shortfall with Stochastic Kriging

Ming Liu, Ph.D. Candidate, Northwestern University, 2145 Sheridan Road, Room C231, Evanston, IL, 60208, United States of America, ming-liu@northwestern.edu, Jeremy Staum

We present an efficient two-level simulation procedure which uses stochastic kriging, a metamodeling technique, to estimate expected shortfall. The outer level simulates financial scenarios and the inner level of simulation estimates the portfolio value given a scenario. Because expected shortfall involves the scenarios that entail the largest losses, our procedure allocates more computational effort to inner-level simulation of those scenarios, which also improves computational efficiency.

■ SB33

H-Room 505, Fifth Floor

Technology Change Management for Sustainability

Sponsor: Technology Management
Sponsored Session

Chair: Hsueh-Ming Wang, University of Alaska Anchorage, ESPM Department 3211 Providence Dr, Anchorage, AK, United States of America, afhsw1@uaa.alaska.edu

1 - Replacement Analysis of Small Off-Grid Nuclear Reactors

Lei Yao, University of Alaska Anchorage, 3901 Old Seward Highway, Anchorage, AK, 99503, United States of America, asly4@uaa.alaska.edu, LuAnn Piccard, Hsueh-Ming Wang

This research will focus on replacement analysis of ageing diesel generator systems in rural off-grid Alaskan communities. Marginal cost and annual equivalence analysis will be used to establish multiple-objective decision making process selection criteria to minimize life cycle cost, environmental impact, and disposal risk for small nuclear power generation systems.

2 - Patent Mapping for Forecasting the Technology Change of Light Emitted Diode (LED) Streetlights

LuAnn Piccard, Instructor, University of Alaska Anchorage, ESPM 3211 Providence Dr., Anchorage, AK, 99508, United States of America, aflp@uaa.alaska.edu, Hsueh-Ming Wang, Lei Yao

LED lamps are costly but energy efficient lighting systems. This research focuses on the application of the white LEDs used in streetlight applications, and investigates the morphology of LED patents including diode, bulb, structure, heat, fixture, and intelligent systems. The results demonstrate how local technology applications can foster global cooperation.

3 - Optimization Analysis of Warranty for the Technology Change of LED Streetlights

Oleg Bukhtiyarov, University of Alaska Anchorage, 727 Elm Street, 674, Anchorage, AK, 99501, United States of America, linousa@mail.ru, Hsueh-Ming Wang, LuAnn Piccard

LED streetlights may economically replace the traditional streetlights. The fast change of the streetlight technology causes the difficulty of determination of the warranty period. Forecasting based on stochastic iterations/infinitive modeling with dynamic change of product quality provides a warranty strategy for the market that maximizes their profit over time.

4 - Optimal Analysis of a Hybrid Solar-Wind Power Generation System with LPSP Technology for LED Lighting

Hsueh-Ming Wang, University of Alaska Anchorage, ESPM Department 3211 Providence Dr, Anchorage, AK, United States of America, afhsw1@uaa.alaska.edu, LuAnn Piccard, He Liu

This research explores a self-contained system using the renewable energy sources such as wind and solar and an energy saving load. Proposed is an algorithm to optimize the design of hybrid solar-wind power generation systems with Loss of Power Supply Probability (LPSP) technology for Light-Emitting Diode (LED) lights.

■ SB34

H-Room 520, Fifth Floor

Environmental Legislation and Green Supply Chain Management

Cluster: Green Supply Chain
Invited Session

Chair: Eda Kemahlioglu-Ziya, University of North Carolina- Chapel Hill, CB # 3490, Chapel Hill, NC, United States of America, Eda_KemahliogluZiya@unc.edu

Co-Chair: Terry Taylor, Associate Professor, Haas School of Business, U.C. Berkeley, Berkeley, CA, 94611, United States of America, taylor@haas.berkeley.edu

1 - Competitors as Whistle-blowers in Enforcement of Product Standards

Erica Plambeck, Stanford Graduate School of Business, Memorial Way, Stanford, CA, 94305, United States of America, elp@stanford.edu

Under a product standards (eg RoHS, REACH) firms have an incentive to test competitors' products, reveal violations to the regulator, and thus gain market share. Often, regulators should rely entirely on competitive testing. Then, each firm's compliance effort increases with its product quality and with market concentration. In the long run, entry by small, low-quality firms and reduced quality investment will weakens compliance.

2 - Structural Efficiency in Take-Back Legislation

Atalay Atasu, Georgia Institute of Technology, Atlanta, GA, United States of America, Atalay.Atasu@mgt.gatech.edu, Oznur Ozdemir, Luk Van Wassenhove

We investigate the economics of two commonly implemented take-back legislation models: recycling fees and recycling rate mandates. We measure the efficiency of the two models from the perspectives of consumers, manufacturer(s), and the social planner for monopolistic and competitive environments and extend our analysis to possible scenarios with an externality of take-back rate assurance.

3 - Technology Choice and Emissions Flexibility in a Carbon Economy

David Drake, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, David.Drake@insead.edu, Paul Kleindorfer, Luk Van Wassenhove

Some 12,000 facilities in Europe now fall under a cap and trade system for carbon emissions. Technology choices for these facilities determine not only capacity and operating cost, but also firms' emissions profile. This paper extends the diverse technology literature to study capacity decisions under carbon regulation in build-to-order and build-to-stock environments. We characterize the optimal risk-neutral profit, emissions, and service level; comparing these to various heuristic approaches.

4 - Complying with Take-Back Legislation: A Cost Comparison and Benefit Analysis of Compliance Schemes

Eda Kemahlioglu-Ziya, University of North Carolina - Chapel Hill, CB # 3490, Chapel Hill, NC, United States of America, Eda_KemahliogluZiya@unc.edu, Gokce Esenduran

We compare three compliance schemes (i.e. individual, collective and collaborative) that producers follow to comply with take-back legislations. We model each scheme as a two-stage Nash game and find the key market/operating conditions that make one scheme preferable to the others. However the most cost effective scheme may fall short on environmental benefits that the legislation is trying to achieve. Thus we also identify how collection/treatment levels compare between the three schemes.

■ SB35

H-Sapphire A, Fourth Floor

Stochastic Disease Modeling and Decision Making

Sponsor: Health Applications
Sponsored Session

Chair: Shengfan Zhang, North Carolina State University, Campus Box 7906, College of Engineering, Raleigh, NC, 27695, United States of America, szhang5@ncsu.edu

1 - Estimating the Likelihood of Cancer Progression for Prostate Cancer

Alex Tsodikov, Professor of BIostatistics, University of Michigan, 1420 Washington Heights, Ann Arbor, MI, 48109, United States of America, tsodikov@umich.edu

Nowadays a lot of cancers are over-diagnosed and do not need treatment. The key question of disease management is whether cancer would progress if left untreated. Since few if any patients are left untreated on diagnosis, the disease progression within the subject is unobserved. Statistical approaches to the problem are discussed, and the methodology is applied to estimate the likelihood of cancer progression from cancer registry SEER data.

2 - Estimating the Likelihood of Cure From Lung Cancer

Ray Lin, PhD Candidate, Stanford University, 1201 Welch Road, Room P284, Stanford, CA, CA94305, United States of America, raylin@stanford.edu, Sylvia Plevritis, Bronislava Sigal

Lung cancer is the leading cause of cancer death, yet screening is not recommended. A stochastic model of the natural history of lung cancer was developed to estimate the relationship between the size of the primary tumor and the likelihood of cure. Model parameters were estimated using survival data from SEER cancer registry and validated on Mayo Lung Project. Our findings indicate that most lung cancer patients may be cured if the primary tumor is detected and treated in the millimeter-range.

3 - Modeling Disease Spreading on Networks

Lauren Gardner, University of Texas at Austin, Austin, TX, lmgardner@mail.utexas.edu, David Fajardo, Travis Waller

The spread of infectious diseases is an inherently stochastic process. Real time control and prediction methods present a huge challenge due to the dynamic and stochastic nature of the problem combined with imperfect information. The focus of this work is on the development of a stochastic network model that can be used for predicting disease propagation through a population, and evaluating potential real-time intervention strategies.

4 - Inverse Breast Cancer POMDP Model

Kuang-Hao Yeh, North Carolina State University, Daniels Hall, NCSU, Raleigh, NC, 27695, United States of America, kyeh@unity.ncsu.edu

The identification of an optimal screening policy requires an understanding of the cost (monetary and quality of life) of breast cancer. We develop a POMDP model of breast cancer assuming that the current screening recommendation is optimal and perform an inverse algorithm to find the implied reward function associated with the current policy.

5 - Modeling Mortality Probabilities for Breast Cancer Patients Using Screening Registry Data

Shengfan Zhang, North Carolina State University, Campus Box 7906, College of Engineering, Raleigh, NC, 27695, United States of America, szhang5@ncsu.edu, Julie Ivy, Kathleen Diehl

We use population-based Carolina Mammography Registry Data to estimate mortality probabilities for breast cancer patients. A competing risks model is developed to estimate breast cancer, comorbidity, and all other causes death probabilities as a function of patient age, race, stage at diagnosis and screening behaviors. Left censoring is incorporated to represent the actual start time of breast cancer before the diagnosis. The estimated probabilities are also adjusted to represent US population.

■ SB36

H-Sapphire B, Fourth Floor

Healthcare / Treatment Management-Cancer

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - Cancer Patient Treatment Planning

Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

Cancer treatments are usually delivered in sequence of sessions from day to years. The long term planning improves not only the patients' waiting times and quality of life, but also the safety of treatment procedures and healthcare resource usages. Based on the growing detail of patient cancer development stage, treatment plan can be reoptimized along with newly available techniques during the course of patient treatment. Analysis on model constructed will be carried out over a public database.

2 - A New On-line Re-optimization Model for IMRT Treatment Planning

Chunhua Men, University of California, San Diego, Department of Radiation Oncology, 3855 Health Sciences Dr., La Jolla, CA, 92093, United States of America, cmen@ucsd.edu, Xuejun Gu, DJ Choi, Amit Majumdar, Steve Jiang

The Fluence Map Optimization (FMO) for Intensity Modulated Radiation Therapy (IMRT) is a large-scale problem and it is a bottle-neck for online re-optimization. We present a new re-optimization model which avoids re-verification by physicians. We solve it using interior point method and gradient projection method with clinical data. We show that such algorithms can be solved much more efficient on the Graphics Processing Units (GPUs) which have highly parallel nature than the traditional CPUs.

3 - Patient Pathway Scheduling: A Case Study

Alessandro Condotta, School of Computing, University of Leeds, University of Leeds, Leeds, LS2 9JT, United Kingdom, condotta@comp.leeds.ac.uk, Natalia V. Shakhlevitch

A key reform in the UK healthcare system involves the concept of patient pathway management. Scheduling all appointments for a patient offers a number of advantages in comparison with the traditional policy of booking one appointment at a time. We study a new combinatorial optimization problem related to the chemotherapy pathway. The suggested solution procedure results in improved resource usage, patients' waiting times and procedure safety.

■ SB37

H-Sapphire C, Fourth Floor

Supplier Management and Selection

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Karen Donohue, Associate Professor, Carlson School, University of Minnesota, 321 19th Ave S, 3-150 CSOM, Minneapolis, MN, 55455, United States of America, donoh008@umn.edu

1 - Strategic Positioning for High-Tech Contract Manufacturers

S. David Wu, Dean, College of Engineering, Lehigh University, 19 Memorial Drive West, Bethlehem, PA, 18015, United States of America, sdw1@Lehigh.EDU, Banu Gemici-Ozkan

We investigate contract manufacturers' (CM) incentive to develop their own market presence. We analyze their strategic market entry decision under a wide range of conditions. Our aim is to establish theoretical foundations that can be cross-referenced with empirical-based market entry research in the literature, while deriving new insights. We further our analysis on the strategic interactions between the brand-carrying customer and the contract manufacturer.

2 - An Empirical Analysis of Price, Quality and Incumbency in Online Procurement Auctions

Tunay Tunca, Associate Professor, Graduate School of Business, 518 Memorial Way, Stanford University, Stanford, CA, 94305, United States of America, tunay@stanford.edu, Vivian Zhong, DJ Wu

Using data from legal service procurement auctions, we study how online auctions can be used fairly and effectively in procuring business services, and demonstrate the roles supplier quality and incumbency play in this process. We theoretically show and empirically demonstrate how an open ended auction format can significantly boost a buyer's savings from an online auction and explore the role of incumbency in award decisions.

3 - Stability of Group Purchasing Organizations

Greys Sosic, Associate Professor, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, United States of America, sosic@marshall.usc.edu, Mahesh Nagarajan, Hao Zhang

GPOs exist in several sectors and benefit its members through quantity discounts and negotiation power when dealing with suppliers. However, GPOs may suffer from member dissatisfaction due to unfair allocations of the savings. We consider several allocation mechanisms and identify stable buyer alliances for them. We look at discount schedules that seem to encompass a large class of practical schedules and analyze both exogenous and endogenous purchasing requirements of the members.

4 - Optimal Service-Based Procurement Design: Competition versus Incentive Contracts

Ehsan Elahi, Assistant Professor, UMass Boston College of Management, 100 Morrissey Blvd, Boston, MA, 02125, United States of America, ehsan.elahi@umb.edu, Karen Donohue, Saif Benjaafar

We consider a procurement problem in which a buyer wishes to maximize profit by maximizing the service levels suppliers provide. The buyer can induce suppliers to provide higher service levels either through orchestrating a service-based competition or through designing an incentive contract in which suppliers are rewarded based on the service levels they provide.We show optimal forms of these two mechanisms and compare the result with the buyer's profit when there is a central decision maker.

■ SB38

H-Sapphire D, Fourth Floor

Approximate Dynamic Programming for Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Adam Mersereau, Asst. Professor, University of North Carolina, Kenan-Flagler Business School, CB #3490, Chapel Hill, NC, 27599-3490, United States of America, ajm@unc.edu

1 - Contract Portfolio Optimization for a Gasoline Supply Chain
Shanshan Wang, swang5@chicagobooth.edu, Dan Adelman

We consider one supplier selling one product through three channels: branded (long-term), unbranded (short-term) and spot. We address a finite horizon problem, with the objective of finding the optimal contract portfolio constrained by future market conditions and contractual obligations to maximize the total expected discount profit. We characterize the optimal policy and provide both analytical and numerical results.

2 - A Dual Approach for Bounds in Stochastic Inventory Models
James E. Smith, Professor, Fuqua School of Business, jes9@duke.edu, Peng Sun, David Brown

When studying complex inventory systems, researchers often propose heuristic policies and use simulation methods to estimate the expected costs of a policy. In this talk, we will describe a dual approach that provides a lower bound on the optimal expected costs. This dual approach can help determine whether a proposed policy is "good enough" and identify ways to improve the policy. We illustrate this approach with an inventory system with non-stationary, unobserved demand process.

3 - Dynamic Capacity Allocation to Customers Who Remember Past Service
Adam Mersereau, Asst. Professor, University of North Carolina, Kenan-Flagler Business School, CB #3490, Chapel Hill, NC, 27599-3490, United States of America, ajm@unc.edu, Dan Adelman

We study the problem faced by a supplier deciding how to dynamically allocate limited capacity among a portfolio of customers who remember the fill rates provided to them in the past when making ordering decisions. Customers differ from one another in the prices they are willing to pay, in their sensitivity to past fill rates, and in their demand variance. We seek to understand the impacts of these factors on the supplier's allocation policy.

■ SB39

H-Sapphire E, Fourth Floor

Healthcare Supply Chains

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Hui Zhao, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, zhaoh@purdue.edu

1 - Inventory Management under Shipment Errors
Leroy Schwarz, Professor of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47906, United States of America, lschwarz@purdue.edu, Vinayak Deshpande

This research examines the consequences of product misidentification leading to shipment errors using a two-product 'newsvendor' model in which ordering and/or receiving mistakes occur with known probabilities. We establish that the form of the optimal policy is a state-dependent base-stock policy. We are also able to analytically establish the sensitivity of the corresponding base stocks (and safety stocks) to model parameters and inventory levels.

2 - The Impact of "Inventory Management Agreements" on Pharmaceutical Supply-Chain Inventory
Leroy Schwarz, Professor of Management, Purdue University, 403 West State Street, West Lafayette, IN, 47906, United States of America, lschwarz@purdue.edu, Hui Zhao

Until 2002, a significant portion of pharmaceutical distributors' gross margin was earned by "investment buying". Today, investment buying is mostly gone. Instead, manufacturers and distributors have Inventory Management Agreements (IMAs), under which manufacturers limit distributor purchases and distributors report inventories and sales. This research examines the impact of Inventory Management Agreements on the size of inventories pharmaceutical supply chain inventory.

3 - The Value of Information in the Pharmaceutical Distribution Chain
Chuanhui Xiong, Purdue University, Krannert School of Management, West Lafayette, United States of America, cxiong@purdue.edu, Hui Zhao, Leroy Schwarz

Pharmaceutical distributors experienced a switch from IB (Investment Buying) model motivated by continuous price increases to FFS (Fee For Service) and IMA (Inventory Management Agreement) model. We demonstrate the impact of price increases to the manufacturer in the IB model, fee structures in the FFS model, and correspondingly the value of demand information under FFS and IMA. We also compare these two different models.

4 - Clinic Overbooking and Patient Responses: A Game Theoretical Analysis
Hui Zhao, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, zhaoh@purdue.edu, Mark Lawley, Bo Zeng

We consider the impact of overbooking on two most important factors of patient no-show: appointment delay and patients' dissatisfaction. While overbooking increases patients' office waiting time (office delay), it reduces the lag between making an appointment and seeing the doctor (appointment delay). We use a game theoretic framework and a queueing model to characterize these two effects and obtain more comprehensive evaluation of overbooking on clinic overbooking.

■ SB40

H-Sapphire H, Fourth Floor

Tutorials: Financial Engineering

Sponsor: Financial Services
Sponsored Session

Chair: Chanaka Edirisinghe, Professor, University of Tennessee, College of Business, Knoxville, TN, United States of America, chanaka@utk.edu

1 - Applying Dynamic Portfolio Theory: Lessons From the 2008 Crash
John Mulvey, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08540, United States of America, mulvey@princeton.edu

Numerous investors needlessly lost much of their wealth in 2008. We discuss contributing factors: inertia, changing correlations/contagion, volatility, and static investment planning and extend traditional portfolio models. Topics include: 1) integrating assets, liabilities, and goals; 2) transaction costs; 3) multiple regimes; 4) short time-steps; and 5) importance of liquidity. Advantages of dynamic strategies are shown by reference to historical backtests and a Princeton-based hedge-fund.

2 - Optimization Approaches in Credit Risk
Stan Uryasev, University of Florida, Department of Industrial and Systems Engineer, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, uryasev@ufl.edu

This tutorial will discuss several optimization models in credit risk management. We will consider optimization problem statements and present numerical case studies for the following problems: 1) Optimization of positions in a portfolio of bonds 2) Optimal structuring of Collateralized Debt Obligations (CDOs) 3) Estimating credit default distributions with Maximum Entropy Approach.

■ SB41

H-Sapphire L, Fourth Floor

Threats to Life and Limb

Sponsor: Public Programs, Service, and Needs
Sponsored Session

Chair: Arnie Barnett, MIT, Cambridge, MA, United States of America, abarnett@mit.edu

1 - Re-assessing the Threat: Redemption in the Face of Criminal Records
Alfred Blumstein, Carnegie-Mellon University, Heinz College, 5000 Forbes Avenue, Pittsburgh, PA, 15213, ab0q@andrew.cmu.edu, Kiminori Nakamura

With the growing ubiquity of background checking, and also of criminal-justice encounters, many people are denied jobs because of a stale criminal record. Since hazard rate declines with time clean, we provide the first empirical estimates of redemption times from the earlier event based on reasonable compliance criteria.

2 - Cross National Differences in Aviation Safety Records
Arnie Barnett, MIT, Cambridge, MA, United States of America, abarnett@mit.edu

The passenger death risk on a randomly-chosen airline flight in the world is about one in three million. But, much as the center of mass of a doughnut is at the center of the hole—where there is no mass—there are few if any countries in which the mortality risk of air travel is one in three million. Rather, there is considerable heterogeneity in aviation risk across nations, which we explore in an analysis of fatal-accident data from 2000-08.

3 - The 2009 H1N1 Virus: What is Happening?
Richard Larson, Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building E40-233, Cambridge, MA, 02139, United States of America, rclarson@MIT.EDU, Stan Finkelstein

We model the spread and consequences of the H1NI virus in 2009, based on data about its rise and diffusion starting in the spring of this year.

■ SB42

H-Sapphire P, Fourth Floor

Managing Variability in Supply Chains

Contributed Session

Chair: Sudarsan Rangan, Texas A&M University, 4217 TAMU, College Station, TX, 77840, United States of America, srangan@mays.tamu.edu

1 - Measuring the Variability in Supply Chains with the Peakedness: Model and Application to FMCG
Ying Wei, Post-doctoral Fellow, CORE, Louvain-la-Neuve, 1348, Belgium, ying.wei@uclouvain.be, Philippe Chevalier, Jean-Christophe Van den Schrieck

We introduce a novel way to measure the variability of flows in supply chains, the peakedness. We are able to estimate the peakedness from arrival data, and characterize demand, forecast and inventory based on the peakedness functional. In addition, we can predict the variability in single and multi-stage inventory systems, and tree-structured supply chains. Based on real life data for fast moving consumer goods (FMCG), we compare the results of the peakedness approach with that of simulation.

2 - Modeling and Analysis of the Impact of Demand Seasonality on Post-merger Synergy
Li Tan, Assistant Professor, Washington State University, 2710 University Drive, Richland, WA, 99354, United States of America, litan@wsu.edu, Shenghan Xu

M&As bring opportunity for companies to streamline supply chains. To fully benefit from the possible synergy, a merged company has to consider how the seasonal demand patterns of its original and adopted products may affect logistic cost. We model and analyze supply-chain consolidation of various settings, and we study the seasonal demand variance of products and study its impact on post-merger synergy. We propose two metrics for demand seasonality and identify their relations to the synergy.

3 - An Empirical Model to Assess the Effectiveness of Supply Chain Collaboration
Amarpreet Kohli, University of Southern Maine, P.O.Box 9300, Portland, ME, 04104, United States of America, akohli@usm.maine.edu, John Jensen

Social or technical factors have been observed to influence successful supply chain relationships. This research proposes an instrument to measure the impact of factors viz. goal congruence, personal interaction, trust, nature of collaboration and environmental variables on the effectiveness of supply chain collaboration. Preliminary results suggest that personal interaction and trust may not be as significant a predictor of operational effectiveness as goal congruence.

4 - Seafood Value Chain and Supply Chain Optimization
Yousaf Shad Muhammad, NTNU, Alfred Gtz veg 3, 10 etg, Trondheim, Norway, yousaf@iot.ntnu.no, Asgeir Tomasgard

We are presenting a seafood value chain model about optimal use of logistics and installed facilities on multiple locations. Complex processing of seafood is addressed in the model. This is a problem of products, locations, and a supply chain design. The objective of study is to develop tools for the management by structuring an optimization model that accommodates the operational complexity of the economical modeling of resources, logistics, yield management and market demand under uncertainty.

5 - Distributor's Integrated Inventory and Outbound Shipment Decisions
Sudarsan Rangan, Texas A&M University, 4217 TAMU, College Station, TX, 77840, United States of America, srangan@mays.tamu.edu, Malini Natarajarathinam, Ismail Capar

This analysis is based on a problem faced by a spare parts distributor that supplies n retailers. The distributor has to decide on his inventory system and replenish retailer inventories using a VMI policy. We analyze this problem to provide optimal inventory acquisition and shipment decisions to minimize the overall cost at the distributor.

■ SB43

H-Room 400, Fourth Floor

Mitigating Supply Chain Disruptions

Cluster: Supply Chain Models

Invited Session

Chair: Larry Snyder, Assistant Professor, Lehigh University, Department of Industrial & Systems Eng, 200 West Packer Ave., Mohler Lab, Bethlehem, PA, 18015, United States of America, larry.snyder@Lehigh.EDU

1 - A Continuous-review Inventory Model with Dual-sourcing Strategy and Random Disruptions
Lian Qi, Rutgers, The State University of New Jersey, 1 Washington Park, Room 962, Newark, United States of America, lianqi@business.rutgers.edu

We consider a continuous-review inventory problem for a retailer facing constant demand. This retailer can source from two suppliers who differ in reliability and cost. Supplier 1 is cheaper, but is subject to random disruptions; Supplier 2, the backup supplier, is more expensive, but is perfectly reliable. We identify the optimal inventory and sourcing strategy at the retailer, to reduce the impact of the random disruptions at the primary supplier on its expected working inventory cost.

2 - Supply Disruptions in One-Warehouse Multiple-Retailer Systems
Zumbul Bulut, Ph.D. Candidate, Lehigh University, Mohler Lab., Allentown, PA, 18015, United States of America, zub205@lehigh.edu, Larry Snyder

We examine the impact of supply disruptions on the OWMR systems with non-identical retailers and deterministic demand. We obtain the exact expressions of the stocking levels when disruptions happen at the supply processes of the retailers and develop a heuristic procedure for disruptions in the warehouse's supply system. We propose approximate methods to obtain the stocking levels of the system with non-overlapping and overlapping disruptions at both the warehouse and the retailers.

3 - Insights From a Practical Application of Supply Chain Disruption Modeling
Amanda Schmitt, Postdoctoral Associate, MIT Center for Transportation and Logistics, 77 Massachusetts Ave., E40-266, Cambridge, MA, 02139, United States of America, aschmitt@mit.edu, Mahender Singh

We present results from analysis performed at a major consumer products company to assess disruption risk in their supply chain. The project includes a Monte Carlo simulation, developed to estimate disruption distributions, and a discrete-event simulation, developed to capture interactions in the multi-echelon network. We present results evaluating the impact of disruptions and mitigation responses in the network and discuss insights from the project.

4 - Managing Supply Chain Disruption and Competition
Biying Shou, City University of Hong Kong, Tat Chee Ave., Kowloon, Hong Kong - ROC, biying.shou@cityu.edu.hk, Erick Zhaolin Li, Jianwei Huang

We consider a market with two competing supply chains subject to supply disruptions. The retailers engage in Cournot competition by determining order quantities from their exclusive suppliers. We analyze the equilibria with different supply chain contracts and show that supply chain coordination is a dominant strategy. Moreover, we show that investment in supply chain coordination may or may not result in positive gains for the supply chain.

■ SB44

H-Room 402, Fourth Floor

Joint Session Service Science/Data Mining: Service Quality

Sponsor: Service Science & Data Mining

Sponsored Session

Chair: Fugee Tsung, Professor, Hong Kong University of Science and Technology, Department of IELM, Hong Kong University of Sci. & Tech., Hong Kong, Hong Kong - PRC, season@ust.hk

Co-Chair: Wei Jiang, United States of America, jiangwei08@gmail.com

1 - Statistical Quality Techniques to Service Science and Engineering
Fugee Tsung, Professor, Hong Kong University of Science and Technology, Department of IELM, Hong Kong University of Sci. & Tech., Hong Kong, Hong Kong - PRC, season@ust.hk

With the shift in economic focus from manufacturing to service, industrial and academic research facilities may need to apply more scientific rigor to the practices of service, such as discovering better methods to use statistics to increase quality and productivity to meet the challenges. This talk will focus on the development of statistical quality techniques, and discuss several technical challenges and recent extensions to the service engineering research area.

2 - Transfer Learning of Graphical Models with Application in Alzheimer's Studies
Jing Li, Assistant Professor, Arizona State University, Tempe, United States of America, jing.li.8@asu.edu, Shuai Huang

This research develops a method to learn Gaussian Graphical Models from data for multiple related tasks. The method enables the knowledge gained during the learning of one task to be transferred to help the learning of another related task. An application in brain connectivity modeling of Alzheimer's disease is provided.

3 - Data Stream Clustering and Modeling Using Context-Trees
Wei Jiang, United States of America, jiangwei08@gmail.com, Pierre Brice

Many context-dependent models that deal with categorical or mixedvalue data streams are not scalable. This paper proposes a clustering method for generating them around relevant aggregates of these data streams rather than the individual samples. Both theoretical and experimental evaluations of the technique are obtained to compare with other prominent clustering techniques for categorical data streams.

■ SB45

H-Room 410, Fouth Floor

Panel Discussion: Teaching Interdisciplinary Courses in Product Design and Development

Cluster: New Product Development
Invited Session

Chair: Sebastian Fixson, Babson College, Tomasso 226, Babson Park, MA, 02457, United States of America, sfixson@babson.edu

1 - Teaching Interdisciplinary Courses in Product Design and Development
Moderator: Sebastian Fixson, Babson College, Tomasso 226, Babson Park, MA, 02457, United States of America, sfixson@babson.edu, Panelists: Sara Beckman, Manuel Sosa, Nitin Joglekar, Michael Meyer, William Lovejoy

Come and join us for a discussion of the past, present, and future of interdisciplinary courses in product design and development (PDD). Our panel of accomplished teachers who have successfully developed and executed their versions of PDD courses will share their experiences, insights, and advice.

■ SB46

H-Room 411, Fourth Floor

Knowledge, Learning, Intellectual Captial (KLIC) - 1: The Dynamics of Learning

Sponsor: Technology Management
Sponsored Session

Chair: Charles Weber, Porland State University, P.O. Box 751 — ETM, Portland, OR, 97207, United States of America, charles.weber@etm.pdx.edu

1 - Status in Open Innovation Contests
Cheryl Druehl, Assistant Professor, George Mason University, School of Management, MS 5F4, Fairfax, VA, 22030, United States of America, cdruehl@gmu.edu

Firms such as InnoCentive act as intermediaries between companies with problems to solve (seekers) and individuals offering solutions (solvers). I incorporate status as a motivation into a model of solver participation with the goal of understanding how to design contest environments.

2 - How Delays Complicate Organizational Learning
Hazhir Rahmandad, Assistant Professor, Virginia Tech, 7054 Haycock Road, Room 430, Falls Church, VA, 22043, United States of America, hazhir@vt.edu

From investing in product development to burning fossil fuels and spending time on education, delays between taking actions and observing the results are pervasive in individual, organizational, and social settings. In this talk I summarize the major mechanisms through which these delays complicate learning and thus can lead to inefficient allocation of resources and decision-making biases.

3 - Knowledge Sharing in Communities: The Role of "Community Munificence"
Zeynep Erden, Doctoral Candidate, ETH Zuerich, KPL G 13, Kreuzplatz 5, Zuerich, ZH, 8032, Switzerland, zerden@ethz.ch, Seonwoo Kim, Georg von Krogh

Understanding why people intend to share or avoid sharing knowledge in a community is crucial for the community performance and outcomes. Yet, the role of "community" in explaining why people intend to share knowledge has not been studied in organizational knowledge creation literature. The goal of this paper is to fill the gap in the literature by looking at what community provides to the members that shapes the intentions to share knowledge.

4 - Radical Organizational Learning, Circadian Rhythms and the Broad Structure
Charles Weber, Associate Professor, Portland State University, Engineering and Technology Mangement, P.O. Box 751, Portland, OR, 97201, United States of America, webercm@gmail.com

The theory of punctuated equilibrium associates radical change with the disruption of an organization's deep structure. An empirical study of semiconductor photomask manufacturing suggests that radical improvement in organizational performance is contingent upon synchronizing circadian rhythms across a stable broad structure of organizations within and outside the firm.

■ SB47

H-Room 412, Fourth Floor

2009 Dantzig Dissertation Award Finalists

Cluster: George B. Dantzig Disseration Prize
Invited Session

Chair: M. Eric Johnson, Professor, Dartmouth College, Tuck School of Business, 100 Tuck Hall, Hanover, NH, 03755, United States of America, M.Eric.Johnson@tuck.dartmouth.edu

1 - Optimal Management of Mammography Findings for Breast Cancer Diagnosis: Patient's Perspective
Jagpreet Chhatwal, Health Economist, Merck Research Laboratories, North Wales, PA, 19454, United States of America, jagpreet_chhatwal@merck.com, Oguzhan Alagoz, Elizabeth Burnside

We address several issues with the current practice of breast cancer diagnosis including unnecessary biopsies and follow-up imaging. We use Markov decision processes and risk prediction models (Bayesian networks and logistic regression) to develop optimal policies that maximize a patient's quality-adjusted life expectancy. We investigate several structural properties and provide their clinical intuitions. Our results show better decision-making when compared to the current clinical practice.

2 - Pre-launch Forecasting of New Product Diffusions
Evren Ozkaya, Associate Consultant, McKinsey & Company, 9204 Madison Dr, Atlanta, GA, 30346, United States of America, evren_ozkaya@mckinsey.com, John Vande Vate, Michael Waithe, Pinar Keskinocak

In this paper, we present a practical framework for the analysis of historical product diffusion patterns and propose several methodologies for algebraically estimating new product diffusion parameters. We introduce user-friendly versions of the classic Bass Diffusion Model with new sets of parameters that are more intuitive and have natural interpretations. We test our models on real-world data sets from the high-tech industry and report significant forecast improvement opportunities.

3 - Modeling the Choice of an Airline Itinerary and Fare Product Using Booking & Seat Availability Data
Emmanuel Carrier, AI Systems, 3500 Carillon Point, Kirkland, WA, United States of America, ecarrier@MIT.EDU, Moshe Ben-Akiva, Peter Belobaba

In this paper, we develop a methodology to analyze the choice of an airline itinerary and fare product based on booking data. To incorporate the impact of airline pricing and RM and reconstruct the passenger choice set, booking data is combined with fare rules and seat availability data. In addition, characteristics of the traveler and the trip are retrieved and used to estimate a latent class choice model providing an alternative to the traditional segmentation based on trip purpose.

4 - Disruption Risk Management and Supply-Chain Resilience
Nitin Bakshi, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nbakshi@london.edu

In this thesis we highlight the role played by collaboration in supply-chain risk management. We first mathematically characterize the notion of collaboration and underline the improvements over a non-cooperative approach. Next, we consider the specific context of protecting the containerized supply chain against terrorist attacks. Using game theory, queueing models and discrete event simulation we analyze container security at US domestic and international ports.

5 - Internet Advertising: Optimization and Economic Aspects
Hamid Nazerzadeh, Post-doc Researcher, Microsoft Research, One Memorial Dr, Cambridge, MA, United States of America, hamidnz@microsoft.com

Internet advertising is a very large-scale market where the supply is associated with pageviews of the users, and the demand is associated with advertisers with complex preferences. In this dissertation, I present mechanisms that address some of the challenges that emerge in this market.

■ SB48

H-Sapphire Green Room, Fourth

Service Scheduling & Operational Efficiency

Sponsor: Service Science
Sponsored Session

Chair: Sanjeev Bordoloi, Associate Professor, University of St Thomas, Opus College of Business, 1000 LaSalle Ave., TMH 443, Minneapolis, MN, 55403, United States of America, bord9806@stthomas.edu

1 - Combining Integer Programming and the Randomization Method to Schedule Employees
Armann Ingolfsson, Associate Professor, University of Alberta, Edmonton, CA, T6G2R6, Canada, Armann.Ingolfsson@ualberta.ca

We present a method to find low cost shift schedules with a time-varying service level above a specified minimum. The method calculates transient service levels with the randomization method and generates schedules with an integer programming heuristic. The resulting schedules are near-optimal and considerably less costly than schedules generated with simpler heuristics. Computational times are substantially shorter than with a method that guarantees optimality.

2 - Stabilizing Abandonment in Many-Server Queues with Time-Varying Arrivals
Yunan Liu, Student, Columbia University, 560 Riverside Drive, #4B1, New York, NY, 10027, United States of America, yl2342@columbia.edu, Ward Whitt

We propose a new offered-load approximation involving infinite-server models to determine time-dependent staffing levels to stabilize abandonment probabilities and expected delays at target levels in the M_t /GI/s_t + GI many-server queueing model, having time-varying arrivals (the M_t) and allowing non-exponential customer abandonment (the +GI). With the new offered load, a square-root-staffing formula is remarkably effective over a wide range of loads.

3 - Specialty Hospitals and Hospital Efficiency in the U.S.
Sameer Kumar, Professor of Decision Science and Qwest Endowed Chair, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, SKUMAR@stthomas.edu

Over the last 15-20 years, general hospitals have faced a new competition from for-profit specialty hospitals that operate on a focused factory model and are threatening to siphon-off the most profitable patients. This paper will attempt to compare the efficiency of general hospitals and specialty hospitals in the United States using stochastic frontier regression analysis.

4 - Shift Scheduling in Multiskill Call Centers
Ger Koole, VU University Amsterdam, De Boelelaan 1081A, Amsterdam, 1081 HV, Netherlands, koole@few.vu.nl, Sandjai Bhulai, Auke Pot

We introduce a new method for shift scheduling in multiskill call centers. The method consists of two steps. First, staffing levels are determined, and next, in the second step, the outcomes are used as input for the scheduling problem. The scheduling problem relies on a linear programming model that is easy to implement and has short computation times.

5 - Staffing Decisions in Healthcare Operational Efficiency
Sanjeev Bordoloi, Associate Professor, University of St Thomas, Opus College of Business, 1000 LaSalle Ave., TMH 443, Minneapolis, MN, 55403, United States of America, bord9806@stthomas.edu

Healthcare industry, as a major service provider, is undergoing major reforms lately. The operational efficiency in healthcare depends heavily on its human resources, namely physicians and nurses, which is also a major component of the healthcare costs. This makes it imperative to manage human resources efficiently. This paper takes a critical look at the staffing decisions in healthcare and provides a basic model to minimize costs while maintaining operational quality and efficiency.

■ SB49

H-Room 300, Third Floor

Project Scheduling

Cluster: Project Management
Invited Session

Chair: Willy Herroelen, Emeritus Professor, K.U.Leuven, Naamsestraat 69, Research Center for Operations Mgmt., Leuven, B-3000, Belgium, Willy.Herroelen@econ.kuleuven.be

1 - Measuring Slack in Stochastic Activity Networks
Gary Mitchell, Assistant Professor, University of Portland, 5000 N. Willamette Blvd, Portland, OR, OR 97203, United States of America, mitchelg@up.edu, Ted Klastorin

The concept of slack in deterministic activity networks is well developed in the project management literature. However, there has been little discussion of slack measures in stochastic activity networks. How should stochastic slack measures be calculated? How can practitioners use stochastic slack and related concepts to better manage projects? In this paper we address these questions and present an approach for determining slack time distributions and useful summary measures.

2 - Impact of Agility on Project Duration
Karolina Glowacka, Assistant Professor, Stevens Institute of Technology, Hoboken, NJ, United States of America, kglowack@stevens.edu, Richard Wendell, Timothy Lowe

Project scheduling typically assumes that an activity begins as soon as its predecessors are completed. Thus, if all predecessors of an activity finish ahead of schedule, the activity begins early. Unfortunately in practice activities may not be forward agile in capturing the benefits of starting early. We investigate the impact on project duration when projects lack such forward agility. Specifically, we evaluate the impact on the probability of achieving a target time for finishing a project.

3 - Resource-constrained Project Scheduling under Activity Duration Variability
Filip Deblaere, PhD Student, K.U.Leuven, Naamsestraat 69, Leuven, Belgium, filip.deblaere@econ.kuleuven.be, Willy Herroelen, Erik Demeulemeester

The resource-constrained project scheduling problem involves the determination of a baseline schedule of the project activities, satisfying the precedence relations and resource constraints while minimizing the project duration. In practice, activity durations may be subject to variability that render the execution of the schedule impossible. We propose a methodology for the determination of a project execution policy that attempts to minimize the expected activity starting time deviations.

4 - On the Optimal Choice of Activity Modes in Robust Project Scheduling
Erik Demeulemeester, Professor, K.U.Leuven, Naamsestraat 69, Leuven, Belgium, erik.demeulemeester@econ.kuleuven.be, Wendi Tian

The critical chain scheduling and buffer management approach, proposed by Goldratt, has proven to be a good way to robustly schedule resource-constrained projects. However, in this problem one considers the modes for each activity to be fixed. In our research, we consider the multi-mode version of the problem and we try to determine the optimal choice of the activity modes when the objective is to schedule the project as robust as possible. Extensive computational results will be provided.

■ SB51

H-Room 303, Third Floor

Advances in Linear and Convex Programming Applications and Algorithms

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Mihai Anitescu, Argonne National Laboratory, Mathematics and Computer Science Divisio, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov

1 - Using Linear Assignment for Accelerated Protein Configuration Calculations
Mihai Anitescu, Argonne National Laboratory, Mathematics and Computer Science Divisio, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov

We aim to compute free-energy (FE) differences between protein conformations by using a transformation of a source conformation into a target conformation. Such calculations are crucial for computing-based drug design. To enhance the transformation procedure we seek to find the permutation that minimizes the

mean-square distance traveled by the atoms. The best permutation can be found quickly by solving a linear assignment problem and significantly improves the efficiency of FE calculations.

2 - A Nonstandard Simplex Algorithm for Linear Programming
Ping-Qi Pan, Professor, Southeast University, Department of Math., Southest University, Nanjing, 210096, China, panpq@seu.edu.cn

With the simplex framework, the proposed algorithm generates a series of feasible points that are not necessarily vertices. In particular, it is an interior point algorithm if the initial point used is interior. It terminates at an approximate optimal vertex, or at an exact optimal vertex if a simple purification is incorporated. Extensive computational experiments show that the algorithm are very efficient, relative to the standard simplex algorithm.

3 - A Method for Solving the General Parametric Linear Complementarity Problem
Marianthi G. Ierapetritou, Department of Chemical and Biochemical Engineering Rutgers -The State University of New Jersey, 98 Brett Road, Piscataway, 08854, United States of America, marianth@soemail.rutgers.edu, Zukui Li

We present a solution method for the general parametric Linear Complementarity Problem LCP(q,M), where q is affine function of uncertain parameters Œ∏ (q=d+FŒ∏). The method identifies how the minimum norm solution of the LCP depends on the value of the uncertain parameters in the given range through a multiparametric mixed integer linear programming algorithm. The proposed approach can address general matrix M and also the integer LCP where integrality restriction on the solution is applied.

■ SB52

H-Room 304, Third Floor

Rebates

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Qin Geng, Assistant Professor, Robert Morris University, 6001 University Boulevard, Moon Township, PA, 15108, United States of America, geng@rmu.edu

1 - Rebates in a Competitive Multichannel Market
Xiting Gong, PhD Candidate, Peking University, Department of Management Science, Bejing, China, gongxiting@gsm.pku.edu.cn, Gangshu Cai

Rebates have been popular in retailing. This paper investigates the optimal rebate strategies in a competitive circumstance where two supply chains are competing for a pool of customers. We compare models when either suppliers or retailers provide the rebates. We demonstrate that the suppliers prefer rebates more than the retailers do in some situations. It is shown that the rebate strategies are different from those in a single-channel supply chain.

2 - Using MSRP to Enhance the Ability of Rebates to Control Distribution Channels
Shilei Yang, Southwestern University of Finance and Economics, School of Business Administration, Chengdu, SC, 610074, China, syang@swufe.edu.cn, Chuck Munson, Bintong Chen

Manufacturers have increasingly instituted widespread rebate programs in recent years. However, retailers can counteract the power of rebates to impact demand by raising the retail price. We show that by combing a MSRP along with a rebate, the manufacturer can better control the channel by inhibiting the retailer's ability to raise price, particularly when consumers exhibit loss aversion. Incorporating MSRP with a rebate increases the manufacturer's profit, the channel profit and efficiency.

3 - Newsvendor Retailer's Mail-In Rebate
Qin Geng, Assistant Professor, Robert Morris University, 6001 University Boulevard, Moon Township, PA, 15108, United States of America, geng@rmu.edu, Suman Mallik

We examine mail-in rebates offered in a distribution channel consists of a single manufacturer and a single retailer within a newsvendor framework. We study two scenarios: only the retailer considers to offer rebate; and both the manufacturer and the retailer consider to offer rebate.We first study decision making under exogenous retail price.The models are extended to include endogenous retail price and rebate dependent redemption rate.

■ SB53

H-Room 305, Third Floor

IP Approaches for Optimization under Uncertainty

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Shabbir Ahmed, Associate Professor, Georgia Institute of Technology, School of Industrial & Systems Engineeri, 765 Ferst Drive, Atlanta, GA, 30332, sahmed@isye.gatech.edu

1 - Strength of Mixed Integer Programming Formulations for Probabilistically Constrained Linear Programs
Juan Pablo Vielma, ISyE, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, jvielma@isye.gatech.edu, Shabbir Ahmed, George Nemhauser

We study the strength of different extended formulations for probabilistically constrained linear programs with right hand side uncertainty. In particular, we compare the relative strength between formulations that consider only one row at a time and formulations that consider two or more rows at a time. We also consider the effect of different assumptions on the distribution of the uncertain coefficients.

2 - On Mixing Sets and the Complexity of a Probabilistic Lot-sizing Problem
Simge Kucukyavuz, Ohio State University, Columbus, OH, 43202, United States of America, kucukyavuz.2@osu.edu

We consider a probabilistic lot-sizing problem with service level constraints and a finite discrete demand distribution. Assuming that the planning horizon is fixed, we show that the problem is polynomially solvable, using compact mixing set and p-efficient point reformulations.

3 - Experimenting with Convex Lower Envelope of Submodular Functions
Alper Atamturk, Professor, UC Berkeley, 4175 Etcheverry Hall MC 1777, Berkeley, CA, 94720, United States of America, atamturk@berkeley.edu, Vishnu Narayanan

We give a new proof for convex lower envelope construction for a submodular function and present computational experiments on minimizing several specific submodular functions.

■ SB54

H-Room 306A, Third Floor

Recent Applications of Semidefinite Programming

Sponsor: Optimization/Networks
Sponsored Session

Chair: Anthony Man-Cho So, The Chinese Univ of Hong Kong, Department of SE&EM, Shatin, NT, Hong Kong - PRC, manchoso@se.cuhk.edu.hk

1 - Measurement Sparsification and Chordal Decomposition for Sensor Network Localization
Zhisu Zhu, Stanford University, 102 Hoskins Ct, Apt 419, Stanford, CA, 94305, United States of America, zhuzhisu@stanford.edu, Anthony Man-Cho So, Yinyu Ye

We consider sensor network localization or graph realization with sparse and local edge-distance measurements. We develop a necessary and sufficient condition on localizability of the graph using only O(n) edge-distance measurements, where n is the number of nodes. This is in contrast to the early known result of O(n^2) or complete edge-distance measurements. As a result, we develop a more efficient semidefinite programming (SDP) method based on edge sparsification and clique decomposition.

2 - Integrality Gaps for Strong SDP Relaxations of Unique Games
David Steurer, Student, Princeton University, 35 Olden St, Princeton, NJ, 08540, United States of America, dsteurer@cs.princeton.edu, Prasad Raghavendra

We obtain the first integrality gaps for certain strong SDP relaxations of Unique-Games. For instance, we prove that after any number of rounds of Sherali-Adams lift-and-project a large gap remains. As consequence of this work, any number of rounds of Sherali-Adams lift-and-project does not improve the approximation ratio of the standard SDP for a variety of problems, e.g., Max-Cut, Max-3SAT, Multiway-Cut, and Maximum-Acyclic-Subgraph. We also obtain new SDP integrality gaps for Sparsest-Cut.

3 - Probabilistic Analysis of SDP Relaxations, with Application to MIMO Detection

Anthony Man-Cho So, The Chinese Univ of Hong Kong, Department of SE&EM, Shatin, NT, Hong Kong - PRC, manchoso@se.cuhk.edu.hk

One of the fundamental problems in modern digital communication is the detection of symbols in a MIMO channel. It can be approximately solved using SDP. Simulations have shown that such a heuristic has excellent empirical performance. However, its theoretical properties are still not well understood. In this talk we will introduce a general approach for analyzing the approximation guarantee of the SDP heuristic and give justification for its use in practice.

■ SB55

H-Room 306B, Third Floor

Models for Complex Networks

Sponsor: Optimization/Networks
Sponsored Session

Chair: Milena Mihail, Professor, Georgia Institute of Technology, 2138 Klaus Advanced Computing Building, 266 Ferst Drive, Atlanta, GA, 30332, United States of America, mihail@cc.gatech.edu

1 - Convergence of Network Dynamics

Amin Saberi, Professor, Stanford University, Terman Engineering Building, Room 317, Stanford, CA, 94305, United States of America, saberi@stanford.edu

Specific network structures have been shown to have dramatic influence on the convergence of network dynamics. In this talk, we make these results precise, and distinguish between probabilistic and game theoretic dynamics.

2 - Community Structure in Large Social and Information Networks

Michael Mahoney, Department of Mathematics, Stanford University, Stanford, CA, 94305, United States of America, mmahoney@cs.stanford.edu

We have performed a large scale analysis of a wide range of information networks. Our results suggest a different picture of community structure than has been assumed previously. We found that, at larger scales, the best possible communities gradually ``blend in" with the rest of the network. This behavior is not explained by any of the commonly-used network generation models.

3 - Inner Product Graphs as Models for Complex Networks

Stephen Young, Post Doctoral Fellow, Georgia Institute of Technology, Klaus Advanced Computing Building, 266 Ferst Drive, Atlanta, GA, 30332, United States of America, young@math.gatech.edu

Inner Product Graphs generalize Erdos-Renyi graphs by endowing network nodes with attributes and determining network links according to inner products (and more general kernel functions). We characterize the structure of these graphs, including degree distribution, diameter, clustering and conductance.

■ SB56

H-Room 307, Third Floor

Optimization Applications in the Natural Gas Industry

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Kevin Furman, ExxonMobil, 3120 Buffalo Speedway, URC-URC-C328, Houston, TX, 77098, United States of America, kevin.c.furman@exxonmobil.com

1 - Parallelizing the GassOpt-Model

Peter Schutz, SINTEF Technology & Society, S.P. Andersens vei 5, Trondheim, Norway, peter.schutz@sintef.no, Lars Hellemo

The GassOpt-model is a mixed-integer program intended to maximize the flow of natural gas from the gas fields in the North Sea to the European customers. The problem is formulated as a multi-commodity network flow problem with pooling constraints in some of the nodes. These pooling constraints increase the complexity, and thus the solution time, of the problem considerably. We discuss our approach to solving the problem by decomposition and parallelization of the solution method.

2 - Risk Management Models of Natural Gas Contracts Portfolio Optimization for Gas Power Plants

Qipeng Zheng, PhD Student, University of Florida, Department ISE, Weil 303, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, zqp@ufl.edu, Panos Pardalos

In order to improve efficiency and release less green house gases while meeting the surge of the global energy demands, more and more power plants have started using natural gas as its energy source. In this talk, risk management models for the natural gas power plants are discussed. These models try to maximize the profit of the power plant while controlling the risks by optimizing gas contracts portfolios, and are solved by Embedded Benders Decomposition proposed by the authors.

3 - Development Planning of Natural Gas Transmission Pipeline Networks

Alireza Kabirian, Assistant Professor, University of Alaska-Anchorage, College of Business and Public Policy, 3211 Providence Drive, Anchorage, AK, 99508-4614, United States of America, a_kabirian@yahoo.com

The development planning of an existing natural gas transmission pipeline network is modeled as a nonlinear mixed integer optimization problem. In this model, the type, location, and installation schedule of major physical components of a network including pipelines and compressor stations are decided upon over a planning horizon with least cost goal and subject to network constraints. A heuristic optimization method is developed to solve the problem and a case study is used to show application.

■ SB57

H-Room 308, Third Floor

Optimization in Radiotherapy I

Sponsor: Health Applications
Sponsored Session

Chair: Robert Meyer, Professor Emeritus, University of Wisconsin-Madison, Madison, WI, United States of America, rrm@cs.wisc.edu

1 - A Set-cover Approach to Beam Orientation Optimization In Total Marrow Irradiation Using IMRT

Dionne Aleman, University of Toronto, Department of Mechanical and Industrial Engin., 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca, Chieh-Hsiu Lee, Michael Sharpe

Selecting beams in site-specific intensity modulated radiation therapy (IMRT) treatment optimization is difficult; beam orientation optimization (BOO) for total marrow irradiation (TMI) using IMRT is even more complex. Because of the difficulty in designing treatments, TMI is not used with IMRT in practice. We propose formulating the BOO problem as a set-cover problem, and then apply set-cover heuristics to select beams. Our approach is fast and yields quality TMI treatment plans.

2 - A Two-stage Approach to IMRT Dose Optimization

Warren D'Souza, Associate Professor, University of Maryland, School of Medicine, Baltimore, MD, wdsou001@umaryland.edu, Robert Meyer, Hao Zhang

We present a two-stage approach to IMRT dose optimization based on (1)a fast Monte-Carlo-based aperture dose calculation (using apertures obtained via a conventional method) combined with (2) an IMRT dose optimization approach that uses sequential linear programming (SLP) to handle very large LP models. Results are presented for three challenging clinical test cases and contrasted with alternative approaches for IMRT dose optimization.

3 - A Network Approach for Intensity Modulated Arc Therapy (IMAT)

Athula Gunawardena, Associate Professor, University of Wisconsin-Whitewater, 800 West Main Street, Whitewater, United States of America, athula@cs.wisc.edu, Michael Ferris, Robert Meyer

We present an effective algorithm using network models for optimizing the delivery of Intensity Modulated Arc Therapy (IMAT).

4 - Minimum Knowledge Base for Predicting Organ-at-Risk Dose-Volume Levels and Complications

Hao Zhang, University of Maryland, 6802 Harrowdale Road, Baltimore, MD, 21209, United States of America, hzhan001@umaryland.edu, Warren D'Souza, Robert Meyer, Leyuan Shi

We present an approach for determining the minimum number of treatment plans required to build accurate representations of the intensity-modulated radiation therapy plan surface in order to predict organ-at-risk dose-volume (DV) levels and complications as a function of input DV constraint settings. Machine Learning algorithms embedded within a multi-plan framework were used for modeling and prediction.

■ SB58

H-Room 309, Third Floor

Contemporary Scheduling

Cluster: Scheduling
Invited Session

Chair: Joseph Leung, Distinguished Professor, New Jersey Institute of Technology, Department of Computer Science, Newark, NJ, 07102, United States of America, leung@oak.njit.edu

1 - Makespan Minimization with Machine Availability
Hairong Zhao, Assistant Professor, Purdue University Calumet, Department of Math., C.S., and Statistics, Hammond, IN, 46323, United States of America, hairong@calumet.purdue.edu, Bin Fu, Yumei Huo

We study makespan minimization problems with constant number of parallel machines under two availability models: the preventive model where the unavailability is due to maintenance and the fixed job model where the unavailability is due to a priori assignment of some fixed jobs. Assuming jobs are resumable, we design an FPTAS for fixed job model, a PTAS if one machine is always available and an approximation algorithm when all machines have unavailable intervals for the preventive model.

2 - Online Scheduling on Uniform Machines Subject to Eligibility Constraints
Kangbok Lee, Postdoc, New York University, Department Information, Operation and Management, 44 W. 4th St., New York, NY, 10012, United States of America, klee3@stern.nyu.edu, Michael L. Pinedo, Joseph Y-T Leung

We consider two models of online scheduling problem minimizing the makespan on uniform machines subject to eligibility constraints. Two models assume that 1) jobs arrive in a list and 2) jobs arrive over time, respectively. We provide lower bounds examples and algorithms with upper bounds under various scenarios on eligibility constraints and processing time.

3 - Parallel Machine Scheduling with Nested Processing Set Restrictions
Yumei Huo, Assistant Professor, CUNY at Staten Island, Department of Computer Science, Staten Island, NY, 10314, United States of America, yumei.huo@csi.cuny.edu, Joseph Leung

We consider the problem of scheduling a set of n jobs on m machines, where each job can only be scheduled on a subset of machines called its machine interval. The machine intervals are nested. Preemption is not allowed. Our goal is to minimize the makespan. We give an algorithm with a worst-case ratio of 7/4, which is an improvement over the best known algorithm with a worst-case ratio of 2-1/m. For two and three machines, the algorithm gives a worst-case ratio of 5/4 and 3/2, respectively.

4 - A Game of Competitive Investment: Over-capacity and Under-learning
Jian Yang, Associate Professor, New Jersey Institute of Technology, 323 Martin Luther King Jr Blvd, Newark, NJ, 07102, United States of America, jian.yang@njit.edu, Yusen Xia

We let firms decide individual investment levels. The sum of these levels determines the total return, which the firms share in proportions to their contributions. Firms may spend to learn the return function. Using this model, we can explain the over-capacity phenonenon that appeared from PC manufacturing to mortgage lending. The model involving competitive learning also sheds light on the chronical neglect of due diligence when companies need to conduct demand-forecast studies.

■ SB59

H-Room 310, Third Floor

Teaching Process Modeling Using IBM Software

Cluster: Tutorials
Invited Session

Chair: Rick So, Professor, UCI, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, rso@uci.edu

Co-Chair: Sharon McFadden, Program Manager, IBM Academic Initiative, slmcfadd@us.ibm.com

1 - Teaching Process Modeling Using IBM Software
Rick So, Professor, UCI, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, rso@uci.edu, Sharon McFadden, Neil Sahota

In this tutorial, we share our approach and experience in teaching a process modeling class using the IBM Websphere Business Modeler. The class was offered to a group of about 15 MBA students. Through industry practitioners and deploying the IBM commercial software, the students gain hands-on experience in analyzing and improving business process performance through process mapping and simulation. Specific support to class activities provided by IBM Academic Initiatives will also be discussed.

■ SB60

H-Room 311, Third Floor

Gradient Algorithms for Large Scale Convex Optimization

Cluster: Large Scale Optimization (In Honor of Jean-Louis Goffin)
Invited Session

Chair: Peter Richtarik, University of Edinburgh, James Clerk Maxwell Building, The King's Buildings, Edinburgh, EH9 3JZ, United Kingdom, peter.richtarik@uclouvain.be

1 - Primal-Dual Gradient Methods for Structured Convex Problems
Peter Richtarik, University of Edinburgh, James Clerk Maxwell Building, The King's Buildings, Edinburgh, EH9 3JZ, United Kingdom, peter.richtarik@uclouvain.be, Yurii Nesterov

In this work we develop and analyze an algorithm for minimizing a linear function over a simple convex compact set intersected with an affine subspace. We construct a primal-dual convex reformulation of the original problem with optimal value zero and analyze new gradient methods for minimizing convex functions with known optimal value. A special case of our algorithm is the subgradient method at one extreme and the level method at the other.

2 - Approximate and Restarted Estimate Sequences Schemes
Michel Baes, ETH, IFOR, Ramistrasse 101, Zurich, 8092, Switzerland, michel.baes@ifor.math.ethz.ch

Estimate sequences are provably the fastest gradient method for smooth convex problems. At every iteration, one must compute the objective gradient and solve two optimization problems. We determine how accurately those computations have to be done to avoid error propagations. Several variants of estimate sequence schemes will also be analyzed, including different restarting strategies.

3 - AdaBoost - Nothing Else Than a Mirror Descent Algorithm?
Michael Buergisser, ETH, IFOR, Ramistrasse 101, Zurich, 8092, Switzerland, michael.buergisser@ifor.math.ethz.ch, Michel Baes

Freund and Schapire introduced AdaBoost, a standard scheme in Machine Learning, in the late nineties. Mirror descent methods are due to Nemirovski and Yudin and belong to the class of subgradient schemes. We show that AdaBoost coincides with a well-chosen mirror descent algorithm. For this, we define an appropriate objective function and interpet AdaBoost's weak learner as an oracle providing approximate stochastic subgradients.

■ SB61

H-Room 312, Third Floor

Stochastic Location Models

Sponsor: Location Analysis
Sponsored Session

Chair: Oded Berman, Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5E 3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - A Production-inventory-location System with a Manufacturer and Multiple Demand Sources
Hossein Abouee Mehrizi, Rotman School of Management, 105 St. George Street, Toronto, Canada, H.AboueeMehrizi07@Rotman.Utoronto.Ca, Oded Berman, Hasan Shavandi, Ata Zare

We analyze a production-inventory-location system problem where a manufacturer is to be established to satisfy the demand of retailers for a single product through distribution centers. The manufacturer and DCs may hold inventory in anticipation of future demand. If demand cannot be immediately satisfied from DC's inventory, it is backordered. We present an upper and lower bound for the optimal base stock levels, and an algorithm for determining the optimal location of manufacturer and DCs.

2 - Relocating Coverage Providing Facilities under Travel Time Uncertainty
Iman Hajizadeh, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, iman@rotman.utoronto.ca, Oded Berman, Dmitry Krass

A multi-objective maximum covering problem on a network with travel time uncertainty is analyzed with the objective of minimizing the number of facility relocations while ensuring adequate coverage under all travel time scenarios. A variety of model formulations are explored and compared. Exact and heuristic algorithms are presented.

3 - Minmax Regret Location for the Gradual Covering Problem on a Network with Uncertain Node Weights

Jiamin Wang, Associate Professor, Long Island University, Roth Hall 202, 720 Northern Blvd, Brookville, 11548, United States of America, Jiamin.Wang@liu.edu, Oded Berman

The gradual covering location problem seeks establishing facilities so as to maximize the total number of customers covered in the presence of partial coverage. This study considers finding the 'minmax regret' location that minimizes the worst-case coverage loss due to a decision made with an interval estimate being the only information available on the number of customers at each node. Polynomial time algorithms are respectively developed for the problem on a general network and a tree network.

4 - Location Models for Emergency Servers with Two Demand Classes

Seokjin Kim, Sawyer Business School, Suffolk University, 8 Ashburton Place, Boston, MA, 02108, United States of America, kim@suffolk.edu, Opher Baron, Oded Berman, Dmitry Krass

We propose location models for emergency servers with two demand classes of high priority and low priority. The problem is to minimize the number of servers on a network while achieving at least required service levels for the two classes. Exponential demand arrival times are specific to nodes and also classes. Servers stationed at nodes provide non-preemptive service in an exponential time within a pre-specified coverage radius.

■ SB62

H-Room 313, Third Floor

Experimental Studies on Sales and Channel Contracts

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Tony Cui, University of Minnesota, 321 19th Ave S, Suite 3-150, Minneapolis, MN, 55455, United States of America, tcui@umn.edu

1 - Tiers in One-sided Matching Markets

Yu Wang, Assistant Professor of Marketing, University of Texas at Dallas, 800 West Campbell Rd., SM32, Richardson, TX, 75080, United States of America, yuwang@utdallas.edu, Ernan Haruvy

The practice of shared ownership (with exchange options) has become increasingly popular in the luxury goods market. We demonstrate, both theoretically and experimentally, how a tiered structure in this one-sided matching market can allow firms to maintain both consumers' incentive to purchase high quality products in the primary sales market and their incentive to participate in the secondary matching market.

2 - Social Loss Aversion and Contest Deisgn

Noah Lim, University of Houston, 336 Melcher Hall, Houston, TX, 77204, United States of America, noahlim@uh.edu

We present a behavioral economics model to formalize the idea that changing the proportion of winners in a contest can alter the reference points that contestants use to make social comparisons. We show that a contest with a higher proportion of winners than losers can yield greater effort than one with fewer winners than losers if the degree of social loss aversion is sufficiently strong. We use two experiments validate this prediction.

3 - Quantal Response Equilibrium in Channel

Tony Cui, University of Minnesota, 321 19th Ave S, Suite 3-150, Minneapolis, MN, 55455, United States of America, tcui@umn.edu, Paola Mallucci

Cui, Raju, and Zhang (2007) analytically show that concerns of fairness in a dyadic channel could effectively alleviate double-marginalization. In this paper, we setup a Quantal Response Equilibrium model to analyze subjects behaviors in such a setting. We are interested in 1). How channel members make pricing decisions; 2). Do subjects show any concerns of fairness; and 3). What are subjects' weights associated with fairness relative to pecuniary payoff.

■ SB63

H-Room 314, Third Floor

Joint Session OR Bio/HAS: Public Health and Operations Research

Cluster: OR in Biomedicine and Global Health & Health Applications
Invited Session

Chair: Joseph Wu, Assistant Professor, University of Hong Kong, 21 Sassoon Rd, Pokfulam, Department of Community Medicine, Hong Kong, Hong Kong - PRC, joewu@hku.hk

1 - Population Screening and Protection in Response to Radiological Events

Eva Lee, Professor, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, evakylee@isye.gatech.edu

State/local public health officials and emergency response personnel are responsible for planning and preparing for radiological incidents. Population monitoring plans must be in placed to improve current state/local agencies' capabilities and response logistics. In this talk, we describe the design of community reception center, efficient staffing, and training of key personnel to familiarize with the procedures. This work is joint with Dr. Ansari and Mr.Casper at CDC.

2 - A Dynamic Model for Post-traumatic Stress Disorder Among U.S. Troops in Operation Iraqi Freedom

Michael Atkinson, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, United States of America, mpatkins@nps.edu, Adam Guetz, Lawrence Wein

We develop a model to predict how many troops will develop PTSD during Operation Iraqi Freedom (OIF). First we estimate troop deployment schedules. In the second part of the model we assume servicemembers incur a random amount of combat stress during each month of deployment, develop PTSD if their cumulative stress exceeds a servicemember-specific threshold, and then manifest symptoms for PTSD after an additional time lag. After calibrating the model we analyze how many troops may develop PTSD.

3 - Potential Benefits of a Population-wide Passive Immunotherapy Program during an Influenza Pandemic

Joseph Wu, Assistant Professor, University of Hong Kong, 21 Sassoon Rd, Pokfulam, Department of Community Medicine, Hong Kong, Hong Kong - PRC, joewu@hku.hk

Influenza pandemic preparedness and response planning has mainly focused on vaccines, antivirals and non-pharmaceutical interventions such as wearing of face masks, hand hygiene, household-based quarantine, school closure and other social distancing measures. In comparison, passive immunotherapy has received limited attention. We use a math model to explore the potential benefits of a population-wide passive immunotherapy program.

■ SB64

H-Room 202A, Second Floor

Panel Discussion: Teaching the Art of Modeling

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: James Orlin, Professor, MIT, E53-363, Cambridge, Ma, 02139, United States of America, jorlin@MIT.EDU

1 - Can Modeling be Taught?

Moderator: James Orlin, Professor, MIT, E53-363, Cambridge, MA, 02139, United States of America, jorlin@MIT.EDU, Panelists: Stephen Powell, Robert Shumsky

Modeling unstructured problems is fundamental to OR/MS, but many believe it is an art that cannot be taught. We believe that it can be taught, especially if one begins with an understanding of how novices approach such a modeling task. We discuss recent research on the modeling process. We then demonstrate some of the tools we use to teach this type of modeling by tackling a new problem we have not seen before live in front of the audience. Bring pen and paper and expect to be involved!

■ SB75

C-Room 32A, Upper Level

Planning Models for Rail Transportation

Sponsor: Railroad Applications
Sponsored Session

Chair: Teodor Crainic, CIRRELT-UQAM, C.P. 6128, succursale Centre-ville, Montreal, QC, H3C 3J7, Canada, theo@crt.umontreal.ca

1 - Scheduled Service Network Design for Rail Carriers

Endong Zhu, CIRRELT / Université de Montréal, Canada, endong@crt.umontreal.ca, Teodor Crainic, Michel Gendreau

Service network design aims to produce a good operating plan for railways. We integrate the essential operations at the tactical level into one compound model in order to generate the scheduled service design, blocking policy, train make-up policy and traffic distribution simultaneously. A slope scaling heuristic with long-term memory perturbation is developed and preliminary results on random instances show the proposed algorithm is efficient to find good feasible solutions.

2 - Minimizing Greenhouse Gas Emissions in Intermodal Freight Transport: An Application to Rail

Tolga Bektas, Dr, University of Southampton, Southampton, SO171BJ, United Kingdom, T.Bektas@soton.ac.uk, Teodor Crainic, Joanna Bauer

This paper addresses the issue of incorporating environment-related costs (greenhouse gases, to be specific) into freight transportation planning and proposes an integer program in the form of a linear cost, multicommodity, capacitated network design formulation that minimizes the amount of greenhouse gas emissions of transportation activities. Computational results based on an application of the proposed approach on a real-life rail freight transportation network are presented.

3 - Blocking Studies at CSX Transportation

Cary Helton, VP Service Planning, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32202, United States of America, Cary_Helton@csx.com, Dharma Acharya, Ravindra Ahuja

Earlier this year, CSX performed very thorough studies related to optimizing its blocking plan, downgrading and closing its system yards, and capacity expansion of yards. These studies gave us valuable insights into the impact of yard locations and yard capacities on railcar handlings and car miles. In this presentation, we will share our insights with the audience.

4 - Managing Locomotives in Freight Rail Transportation Systems

Mervat Chouman, CIRRELT-UQAM, C.P. 6128, Succursale Centre-ville, Montreal, Qc, H3C 3J7, Canada, mervat@crt.umontreal.ca, Teodor Crainic

The problem concerns the planning of locomotive fleet management for a freight rail carrier. It consists in assigning a set of heterogeneous locomotives to scheduled trains, such that all trains have the required power during their entire journey, while a number of restrictions are satisfied. We present an integer formulation and propose a heuristic approach to obtain high-quality solutions.

Sunday, 1:30pm - 3:00pm

■ SC01

C-Room 21, Upper Level

Strategy & Risk Management

Sponsor: Decision Analysis
Sponsored Session

Chair: Mazen Skaf, Managing Director, Strategic Decisions Group, 745 Emerson St, Palo Alto, CA, 94301, United States of America, mskaf@sdg.com

1 - Decision Analysis in Enterprise Risk Management

Carl Spetzler, Chairman & CEO, Strategic Decisions Group (SDG), 745 Emerson St, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

Most professionals in the risk management community come from different disciplines than decision analysis. As ERM has grown to getting significant board and c-level attention it has begun addressing strategic decision problems without the frame and tools of DA. For the DA professional, this represents a major new market opportunity.

2 - Evaluating the Impact of Project Risk Analysis at ConocoPhillips

John Lehman, Risk Specialist, ConocoPhillips, 600 N. Dairy Ashford, Houston, TX, 77079, United States of America, john.lehman@conocophillips.com

After several years of formalized project risk analysis on capital projects ranging in size from the tens of millions to the trillions of dollars, ConocoPhillips has gathered enough history to begin to evaluate the impacts of risk analysis on its decision process. The paper will present the results of this evaluation. It will address common evaluation errors, bias in parameter estimation, sources of ambiguity and paths towards improved analysis and decision quality.

3 - Risk Models and Model Risks: A Decision-Making Perspective

Robert Stibolt, Managing Director, JP Morgan, bob.stibolt@stanfordalumni.org, Mazen Skaf

Over-reliance on models, over-simplifications and ignoring low probability events, and poor understanding of how to use analytic tools have contributed to risk management failures. We will review cases from the energy industry, commodity-intensive industries, and financial services and discuss lessons and principles from a decision-making perspective.

4 - Integrated Approach to Risk Management From Strategy to Operations

Mazen Skaf, Managing Director, Strategic Decisions Group, 745 Emerson St, Palo Alto, CA, 94301, United States of America, mskaf@sdg.com

The greatest risks that a business may face are strategic risks. Equally important in some cases, particularly in businesses exposed to highly volatile commodity and financial markets, are trading and operational risks. We present an integrated approach for risk management from strategy development and strategic investment decisions to managing operations. A case study will further illustrate the concepts, approach, process, and decision support systems.

■ SC02

C-Room 22, Upper Level

Value and Valuation: A Decision Analytic Approach

Sponsor: Decision Analysis
Sponsored Session

Chair: Ibrahim Almojel, Stanford University, P.O. Box 15348, Stanford, CA, 94309, United States of America, mojel@stanford.edu

Co-Chair: Somik Raha, Stanford University, Stanford, CA, 94309, United States of America, somik@stanford.edu

1 - Sources of Value

Somik Raha, Stanford University, Stanford, CA, 94309, United States of America, somik@stanford.edu

The Axiology literature makes a distinction between value and valuation. Valuation is the activity that helps us realize value. How do we then think about value? The Axiologist's value is not the same as the Decision Analyst's value. This talk will focus on Formal Axiology's Dimensions of Value and discuss its possible uses in Decision Analysis to identify sources of value.

2 - The Valuation of Multiplicative Fleeting Opportunities

Ibrahim Almojel, Stanford University, P.O. Box 15348, Stanford, CA, 94309, United States of America, mojel@stanford.edu, Jim Matheson, Pelin Canbolat

We study situations in which decision makers (DMs) with limited capacity have flows of independent fleeting deals coming over time. We formulate this problem as a dynamic program where the DM can accept directly, reject directly, or seek information and then decide whether to accept or reject. We characterize the optimal policy and the value of information over time and capacity. We assume DMs with multiplicative value functions and power utility.

3 - Valuing Conjugate Fleeting Opportunities

Muhammad Aldawood, Stanford University, Stanford, CA, 94309, United States of America, aldawood@stanford.edu, Ibrahim Almojel

In this paper we extend the problem of fleeting opportunities to include relevance between the deal types over time. The decision maker updates his/her belief as deals are offered over time. Specifically, we study priors belonging to families of conjugate probability distributions. We characterize the optimal policy and the value of information over the deals. Finally, we compare the results to the original fleeting opportunities setup with irrelevant deals.

4 - Valuing and Choosing Partners for an Investment

Laure Canis, Stanford University, 238 Ayrshire Farm Lane Apt 105, Stanford, CA, 94305, United States of America, laure.canis@polytechnique.org, Ibrahim Almojel

When choosing partners for an investment, individuals aim at forming a group whose interests are closest to theirs. We will characterize in terms of wealth and risk tolerance who are the best partners to associate with to maximize the value of the investment for each individual.

5 - Valuation of Fleeting Opportunities - Extensions

Pelin Canbolat, Stanford University, 228 Ayrshire Farm Lane # 203, Stanford, CA, 94305, United States of America, canbolat@stanford.edu

In a problem of fleeting opportunities, a decision maker with a limited capacity chooses between investing in a project with uncertain return or not. Such problems arise in the context of venture capital firms and recruitment processes. Certain assumptions ensure the optimality of a threshold policy, which is easy to compute and to implement. These assumptions include independence and unit capacity requirement of opportunities. This work studies the effects of relaxing these assumptions.

■ SC03

C-Room 23A, Upper Level

Economics of Social Networks

Cluster: Game Theory
Invited Session

Chair: Ilan Lobel, MIT, 77 Mass Ave, Cambridge, MA, United States of America, lobel@mit.edu

1 - Game Dynamics, Equilibrium Selection and Network Structure
Amin Saberi, Professor, Stanford University, Terman Engineering Building, Room 317, Stanford, CA, 94305, United States of America, saberi@stanford.edu

Coordination games describe social or economic interactions in which the adoption of a common strategy has payoff. They are classically used to model the spread of conventions, behaviors, and technologies in societies. Since the pioneering work of Ellison (1993), specific network structures have been shown to have dramatic influence on the convergence of such dynamics. In this talk, I will try to make these results more precise and use the intuition for designing effective algorithms.

2 - Communication Information Dynamics in (Endogenous) Social Networks
Kostas Bimpikis, PhD Candidate, MIT, 321 Haravrd Street, Apt. 202, Cambridge, MA, 02139, United States of America, kostasb@mit.edu, Daron Acemoglu, Asu Ozdaglar

We study a model of costly network formation, information aggregation through communication and decision making in large societies. We identify conditions under which there will be asymptotic learning, i.e., as the society grows, the fraction of agents taking correct actions converges to one. We identify properties of the communication cost structure that lead to topologies, that facilitate learning. Finally, we apply our results to random graph models, such as power law and Erdos-Renyi graphs.

3 - Optimal Network Seeding
Arun Sundararajan, NYU, 44 West 4th Street, New York, United States of America, asundara@stern.nyu.edu

I present a model of seeding with network effects that are "local": each agent is influenced by a (typically small and distinct) neighborhood of other agents rather than the entire population. I show that random seeding is almost always profit improving, provide conditions under which the optimal targeted seeding strategy targets the network's "fringes" (less connected nodes) in favor of the "hubsand discuss variation with underlying network structure, seeding costs and firm objectives.

4 - Non-Bayesian Social Learning
Alireza Tahbaz-Salehi, University of Pennsylvania, 3330 Walnut Street, Philadelphia, PA, 19104, United States of America, atahbaz@seas.upenn.edu, Ali Jadbabaie, Alvaro Sandroni

We propose a non-Bayesian model of opinion formation in a social network. The individuals in our model fail to incorporate their neighbors' information rationally. Instead, the belief of each individual is simply a convex combination of her Bayesian posterior and her neighbors' priors. We show that all individuals will asymptotically learn the true state of the world if the social network is strongly connected and their observations are independent.

■ SC05

C-Room 23C, Upper Level

Panel Discussion: Health Care in System Engineering: Past, Present, and Future Directions (Joint Session: QSR/HAS/Data Mining)

Sponsor: Quality, Statistics and Reliability, Health Appplications, & Data Mining
Sponsored Session

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

1 - Health Care in System Engineering: Past, Present, and Future Directions
Moderator: Jing Li, Assistant Professor, Arizona State University, Tempe, United States of America, jing.li.8@asu.edu, Panelists: George Runger, Andrew Schaefer, Ronald L. Rardin, James Benneyan, Kwok Tsui

The five panelists will share their views on the development and future of health care research in system and industrial engineering. Panelists: Drs. James Benneyan, Andrew Schaefer, Kwok Tsui, Ron Rardin, George Runger.

■ SC06

C-Room 24A, Upper Level

Journal of Quality Technology Invited Paper Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Dan Apley, Associate Professor, Northwestern University, Department of Industrial Engineering, Evanston, IL, 60208-3119, United States of America, apley@northwestern.edu

1 - A Review of Statistical Methods for Quality Improvement and Control in Nanotechnology
Jye-Chyi Lu, Professor, Georgia Institute of Technology, School of Industrial and Systems Engr, Atlanta, 30332-0205, United States of America, jclu@isye.gatech.edu

Nanotechnology has become a multidisciplinary subject with multiple research ventures in recent years. The use of statistical methods has aided the rapid development of nanotechnology in terms of data collection, treatment-effect estimation, hypothesis testing, and quality control. This paper reviews instances where statistical methods have been used in nanoscale applications such as experimental design, uncertainty modeling, process optimization and monitoring, and proposes future research.

2 - Bayes Inference for General Repairable Systems
Steven Rigdon, Southern Illinois University Edwardsville, Department of Mathematics and Statistics, Edwardsville, IL, 62026-1653, United States of America, srigdon@siue.edu, Rong Pan

Models for repairable systems are often characterized by the assumed effect of a failure and the subsequent repair. As-bad-as-old models lead to the nonhomogeneous Poisson process and as-good-as-new models lead to the renewal process. We study Bayesian methods for some models that are a compromise between the bad-as-old and the good-as-new models. For the case of multiple systems, we consider a hierarchical Bayes model.

■ SC07

C-Room 24B, Upper Level

Statistical Methods in Prognostics and Reliability

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Nagi Gebraeel, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, nagi@isye.gatech.edu

1 - Classification of Defectives Products via a Pattern-based Model
Irad Ben-Gal, Associate Professor, Tel-Aviv University, Tel-Aviv University,Ramat Aviv,P.O. Box, Tel aviv, 69978, Israel, bengal@eng.tau.ac.il, Gonen Singer

In this work we propose a method for the classification of defectives products. In the first step, we find the profile for each type of defect based on a pattern-based model that represents the relations among attributes values that are inspected by sensors. In the second step, for each product defect, we obtain a likelihood grade representing its similarity relative to defects classes. Example based on a real dataset will be given.

2 - A Statistical Selection Procedure the Network Reliability Design Problem
Andrew Kiekhaefer, Graduate Research Assistant, University of Iowa, 248 ERF, Iowa City, IA, 52242, United States of America, akiekhae@engineering.uiowa.edu, Yong Chen

In this paper, we present a novel solution approach to the k-terminal network reliability design problem. This procedure selects the design with the highest reliability, given a user specified error rate, through the combination of statistical ranking and selection methods and Monte Carlo simulation.

3 - The Residual Life Distribution for Degradation Models under Time-varying Environment
Linkan Bian, Georgia Tech, 1065 Hampton St., Atlanta, United States of America, linkanbian@gatech.edu, Nagi Gebraeel

We present a stochastic model for characterizing degradation signals of components under time-varying environment, which affects a component's degradation rate. Our model is used to compute residual life using a first-passage time approach. This is achieved by combining population-based degradation characteristics with in-situ degradation signals, and real-time information of the environmental conditions. We validate this model by applying it to real world vibration-based degradation signals.

4 - Degradation Modeling of Complete,Sparse and Fragmented Degradation Signals

Rensheng Zhou, PhD Graduate Student, Georgia Tech, 1903 Drew Dr. NW Rm1202, Atlanta, United States of America, rzhou8@gatech.edu, Nagi Gebraeel, Nicoleta Serban

This paper presents a non-parametric degradation modeling framework for characterizing degradation signals of partially degraded engineering systems. We focus on modeling different types of degradation signals to predict the distribution of a system's residual life using real-time degradation signals. We consider complete signals, sparse signals and fragmented signals which are densely observed at disjoint time intervals. The approach is validated using degradation data of bearings.

■ SC08

C-Room 24C, Upper Level

Best Student Paper

Sponsor: Data Mining
Sponsored Session

Chair: Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23229, United States of America, jpbrooks@vcu.edu

1 - Multiple instance Learning via Margin Maximization

Erhun Kundakcioglu, Assistant Professor, University of Houston, Department of Industrial Engineering, E206 Engineering Building 2, Houston, TX, 77204, United States of America, erhun@ufl.edu, Onur Seref, Panos Pardalos

The classification problem within the multiple instance learning (MIL) context is considered. A combinatorial margin maximization problem for multiple instance classification is introduced and proven to be NP-hard. Computational results are presented for a branch and bound algorithm on publicly available image annotation and molecular activity prediction test cases.

2 - Dynamic Kernel-based Ridge Regression for Autocorrelations of Response Variables

Young-Seon Jeong, PhD Candidate, Rutgers, the State University of New Jersey, United States of America, ysjeong@eden.rutgers.edu, Norman Kim, Myong K. (MK) Jeong

We present a dynamic kernel ridge regression that combines kernel ridge regression with lagged dependent variables (LDVs) to improve the prediction accuracy when the dependent variables are autocorrelated and data are high-dimensional. Experimental results show that the proposed approaches with LDVs perform better than several conventional regression models.

3 - A Randomized Exhaustive Propositionalization Approach for Molecule Classification

Michele Samorani, Leeds School of Business - University of Colorado at Boulder, Bldg #4, UCB 419, Boulder, CO, 80309-0419, United States of America, michael.samorani@colorado.edu, Kirk DeLisle, Daniel Weaver, Manuel Laguna

Propositionalization is the process of generating attributes for observations whose characteristics are stored across the tables of a database. The resulting single table can be used as input for a classification procedure. We extend this approach by generating more expressive attributes and using randomization to sample a small set of complex attributes. We apply our method to molecule classification problems and show that the generated attributes are interpretable and lead to a better accuracy

4 - Mining Association Rules with Disjunctions in Consequents

Abhijeet Ghoshal, University of Texas, Dallas, TX, abhijeet.ghoshal@student.utdallas.edu, Sumit Sarkar

We have identified a kind of rules that would be more useful in making recommendations as compared to traditional rules when multiple items are being recommended. We have developed a novel mining algorithm to obtain such rules. Experiments show that the accuracies of recommendations made using the new rules are significantly higher than those made using conjunctive association rules.

■ SC09

C-Room 25A, Upper Level

Games of Fun and Strategy

Sponsor: Applied Probability
Sponsored Session

Chair: Eric Friedman, Cornell University, School of ORIE, Rhodes Hall, Ithaca, NY, 14853, United States of America, ejf27@cornell.edu

1 - Computer (and Human) Perfection at Checkers

Jonathan Schaeffer, University of Alberta, UHall 2-10, Edmonton, AB, T6G2J9, Canada, jonathan@cs.ualberta.ca

In 1989 the Chinook project began with the goal of winning the human World Checkers Championship. The champion, Marion Tinsley, was as close to perfection at the game as was humanly possible. To be better than Tinsley meant that the computer had to be perfect. In effect, one had to solve checkers. Little did we know that our quest would take 18 years to complete. In this talk, the creator of Chinook tells the story of the quest for computer and human perfection at the game of checkers.

2 - A Geometric Analysis of Nim with a Pass

Adam Landsberg, Associate Professor of Physics, Claremont McKenna, Pitzer, and Scripps Colleges, Joint Science Department, 925 N. Mills Ave, Claremont, CA, 91711, United States of America, alandsberg@jsd.claremont.edu, Rebecca Morrison, Eric Friedman

Nim is among the best known combinatorial games. A seemingly simple variant (proposed by the late David Gale) wherein a "pass" is introduced appears to radically increase the game's complexity. In this talk I describe a novel physics-inspired technique which yields probabilistic insights into deterministic combinatorial games based on their underlying geometry. Applying this to Nim-with-a-pass, I show how the increase in complexity is related to a change in the game's underlying geometry.

3 - Regret Minimization for Solving Large Imperfect Information Games

Michael Bowling, Associate Professor, University of Alberta, Department of Computing Science, Edmonton, AB, T5B2Y5, Canada, bowling@cs.ualberta.ca

We examine the use of regret minimization for computing equilibria in large extensive games. We review the concept of counterfactual regret, and show how sampling can dramatically reduce convergence times of these methods. The resulting algorithms essentially compute an equilibrium by simply playing the game. We show its effectiveness in poker, where it was a key part of Polaris, the first computer poker program to defeat pro players. We also demonstrate it on a diversity of non-poker games.

4 - It's Not Your Imagination, Monopoly Never Ends...

Shane Henderson, Professor, Cornell University, School of ORIE, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu, Eric Friedman

... with positive probability. We estimate the probability that two players playing the board game Monopoly will slug it out forever, i.e., that neither player will bankrupt the other. This probability certainly depends on the player's strategies. We assume specific "reasonable" strategies. We'll explain the different estimation methods we used and provide our probability estimate.

■ SC10

C-Room 25B, Upper Level

Stochastic Models of Market Microstructure

Sponsor: Applied Probability
Sponsored Session

Chair: Costis Maglaras, Professor, Columbia Business School, New York, United States of America, c.maglaras@columbia.edu

Co-Chair: Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu

1 - Stochastic Modeling of a Limit Order Book

Rama Cont, Associate Professor, Columbia University, 500 W. 120th Street, New York, NY, 10027, Rama.Cont@columbia.edu, Rishi Talreja, Sasha Stoikov

The high-frequency dynamics of a limit order book can be described in terms of a queuing system with interesting features. This analogy leads to allows to simulation-free computation of various probabilities, conditional on the state of the order book: an increase in the mid-price, execution of an order at the bid before the ask quote moves, and execution of both a buy and a sell order at the best quotes before the price moves.

2 - The Value of Latency
Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu, Mehmet Salgram

Modern electronic markets have been characterized by a relentless drive towards faster decision making. Significant technological investment have lead to dramatic improvements in latency, or the delay between a trading decision and the resulting trade execution. We describe a model to that allows for the quantitative valuation of latency in trade execution. Our model is surprisingly simple and easy to interpret.

3 - A Multiclass Queueing Model of Limit Order Book Dynamics
Costis Maglaras, Columbia University Business School, 4I Uris Hall, 3022 Broadway, New York, NY, 10027, United States of America, cm479@columbia.edu, Ciamac Moallemi

We model the limit order book as system of two, coupled multiclass queues. Specifically, each side of the book is modeled as a single server, multiclass queue operating under a strict priority rule defined by the prices associated with each limit order. We describe the transient dynamics of this system, and formulate and solve the optimal execution problem for a block of shares over a short time horizon.

■ SC11

C-Room 25C, Upper Level

Port and Border Security

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: Vicki M Bier, Professor, University of Wisconsin-Madison, Room3234 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, bier@engr.wisc.edu

1 - Deterring and Detecting the Smuggling of Nuclear Weapons in Container Freight
Naraphorn Haphuriwat, naraphoh@cae.wisc.edu, Henry H Willis, Vicki M Bier

Concerns about terrorists smuggling nuclear bombs into the U.S. in container freight have led to demands for 100% inspection at U.S. ports. However, under some circumstances, it is possible to deter smuggling attempts with less than 100% inspection. We quantify a model of inspection and deterrence to find the optimal level of inspection in the face of attempted nuclear smuggling, and explore the sensitivity of the model results to plausible changes in parameter values.

2 - Port Security Risk Management and Resource Allocation (PortSec)
Isaac Maya, Director of Research, USC/CREATE, 3710 McClintock Ave., RTH308, Los Angeles, CA, 90089-2902, United States of America, imaya@usc.edu, Anthony Barrett, Michael Orosz, Petros Ioannou, Onur Bakir

This study develops and applies systems-based risk management methodologies and tools for assessing tactical and strategic risk to port operations and evaluating alternative technology-based solutions and resource allocation policies. For tactical usage, PortSec will provide up-to-date risk information for areas of interest and the overall port complex. For strategic usage, PortSec will provide the port security analyst with tools to evaluate costs and benefits of counter-measures.

3 - Novel Inspection Policies to Prevent Nuclear Materials Smuggling
Gary Gaukler, TAMU, TAMU-3131, College Station, United States of America, gaukler@tamu.edu, Alex Vaughn, Michelle McGaha, Yu Ding, Chenhua Li

We propose a layered container inspection system for detecting illicit nuclear materials using radiography information. We argue that the current inspection system, relying heavily on the Automated Targeting System (ATS) and passive radiation detectors, is inherently incapable of reliably detecting shielded radiative materials. This motivates the development of a new inspection system, allowing for improved defense against sophisticated adversaries.

4 - Estimating the Operational Impact of Container Inspections at International Ports
Nitin Bakshi, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nbakshi@london.edu, Stephen Flynn, Noah Gans

A recent US law mandating non-intrusive imaging and radiation detection for 100% of US-bound containers at international ports has provoked widespread concern that the resulting congestion would hinder trade significantly. Using detailed data on container movements, gathered from two large international terminals, we simulate the impact of various inspection policies being considered.

■ SC12

C-Room 26A, Upper Level

ICS Prize Winners

Sponsor: Computing Society
Sponsored Session

Chair: S. Raghavan, Associate Professor, University of Maryland, University of Maryland, College Park, MD, United States of America, raghavan@umd.edu

1 - ICS Prize Session

The winners of the 2009 ICS Prize and the 2009 ICS Student Paper Award present their award-winning work.

2 - An Interior-Point Filter Line-Search Algorithm for Large-Scale Nonlinear Programming
Andreas Wachter, PhD, IBM T.J. Watson Research Center, Department of Mathematical Sciences, P.O. Box 218, Yorktown Heights, NY, 10598, andreasw@watson.ibm.com, Lorenz Biegler

We present an algorithm for large-scale nonlinear continuous optimization, together with real-life applications, such as the tuning of transistors in digital circuits, modeling and design of chemical processes and optimal control of nonlinear dynamic systems. We will also present some recent developments of the algorithm, including parametric sensitivity of NLP solutions and the use of iterative linear solvers. An implementation of this algorithm ("Ipopt") is available as open source.

3 - A Line Search Multigrid Method for Large-Scale Nonlinear Optimization
Zaiwen Wen, NSF Math Institutes Postdoc, IPAM, University of California, Los Angeles and Rice University, United States of America, zw2109@columbia.edu, Donald Goldfarb

We present a line search multigrid method for solving discretized versions of general unconstrained infinite dimensional optimization problems. At each iteration on each level, the algorithm computes either a 'direct search' direction on the current level or a 'recursive search' direction from coarser level models. Introducing a new condition that must be satisfied by a backtracking line search procedure, the 'recursive search' direction is guaranteed to be a descent direction. Global convergence is proved under fairly minimal requirements on the minimization method used at all grid levels. Using a limited memory BFGS quasi- Newton method to produce the 'direct search' direction, preliminary numerical experiments show that our line search multigrid approach is promising.

■ SC14

C-Room 27A, Upper Level

Network Applications

Sponsor: Computing Society
Sponsored Session

Chair: Douglas Shier, Professor, Clemson University, Mathematical Sciences Department, Clemson, SC, 29634, United States of America, shierd@clemson.edu

1 - A Biased Random-keys Genetic Algorithm for Monitor Placement in Telecom Networks
Mauricio G. C. Resende, Lead Member of Technical Staff - Research, AT&T Labs Research, 180 Park Avenue, Room C241, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com

We present a biased random-keys genetic algorithm (BRKGA) for placing monitors on edge routers in a telecommunications network. These monitors are used to measure customer traffic performance between edges routers. A trivial solution places a monitor at each edge router. The solutions produced by the BRKGA allow very few monitors to be used.

2 - Scheduling First-Year Seminars
Kevin Hutson, Associate Professor, Furman University, 3300 Poinsett Hwy., Greenville, SC, 29613, United States of America, kevin.hutson@furman.edu

First-year seminars are designed to help students adjust to college-level material and work load. At some colleges, the seminar is broken into two courses, a seminar-type course and a writing-intensive course. At Furman, incoming students are required to take one of each of these course in their first two terms. Here we discuss algorithms for scheduling students to seminars and the problem of determining how many preference choices to give students for scheduling purposes.

3 - An Optimization Approach to a Geometric Packing Problem
Douglas Shier, Professor, Clemson University, Mathematical Sciences Department, Clemson, SC, 29634, United States of America, shierd@clemson.edu, Brad Paynter

We investigate a geometric packing problem derived from an industrial setting that involves the fitting of patterns of circles without overlap. We model this as a feasibility problem and provide a useful theoretical characterization, leading to shortest path subproblems linked to integer solutions of systems of inequalities. These inequalities can be explicitly solved for small dimensions, but in general require integer programming techniques. Directions for future development are discussed.

■ SC15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Vanguard Software
Rob Suggs, CEO, Vanguard Software Corporation, 1100 Crescent Green, Cary, NC, 27518, United States of America, rob.suggs@vanguardsw.com

Vanguard System solves a fundamental challenge of professional modeling groups ñ enabling stakeholders to interact with your models without requiring them to be modeling experts or to have licenses of your modeling software. See how Vanguard turns desktop models into interactive Web applications for forecasting, simulation, and optimization without Web programming!

2 - Gurobi Optimization - Hands on with the Gurobi Python Interactive Interface
Ed Rothberg, COO and Co-founder, Gurobi Optimization Inc., 3733-1 Westheimer Road, Houston, United States of America, rothberg@gurobi.com

Gurobi Optimization provides robust, high-performance optimization software based on the latest linear and mixed-integer programming technologies. Gurobi includes an impressive full-access, interactive interface written in Python. We will take an in depth look at the Gurobi Python interactive interface and how it can be used as a powerful, rapid prototyping tool.

■ SC16

C-Room 28A, Upper Level

Joint Session IS/eBusiness: Digital Platforms and Competitive Strategy

Sponsor: Information Systems & eBusiness
Sponsored Session

Chair: Vallabh Sambamurthy, Michigan State University, N231 BCC, East Lansing, MI, 48824, United States of America, sambamurthy@bus.msu.edu

1 - Online and Offline Demand and Price Elasticities: Evidence From the Air Travel Industry
Nelson Granados, Assistant Professor of Information Systems, Graziadio School of Business, Pepperdine University, 18111 Von Karman Ave., Irvine, CA, 92612, United States of America, Nelson.Granados@pepperdine.edu, Alok Gupta, Robert Kauffman

We compare the demand functions in offline and online travel agency (OTA) channels, using a data set with millions of records or airline ticket sales in both offline and online channels. To our knowledge, this is the first study that compares demand functions in the two channels using massive sales data. We find that demand on the Internet is more price-elastic, driven by the OTA transparency levels and by a different mix of customers relative to the offline channel.

2 - Digital Systems, Network Structure and Competitive Actions
T. Ravichandran, Associate Professor, RPI, Lally School of Management, 110 Eighth Street, Troy, NY, 12180, United States of America, ravit@rpi.edu, Lei Chi, Goce Andrevski

In this study, we focus on two antecedents of competitive activity of firms: 1) access to network resources and 2) use of information technology. Our focus is on how firms use IT to exploit their external network resources for influencing firm competitive behavior and develop a theoretical model that examines the relationships between IT use, network structure, and competitive action. We test our model using secondary data collected from one industry over a period of 16 years.

3 - A Network Perspective of Digital Competition in Online Advertising Markets: A Simulation Approach
Wonseok Oh, Associate Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A1G5, Canada, wonseok.oh@mcgill.ca, Dowan Kwon, Ray Chang, Alain Pinsonneault

Based on agent-based simulations, we explore how influence networks play a synergy-creating role in the situation where non-market leaders form strategic alliances, either horizontal or vertical, to compete with a dominant leader. We also assess the extent to which targeting strategies and the timing of strategic actions affect alliance outcomes.

■ SC17

C-Room 28B, Upper Level

Ontology, Cognition and Semantics: Conceptualizing Meaning in Information Systems

Sponsor: Information Systems
Sponsored Session

Chair: Vijay Khatri, Associate Professor, Indiana University, 1309 E. 10th Street, BU 560F, Bloomington, IN, 47405, United States of America, vkhatri@indiana.edu

1 - Boundary Objects, Conceptual Models and Cognition: Engaging Users in Work Systems Improvements
Andrew Gemino, Associate Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, gemino@sfu.ca

System analysis researchers should study representation and the cognition of those who create and view representations. Experimental results suggest improved understanding can be facilitated through more effectively presenting system models and providing opportunity for interaction. Stakeholders benefit from these changes that make information from traditional analysis methods more accessible. Accessibility leads to higher levels of engagement and more understanding of work systems improvements.

2 - Ontological Rules in Conceptual Modeling: What and When
Andrew Burton-Jones, Assistant Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, Andrew.Burton-Jones@sauder.ubc.ca, Palash Bera, Yair Wand

In the early stages of developing an information system, systems analysts often create conceptual models to document their understanding of the business domain to be supported by the system. Very few guidelines exist for creating conceptual models. This presentation will summarize a research program that aims to determine whether theories of ontology can provide guidelines for conceptual modeling. The presentation will focus on what such guidelines might be and when they will be most useful.

■ SC18

C-Room 28C, Upper Level

Computational Biology

Sponsor: Computing Society
Sponsored Session

Chair: Ezgi Eren, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, United States of America, ezgieren@neo.tamu.edu

1 - Branch-and-price in Column Generation with Nonlinear Subproblem for Sibling Reconstruction
Chun-An Chou, Department of Industrial and Systems Engineering, Rutgers, The State University of New Jersey, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, joechou@rci.rutgers.edu, Zhe Liang, Tanya Berger-Wolf, Mary Ashley, Bhaskar DasGupta, W. Art Chaovalitwongse, Saad Sheikh, Isabel Caballero

We propose a new branch-and-price in column generation for sibling reconstruction. The master problem is formulated as a set covering problem with multi-objective function, while the pricing subproblem is a quadratic program incorporating a likelihood function. We tested approaches on real data sets, and the results provide important insights in population biology.

2 - Systems Biology Based Drug Target Identification in Diabetes
Soundar Kumara, Professor, Industrial Engineering and Information Science Technology, 310 Leonhard, University park, PA, 16802, United States of America, u1o@engr.psu.edu, Manini Madireddy

In our study morbidly obese diabetic patients undergoing bariatric surgery were found to be freed from diabetes after the surgery. Our hypothesis that the differentially expressed proteins (before and after surgery) in the patients may be related to the potential drug targets for diabetes. We analyze the protein sample in the context of the entire human protein interaction network. Preliminary results indicate that the topological properties of sample proteins provide significant insights.

3 - Prior Knowledge Can Enhance Classification Accuracy of Biomedical Data
Altannar Chinchuluun, Dr., University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, altannar@ufl.edu, Stratos Pistikopoulos, Mario Guarracino

Neural Networks have proven to be a strong method to extract regularities in data and classify events. We propose a way to include knowledge into Radial Basis Function Neural Networks and to express knowledge as set of linear constraints to the underling least square problem. Publicly available biomedical datasets are used as case study to analyze the performance of the approach and to compare the results with state of the art classifiers.

4 - Stochastic Models for Microtubule Dynamics and Organization Inside the Plant Cell
Ezgi Eren, Texas A&M University, Industrial and Systems Engineering, 3131 TAMU, College Station, TX, United States of America, ezgieren@neo.tamu.edu, Natarajan Gautam, Ram Dixit

In this research, we model stochastic growth and interactions of microtubules which are polymers found in living cells. In plant cells, microtubules are created in arbitrary locations on the cell wall and they grow, shrink and interact by running into one another, thereby changing their trajectories. However, these interactions lead to an organized structure which we use discrete and continuous Markov models to characterize. We test the results with computer simulations and lab experiments.

■ SC19

C-Room 28D, Upper Level

Advances in Network Equilibrium Models I

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu

1 - A New Stochastic Traffic Equilibrium Model with Probabilistic Travel Times and Perception Errors
Zhong Zhou, Developer, Citilabs, 1040 Marina Village Pkwy, Alameda, CA, 94501, United States of America, zzhou@citilabs.com, Anthony Chen, William Lam Hing-keung

This study proposes a novel stochastic traffic equilibrium model that considers both reliability and unreliability aspects of travel time variability and perception errors within the travelers route choice decision processes. An approximation method based on moment analysis is developed to compute the perceived mean-excess travel time. The model is formulated as a variational inequality problem, and solved by a route-based algorithm with the use of the modified alternating direction method.

2 - An Improved Path-based Flow Update Algorithm for the Static User Equilibrium Traffic Assignment Problem
Amit Kumar, Research Assistant, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, kumar44@purdue.edu, Srinivas Peeta

We propose an improved algorithm to determine the path-based user equilibrium traffic assignment solution. The algorithm inherits some insights from the gradient projection algorithm of Jayakrishnan et al. (1994) and Florian et al. (2009), and extends the idea of Dial (2006) from a pair of paths to multiple paths. It applies separate flow update move directions for costlier and cheaper paths. The problem is formulated and solutions are presented for a test network.

3 - On the Existence of Dynamic User Equilibrium in a Stochastic Network with Adaptive Travelers
Song Gao, University of Massachusetts Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu

Traffic systems are inherently uncertain with random disturbances such as incidents and bad weather. Therefore travelers might adapt to traffic conditions revealed through traveler information systems, rather than following fixed routes. Conventional network equilibrium analysis does not take into account these factors. This research investigates the existence of dynamic user equilibrium in a stochastic network with adaptive travelers, which is formulated as a fixed point problem.

4 - Method of Isochronal Vehicle Assignment: Methodology, Computational Performance, and Self-Tuning
Eric Nava, The University of Arizona, 1209 E. 2nd St. Room 206, Tucson, AZ, 85719, United States of America, ejnava@email.arizona.edu, Yi-Chang Chiu

Method of Isochronal Vehicle Assignment is an innovative dynamic traffic assignment computational scheme that decouples the network loading and assignment procedure, making 24-hour DTA analysis possible. In this talk, we discuss the MIVA concept, methodology, computational performance, and the self-tuning approach for optimal performance setting.

■ SC20

C-Room 28E, Upper Level

Heuristics for Vehicle Routing Problems III

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: John Beasley, Professor, Brunel University, Mathematical Sciences, Uxbridge, UB8 3PH, United Kingdom, John.Beasley@brunel.ac.uk

1 - Metaheuristics for Orienteering Problems
Richard Hartl, Department of Business Administration, University of Vienna, Vienna, Austria, Richard.Hartl@univie.ac.at

In the orienteering problem not all customers must be visited and a maximum profit should be collected within a given travel time. Heuristic solution techniques based on variable neighborhood search are presented and competitive results for benchmark instances are provided. Also considered is a multi-objective problem variant as well as an application where customers have several alternative time windows.

2 - Column Generation Procedure for the Split Delivery Vehicle Routing Problem
Joe Wilck, Assistant Professor, The University of Tennessee (Knoxville), 411 East Stadium Hall, Knoxville, TN, United States of America, joe.wilck@gmail.com, Tom M. Cavalier

The Split Delivery Vehicle Routing Problem (SDVRP) allows customers to be assigned to multiple routes. A column generation procedure is developed for the SDVRP. Computational results are given for data sets from previous literature. With respect to the total travel distance and computation time, the column generation procedure compares favorably versus previously published methods.

3 - A Tabu Search Heuristic for the Waste Collection Vehicle Routing Problem with Time Windows
John Beasley, Professor, Brunel University, Mathematical Sciences, Uxbridge, UB8 3PH, United Kingdom, John.Beasley@brunel.ac.uk

We have a single depot, a set of waste disposal sites and a set of customers at which waste is collected. Vehicles go out from the depot and collect waste from customers, emptying themselves at the waste disposal sites as and when necessary. A nearest neighbour greedy technique is used to obtain an initial solution. We improve this solution using an approach based on neighbour sets, followed by a tabu search phase. Computational results are presented for problems involving up to 2100 customers.

■ SC21

C-Room 30B, Upper Level

Large-scale Planning and Analysis Models for Air Traffic Flow Management

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Robert Hoffman, Principal Analyst, Metron Aviation Inc., 45300 Catalina Court, Dulles, VA, 20166, United States of America, Hoffman@metronaviation.com

1 - Strategic Air Traffic Management with Dynamic Uncertain Weather
Andrew Churchill, Graduate Research Assistant, University of Maryland, Dept of Civil Engineering, 1173 Martin Hall, College Park, MD, 20742, United States of America, churchil@umd.edu, David Lovell

We consider the problem of routing many aircraft in the presence of uncertain dynamic weather disruptions. Such disruptions presents two challenges: the potential for blocking planned routes, as well as the uncertain nature of the movement and evolution of the disruption. Several variations of this problem are

presented, covering various levels and dimensions of stochasticity, as well as several different methodological approaches. The implications for daily strategic planning are discussed.

2 - Resource Allocation in FCA with Stochastic Termination Times Considering Optimistic Reroutes

Moein Ganji, Ph.D. Candidate, University of Maryland, Department of Civil and Environmental Eng., University of Maryland, College Park, md, 20740, United States of America, moein_g@yahoo.com

We formulate an optimization model for the assignment of dispositions to flights whose preferred flight plans pass through an FCA. The model is a two-stage stochastic program that represents the time of future capacity windfall as a random variable. This paper extends our earlier work on this problem by allowing the initial reroutes to vary from pessimistic to optimistic. We conduct experiments allowing a range of such trajectories and draw conclusions regarding appropriate strategies.

3 - Dantzig-Wolfe Decomposition Applied to National Traffic Flow Management

Joseph Rios, Aerospace Engineer, NASA, Mail Stop 210-10, Moffet Field, CA, 94035, United States of America, Joseph.L.Rios@nasa.gov, Kevin Ross

Scheduling traffic flows over the entire National Airspace System is a computationally intensive task. A job-shop scheduling based model for solving this problem is demonstrated to provide high-fidelity solutions in reasonable time through the application of Dantzig-Wolfe Decomposition. We show that by massively parallelizing by assigning a single flight to each subproblem, computation time and solution integrality properties both improve. Theoretical reasons for the results will be discussed.

4 - Lessons Learned From Running Large-scale Models: The Joy and Pain of it All!

Robert Hoffman, Principal Analyst, Metron Aviation Inc., 45300 Catalina Court, Dulles, VA, 20166, United States of America, Hoffman@metronaviation.com

We will discuss some of the complexities and nuances of implementing large-scale planning models on real-world data.

■ SC22

C-Room 30C, Upper Level

Joint Session Location Analyis/TSL: Location Models for Transportation Facilities

Sponsor: Location Analysis & Transportation Science and Logistics
Sponsored Session

Chair: Seyed Mohammad Nourbakhsh, PhD Student, UIUC, B156, 205 N. Mathews Avenue, Civil & Environmental Engineering, Urbana, IL, 61801, United States of America, nourbak1@illinois.edu

1 - Multi-Modal Facility Location Methodology for Optimal Placement of Park and Ride Facilities

Jhael Isa, Graduate Student, Rensselaer Polytechnic Institute, 2441 22nd Street #5, Troy, NY, 12180, United States of America, isaj@rpi.edu, Satish Ukkusuri, Kien Doan

This work presents a mathematical programming approach to solve a multi-modal facility location problem to locate park-and-ride facilities. The formulation uses facility location techniques to perform the location of the park-and-ride facility. Practical considerations related to environmental objectives and land use agreements will be considered. The model is implemented in the New York City area to illustrate results.

2 - Optimal Fueling Schedule and Fuel Station Problem

Seyed Mohammad Nourbakhsh, PhD Student, UIUC, B156, 205 N. Mathews Avenue, Civil & Environmental Engineering, Urbana, IL, 61801, United States of America, nourbak1@illinois.edu, Yanfeng Ouyang

This study proposes a mathematical model to minimize the total cost needed to fuel all locomotives travel over a railroad network. The given locomotive routes pass through multiple candidate gas stations that are available for contracting and offer different fuel prices. The goal of the model is to balance the trade-off between fuel purchase costs, the delay of the locomotives for fueling, and the contracting cost for the used fuel stations, while ensuring the locomotives never run out of fuel.

■ SC23

C-Room 30D, Upper Level

Methods for Technology Management

Sponsor: Military Applications Society
Sponsored Session

Chair: Ann-Marie Lamb, PhD Student, Engineering & Technology Management, Portland State University, Portland, United States of America, ajlamb@pdx.edu

1 - Optimal Design and Prepositioning of Humanitarian Assistance Pack-Up Kits

Wilson Price, Visiting Professor, Naval Postgraduate School, 1411 Cunningham Road, Monterey, Ca, 93943-5219, United States of America, wipr1@aol.com, Valerie McCall, Gerald Brown

Providing exigent humanitarian relief is a core mission of the U.S. military. We present a design for supply kits, each sufficient to support a thousand people for two weeks, and show how to preposition these kits for quick delivery to affected populations. We illustrate with a policy case study for US Pacific Command.

2 - Application of ANP Methodology in Evaluation of Advanced Manufacturng Technologies

Sharon Ordoobadi, University of Massachusetts-Dartmouth, 285 Old Westport Road, Dartmouth, MA, 02747, United States of America, sordoobadi@umassd.edu

Selection of a new technology is multidimensional in nature and interdependent relationships exist among various qualitative and quantitative elements of the system. Thus the Analytic Network Process (ANP) is used in the development of the proposed decision tool. Several pair-wise comparisons are conducted to determine local priorities for the selection criteria and alternatives. These priorities are then used to determine the overall priorities for rankings of the alternatives.

3 - Emerging Technology Forecasting Method Used for Strategic Technological Breakthroughs

Ann-Marie Lamb, PhD Student, Engineering & Technology Management, Portland State University, Portland, United States of America, ajlamb@pdx.edu, Timothy Anderson

Technology Forecasting Data Envelopment Analysis (TFDEA) is used to assist in predicting technology maturity as well as creating strategy for new product development and revolutionary technology breakthroughs; thereby enabling strategists to plan for(or even drive) technology frontiers. The latest TFDEA application will be shared.

■ SC24

C-Room 30E, Upper Level

Business Mission Area - ERPs

Sponsor: Military Applications Society
Sponsored Session

Chair: Tim Elkins, Department of Systems Engineering, United States Military Academy, Bldg 752, 422 Mahan Hall, West Point, NY, 10996, United States of America, timothy.elkins@usma.edu

1 - Building a Local Logistical Support System for Emergency Response and Disaster Recovery

Timothy Elkins, Department of Systems Engineering, United States Military Academy, Bldg 752, Room 422, Mahan Hall, West Point, NY, 10996, elkins.timothy@gmail.com, John Shaw, Carmine Centrella, Daniel Scace

The Region 3 Emergency Planning Team (Capitol Region of CT) required a system to acquire, inventory, deploy, track, and demobilize emergency response and recovery resources, including personnel. Collaborating with the Department of Systems Engineering at the United States Military Academy, the Team developed a decision analysis / support model to aid in the selection / design of a system to meet the region's needs using a values-driven, holistic approach, the Systems Decision Process.

2 - Achieving the Army Business Transformation via an ERP Center of Expertise

George Albinson, Director, ERP CoE, RDECOM, ARDEC, Bldg 1, Picatinny Arsenal, NJ, 07806-5000, george.albinson@us.army.mil

ARDEC is the first Federal winner of the Baldrige Award and implemented the SAP ERP application for its business requirements, achieving a cross-organization, cross-functional approach. Without adaptive capabilities through agile business processes, the Army Transformation cannot be achieved. Army leadership has formed a Center of Expertise supported by Process Teams. The ARDEC ERP will develop the ERP COE to converge and sustain Army ERP programs.

3 - Configuring an ERP for Army Enterprise Management
John Organek, Enterprise Architect, BMA, Office of the Deputy Undersecretary of the Army, ODUSA, Pentagon 3A514A, Washington, DC, 20310, United States of America, John.Organek@us.army.mil

The US Army has been converging its multiple, largely single-functioned, enterprise resource planning (ERP) software landscape to optimize the efficiency and effectiveness of its core business processes. The converged ERP is to be a key component of the Army's transformation to top-to-bottom enterprise management. The initial integration thread will focus on the processes, activities, and data required to support the Army Force Generation process (ARFORGEN).

■ SC25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Propagation of Flight Delay and Passenger Impacts I

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Cynthia Barnhart, Associate Dean for Academic Affairs, MIT, School of Engineering, Cambridge, MA, 02139, United States of America, cbarnhart@MIT.EDU

1 - A Framework for Evaluating Passenger Delays in Traffic Flow Management
Douglas Fearing, MIT, Operations Research Center, Cambridge, MA, 02139, United States of America, dfearing@mit.edu, Cynthia Barnhart, Constantine Caramanis

Many research problems in TFM would benefit from the analysis of passenger delays. This analysis has been difficult to perform as publicly-available data does not contain passenger counts for individual itineraries. Researchers have instead focused on flight-based analyses, which ignore the delays associated with itinerary disruptions. Thus, we propose a framework for simulating disaggregated passenger flows and approximating airline recovery operations to evaluate the passenger impacts of TFM.

2 - Passenger Impacts of Excessive Surface Delays
Frederick Foreman, Ph.D., Senior Analyst, Metron Aviation, 45300 Catalina Ct, Suite 101, Dulles, VA, 20166, United States of America, foreman@metronaviation.com, Dan Larsen

An Excessive Surface Delay (XSD) is defined as an event where passengers spend three (3) hours or more on an aircraft located somewhere on the surface of one or more airports without deplaning. This paper investigates the possible causes of XSDs and their impact on passengers experiencing XSDs ranging from three (3) to nine (9) hours. Case studies of known XSD events are analyzed and their causes are determined. In addition, strategies for modeling and possibly mitigating XSDs are explored.

3 - Explore the Past to Improve the Future: How Airlines Can Benefit From Historial Data?
Niklaus Eggenberg, EPFL, EPFL ENAC Transp-OR, Station 18, Lausanne, CH-1015, Switzerland, niklaus.eggenberg@epfl.ch, Cynthia Barnhart, Virot Chiraphadhanakul

Airlines' schedules are built such as to maximize expected profit. Such schedules turn out to be more sensitive to delay propagation and have lower on-time performance. Robust schedules are thus used instead. In this paper, we compare two different approaches to derive robust schedules, being either based on historical data or not. We show how the way historical data is considered affects the solutions' quality.

4 - A Model of Delay Propagation in a Network of Airports
Nikolas Pyrgiotis, MIT, Cambridge, MA, United States of America, pyrgios@mit.edu

This work is motivated by airport congestion problems and by the necessity to understand the complex interactions that lead to propagation of delays across airport networks. In this talk we present a model that captures the propagation of delays in a network of airports. Each airport is modeled as a single server queuing system where local delays are estimated and then propagated around the network through the aircraft itineraries. The effects of propagation of delays are discussed.

■ SC26

C-Room 31B, Upper Level

Joint Session AAS/TSL: Stochastic Models in Aviation

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: Senay Solak, Assistant Professor, University of Massachusetts, Isenberg School of Management, Amherst, MA, 01003, United States of America, solak@som.umass.edu

1 - Optimizing Arrival Traffic Managment Given Uncertainties
Clayton Tino, Graduate Research Assistant, Air Transportation Laboratory, Georgia Institute of Technology, 270 Ferst Drive, Atlanta, GA, 30332-0150, United States of America, clayton.tino@gatech.edu, John-Paul Clarke

The implementation of CDA in high density markets is constrained by the ability to merge and space arriving aircraft while avoiding costly, last-minute vectoring. Using fuel-burn optimized, small en-route speed changes, one can manage CDA traffic in the cruise regime. However, this method is highly sensitive to errors in deterministic predicted arrival time calculations. We address this sensitivity by introducing arrival time uncertainty as a constraint in the speed change generation problem.

2 - A Multi-stage Stochastic Programming Approach for the Single-sector Traffic Flow Management Problem
Yu-Heng Chang, Georgia Institute of Technology, Industrial & Systems Engineering, Atlanta, United States of America, yhchang@gatech.edu, Senay Solak, John-Paul Clarke, Ellis Johnson

We study the stochastic single-sector traffic flow management problem which determines the number of aircraft to send towards a sector and the recourse actions under the uncertainty of weather. Based on our two-stage stochastic model, we extend it to a three-stage one which involves more decision-making points. Since a more integrated model is proposed, a better solution in terms of costs is expected.

3 - Monte Carlo Validation of a Diffusion Model for a Single Airport Queue
David Lovell, Associate Professor, University of Maryland, Department of Civil Engrg., 1173 Martin Hall, College Park, MD, 20742, United States of America, lovell@umd.edu, Kleoniki Vlachou

A diffusion approach to modeling a single airport queue is presented. The diffusion approach requires specifying only two moments of the arrival and service distributions. Monte Carlo techniques are used to validate this assumption across a range of distributions.

■ SC27

C-Room 31C, Upper Level

Efficient Simulation

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Hernan Awad, University of Miami, Department of Management Science, Coral Gables, FL, 33124-6544, United States of America, h.awad@miami.edu

1 - Rare-event Simulation of Smooth Gaussian Random Field
Jingchen Liu, Assistant Professor, Columbia University, 1255 Amsterdam Ave, Room 1030, New York, NY, 10027, United States of America, jcliu@stat.columbia.edu, Jose Blanchet, Robert Adler

We present an algorithm to efficiently compute the tail probabilities for the maxima of Gaussian random fields. In particular, we focus on twice differentiable and stationary fields living in a compact subset of R^d. The efficiency analysis of the algorithm takes advantage of the structures of the random fields around local maxima and area of the excursion set. These properties depend heavily on differentiability and the expansion of the covariance function around origin.

2 - Adaptive Control Variate Methods Using Trust Region Algorithms
Sujin Kim, Assistant Professor, National University of Singapore, Department of Industrial and Systems Eng, Singapore, 117576, Singapore, iseks@nus.edu.sg

We consider adaptive methods based on control variate schemes, where the optimal controls are determined by trust region algorithms. We assume the existence of a parameterized family of control variates and show how such controls can be generated in the Markov-process setting. We discuss the optimization problem of searching for a good choice of parameterization, and study the asymptotic properties and efficiency of the resulting estimator.

3 - Efficient Simulation in Finite Horizon Problems
Leonardo Rojas-Nandayapa, ITAM, Rio Hondo, Mexico City, DF, 01000, Mexico, leorojas@imf.au.dk, Soren Asmussen

Consider f(u,t) the probability that the workload in an empty M/G/1 queue exceeds u at time t, or, equivalently, the ruin probability in the classical Cr·mer-Lundberg model. Assuming service times/claim sizes to be regularly varying, Monte Carlo estimators are suggested, variance estimates are derived, efficiencies are compared numerically and also the estimators are shown to have bounded relative error in some main cases. Extensions to general Lévy processes are treated.

4 - Response Surface Computation via Simulation in the Presence of Convexity
Eunji Lim, Assistant Professor, University of Miami, Room 281, McArthur Engineering Building, University of Miami, P.O. Box 248294, Coral Gables, Fl, 33124-0620, United States of America, lim@miami.edu, Peter Glynn

We will consider the problem of computing a response surface which is known to be convex in the underlying parameter. Our focus is on the case where the underlying parameter resides in a multidimensional space. We will review a method that incorporates the convexity into the function estimator and discuss the asymptotics of this estimator. The effectiveness of this methodology will be illustrated with numerical examples.

■ SC28

H-Room 500, Fifth Floor

Dynamic Pricing

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Serhan Ziya, University of North Carolina, 356 Hanes Hall, Chapel Hill, NC, 27599, United States of America, ziya@email.unc.edu

1 - Pricing and Production Policies for an Online Manufacturer
Victor Araman, NYU/AUB, 44 West 4th Street Room 8-74, New York, NY, 10012, varaman@stern.nyu.edu, Bacel Maddah

We consider a manufacturer selling directly to a customer through an online store. A visiting buyer has two options either to customize his product by selecting the different features or to buy "off-the shelf" some pre-built version of the product. We study how this variety available online affects decisions such as pricing and production (i.e. the ratio between make-to-order and make-to-stock) policies.

2 - Mitigating Strategic Consumer Behavior via Innovative Pricing Strategies
Yossi Aviv, Professor of Operations Management, Washington University in St. Louis, Campus Box 1133, 1 Brookings Drive, Saint Louis, MO, 63130, United States of America, AVIV@WUSTL.EDU

In this talk, we will discuss ways in which sellers can adopt creative dynamic 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.

3 - Stochastic Quasi-Gradient Methods for Dynamic Pricing
Song (Alex) Yang, The University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, 60637, United States of America, syang1@chicagobooth.edu, John Birge

In the traditional dynamic pricing literature, demand function estimation and pricing are done separately. In this talk, we take an alternative approach by considering demand learning and pricing jointly. We apply stochastic gradient method to dynamic pricing with unknown demand function. The advantage of this non-parametric method is that we don't need to assume any specific functional form of the demand distribution.

4 - Choosing the Customer Signal in Personalized Dynamic Pricing of Limited Inventories
Serhan Ziya, University of North Carolina, 356 Hanes Hall, Chapel Hill, NC, 27599, United States of America, ziya@unc.edu

We consider a firm selling a product with a limited inventory over a finite horizon. Each arriving customer provides a signal that gives some indication about the customer's reservation price. The firm's objective is to maximize its expected profit by setting prices depending on the customer signal, the inventory level, and time. Under some reasonable assumptions, we establish conditions under which one particular signal leads to higher optimal expected profits than the other.

■ SC29

H-Room 501, Fifth Floor

Resource Optimization and Renewable Integration

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Shmuel Oren, Professor, University of California, Berkeley, 4119 Etcheverry Hall, Berkeley, CA, 94720, United States of America, oren@ieor.berkeley.edu

1 - Ensuring Revenue Adequacy of Financial Transmission Rights with Transmission Switching
Kory Hedman, PhD Candidate, University of California, Berkeley, 4124 Etcheverry Hall, University of California, Berkeley, Berkeley, CA, 94720, United States of America, kwh@berkeley.edu, Richard O'Neill, Shmuel Oren

The current push to create the smart grid includes research suggesting that we should co-optimize generation along with the network topology. However, optimizing the topology may cause revenue inadequacy of FTRs. We present a transmission switching formulation that includes a feasibility test in order to guarantee that the chosen topology solution is revenue adequate; this guarantee only holds under a DC load flow setting. We also discuss alternative ways of addressing this problem.

2 - Swapping Generators' Assets: Market Salvation or Wishful Thinking
Golbon Zakeri, University of Auckland, 70 Symonds Street, Auckland, New Zealand, g.zakeri@auckland.ac.nz, Anthony Downward, David Young

In April this year the New Zealand Commerce Commission released a review of the New Zealand Electricity Market (NZEM) which was followed by a ministerial review of the NZEM. Both of these reviews a number of asset swap and divestiture options for improving the NZEM. We will present the examine these suggestions in presence of changing costs and line constraints. We will demonstrate that for our simple examples, these structural changes will achieve the opposite of what was intended.

3 - Infrastructure Improvements and Total Welfare in an Electricity Market with Fuel Network
Sarah Ryan, Professor and Director of Graduate Education, Iowa State University, Dept of Industrial & Manufacturing Syste, 3004 Black Engineering Building, Ames, IA, 50011-2164, United States of America, smryan@iastate.edu, Andy B. Philpott, Golbon Zakeri, Anthony Downward

We formulate a game consisting of a minimum cost fuel dispatcher, generators in Cournot competition, and an independent system operator (ISO) that sets nodal prices to balance electricity supply with linear demand functions. A Nash equilibrium exists. Under different assumptions about generator rationality with respect to ISO decisions, paradoxical effects on total welfare can result from expanding capacity of either electricity transmission or low-cost fuel transportation.

4 - Net Emissions Impacts of Plug-In Hybrid Electric Vehicles
Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu, Paul Denholm

We use a unit commitment model to estimate the net emissions impacts of plug-in hybrid electric vehicles (PHEVs) under a controlled charging scenario in which the system operator has some flexibility in controlling PHEV charging. Our results show that controlled charging can result in significant generation efficiency gains and actually reduce generator emissions of NOx, despite net increases in generation. We also estimate SO2 and CO2 emissions and the impact of vehicle to grid services.

■ SC30

H-Room 502, Fifth Floor

Forestry I: Timber Harvest Scheduling

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Forest Management under Market Uncertainty
Andres Weintraub, Professor, University of Chile, Beauchef 850, Santiago, Santiago, Chile, aweintra@dii.uchile.cl, Antonio Alonso, Laureano Escudero, Monique Guignard, Martin Quinteros

We consider the problem of planning timber harvest and building access roads when demand is uncertain. This is formulated as a multistage stochastic integer programming problem, with scenarios representing prices and ranges of possible sales. We developed a Branch and Fix coordinated algorithm to solve it. When compared with a deterministic approach using averages, the stochastic approach is clearly superior, obtaining robust results, and producing feasible solutions for all scenarios.

2 - Imposing Old-growth Patch Constraints in Forest Harvest Scheduling Models
Marcos Goycoolea, Universidad Adolfo Ibañez, Diagonal Las Torres 2640, Peñalolén, Santiago, Chile, mgoycool@gmail.com, Juan Pablo Vielma, Andres Weintraub, Miguel Constantino

One way of addressing wildlife preservation concerns in harvest scheduling is to require large contiguous patches of mature forest to be left standing after harvest. We discuss modeling and solution techniques for integrating this constraint in existing revenue-maximizing models and present computational results on real medium-sized forest instances found in the FMOS repository.

3 - Optimal Cable Corridor Layout for a Given Road Network
Leo Bont, ITES-Land Use Engineering Group, CHN K 75.1, ETH-Zentrum, Zurich, Switzerland, leo.bont@env.ethz.ch, Hans Rudolf Heinimann

Cable corridor layout is a challenging decision for timber harvesting on steep slopes. We introduce an approach to identify an optimal layout, formulated as a MIP cascading facility location problem, which can be solved with a commercial solver. Model application to terrain units of about 10 hectares gives results in reasonable time.

■ SC31

H-Room 503, Fifth Floor

Industrial Applications of Revenue Management and Pricing Methods

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Erol Biberoglu, Hotwire.com, 655 Montgomery St. #600, San Francisco, CA, 94111, United States of America, ebiberoglu@hotwire.com

1 - Assortment and Shelf Space Optimization in Retail
Kerem Tomak, Information Resources Inc, 150 North Clinton Rd., Chicago, United States of America, ktomak@gmail.com

In this talk, we will present state of the art techniques which combine panel, pos and loyalty data to help retailers in their assortment planning and shelf space allocation tasks. We will discuss their application in a large retail store.

2 - Optimal Segmentation via Opaque Pricing
Chris Anderson, Assitant Professor, The school of Hotel Administration, Cornell Univeristy, 335A Statler Hall, ithaca, NY, 14850, United States of America, canderson@cornell.edu, Kristine Xie

Opaque pricing allows the sale of differentiated products at higher prices to brand loyal customers while selling to non loyal customers at lower prices.We develop a model of consumer choice that illustrates segmentation via opaque pricing.We model a monopolist selling via 3 channels:full information channel,opaque posted price channel,opaque bidding channel.We show segmentation created by opaque pricing and compare optimal revenues and prices for sellers with and without opaque pricing.

3 - Market-Level Pricing for Hotels and Gaming Resorts
Ahmet Kuyumcu, President, Prorize, 12138 Madison Drive, Atlanta, GA, United States of America, akuyumcu@prorize.com, Amar Duggasani, Utku Yildirim

Many hotel chains and gaming resorts own more than one property in the same market, often directly competing with each other. In this situation, each property typically has a property-focused pricing approach, which leads to suboptimal results. This presentation explores key challenges and discusses real-world examples.

■ SC32

H-Room 504, Fifth Level

Portfolio Credit Risk

Cluster: Financial Engineering
Invited Session

Chair: Kay Giesecke, Assistant Professor, Stanford University, Management Science and Engineering, Stanford, CA, United States of America, giesecke@stanford.edu

1 - Bilateral Counterparty Risk Valuation with Stochastic Dynamical Models and Application to CDS
Agostino Capponi, PhD, California Institute of Technology, Paadena, CA, 91125, acapponi@caltech.edu, Damiano Brigo

We introduce the general arbitrage-free valuation framework for counterparty risk adjustments in presence of bilateral default risk, including default of the investor. We illustrate the symmetry in the valuation and show that the adjustment involves a long position in a put option plus a short position in a call option, both with zero strike and written on the residual net value of the contract at the relevant default times. We allow for correlation of investor and counteparty default times.

2 - Default Clustering and Valuation of Collateralized Debt Obligations
Steven Kou, Professor, Columbia University, 312 Mudd, Department of IEOR, 500 West 120th Street, New York, NY, 10027, United States of America, sk75@columbia.edu, Xianhua Peng

The recent financial turmoil has witnessed the powerful impact of the default clustering effect. We propose a model based on {\it cumulative} default intensities that can incorporate the default clustering effect. The model is tractable enough to provide a direct link between single-name credit ecurities, such as credit default swaps (CDS), and multi-name credit securities, such as CDOs. The result of calibration to the recent market data during the crisis shows that the model is promising.

3 - Multi-Scale Time Changes Birth Processes for Pricing Multi-Name Credit Derivatives
Erhan Bayraktar, Assistant Professor, University of Michigan, Department of Mathematics, 530 Church Street, Ann Arbor, MI, 48109, United States of America, erhan@umich.edu, Bo Yang

We develop two parsimonious models for pricing multi-name credit derivatives. We derive closed form expression for the loss distribution, which then can be used in determining the prices of tranche and index swaps and more exotic derivatives on these contracts.

4 - What is Default and When is the Recovery?
Xin Guo, Associate professor, UC at Berkeley, Berkeley, United States of America, xinguo@newton.berkeley.edu

Our recent empirical studies of distressed debt prices suggest that proper understandings default and recovery are critical for credit risk management. We show that identifying the "economic default" date, as distinct from the traditional default date, is crucial to obtaining unbiased estimates for recovery rate. This is a joint work with R. Jarrow of Cornell, and H.Z. Lin of CSFB.

■ SC33

H-Room 505, Fifth Floor

Models with Positive Externalities between Customers in Operations Settings

Cluster: Economic Models in Operations Management
Invited Session

Chair: Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu

1 - Firm Service Rate Selection When Quality and Service Rates are Unknown
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Laurens Debo

We study how a high quality service firm may set its service rates to differentiate from a low quality service firm, when the firm can neither communicate its service value nor its service rate to customers. Rational agents make joining decisions without observing the service rate or quality. We find that the combination of uncertainty about the quality of the service and the service rate can lead to a higher profits for service firms.

2 - Designing and Marketing Techno-Fashion Products: The Effect of Consumer Social Interaction
Jiong Sun, Illinois Institute of Technology, Chicago, IL, jsun22@iit.edu, Jinhong Xie

Consumers who want to signal their uniqueness gain social utility if their products contrast with others, whereas those who wish to conform gain social utility by acquiring what others already have. We analyze how such socially-driven preferences affect firms' new product design and marketing decisions. Specifically, we examine when to introduce an advanced version of a product and how to differentiate the advanced version from the existing version in terms of functionality and fashion.

3 - Herding Behavior with Heterogeneously Informed Customers
Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu

In this talk, I discuss how the presence of customers that are heterogeneously informed about the quality of a service influence a firm's service rate selection.

■ SC34

H-Room 520, Fifth Floor

Economics of Environmental Operations

Cluster: Green Supply Chain
Invited Session

Chair: Atalay Atasu, Georgia Institute of Technology, Atlanta, GA, United States of America, Atalay.Atasu@mgt.gatech.edu

1 - Component Commonality under Product Remanufacturing
Ravi Subramanian, Professor, Georgia Tech, Ravi.Subramanian@mgt.gatech.edu, Mark Ferguson, Beril Toktay

We assess the profitability of an OEM implementing component commonality when remanufactured versions of products are sold along with new products.

2 - Turning Waste into By-Product
Deishin Lee, Professor, HBS, Soldier's Field Rd, Morgan 415, Boston, MA, 02163, United States of America, dlee@hbs.edu

We determine, in a competitive setting, the optimal operating regimes of a firm that converts its waste into a useful by-product. The original product and by-product subsidize each other: the original product "feeds" the by-product process and the by-product "consumes" the original product's waste. These two subsidies act as mechanisms to transfer wealth between the original and by-product markets. We analyze the environmental impact of turning waste into by-product.

3 - The Impact of Take-Back Legislation on Remanufacturing
Gokce Esenduran, Ph.D. Student, UNC, gokce_esenduran@unc.edu, Eda Kemahlioglu-Ziya, Jay Swaminathan

There is disagreement on whether takeback legislation will induce or hinder remanufacturing. We use a stylized model with three levels of legislation (no legislation, legislation on collection levels, legislation on collection and reuse levels) and aim to understand whether legislation causes an increase in remanufacturing levels and if it induces an OEM (who remanufactures in-house or whose products are remanufactured by a third-party) to manufacture products that are cheaper to remanufacture.

4 - Environmental Taxes and the Choice of Pollution-Reducing Technology
Anton Ovchinnikov, Professor, Darden School, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, OvchinnikovA@darden.virginia.edu, Dmitry Krass

We study how environmental taxes or pollution fines motivate adoption of innovative and ``green" pollution-reducing technologies. We consider how the firm is choosing its technology (among alternatives that vary in emissions reduction, fixed and variable costs) and market behavior (pricing and production quantity) in response to a tax level, and then consider how anticipating firm's response the regulator is setting tax level strategically to achieve its tax revenue and environmental objectives.

■ SC35

H-Sapphire A, Fourth Floor

Healthcare Management - Planning

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - An Integrative Approach to Capacity Planning in the Health Care Sector
Guoxuan Ma, K. U. Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Guoxuan.Ma@econ.kuleuven.be, Erik Demeulemeester, Lu Wang, Jeroen BeliÎn

The capacity planning problem consists of determining how resources are allocated to specialties and how many patients from each pathology can be treated, which results in the length of the waiting list and affects the patient flow. This paper simultaneously considers hospital profits and patient satisfaction through incorporating an optimization model to produce an optimal case mix and resource allocation scheme and a simulation approach reflecting the impact of variability on performance.

2 - Which Level of Detail is Best for Supporting Medical Managers with Strategic Patient Mix Decisions?
Paul Joustra, PhD student, Academic Medical Center, Meibergdreef 9, Amsterdam, Netherlands, P.E.Joustra@amc.nl, Jesse de Wit, Nico van Dijk, Piet Bakker

Due to budget restrictions, medical managers have to decide which patient groups to treat. We developed a user-friendly, interactive decision support tool to show the consequences of these decisions in terms of the waiting times for an outpatient department and operating theatre of an ophthalmology department in a teaching hospital. We experimented with different levels of detail to decide upon the level best suited to supporting strategic patient mix decisions.

3 - Retail Pharmacy Workflow Process and Patient Wait Time: A Simulation Approach
Shital Shah, Assistant Professor, Rush University Medical Center, 1700 W. Van Buren St, 126B, Chicago, IL, 60612, United States of America, Shital_C_Shah@rush.edu, Denise Farnum, Matthew Kemper, Daniel Sheedy, Jeremy Strong, Labinot Avdiu

As retail pharmacies are competing in oversaturated markets, superior customer services with minimal wait time are becoming integral part of the competitive business operations. In this study, simulation modeling was utilized to identify bottlenecks and test "what-if" scenarios in a large outpatient academic medical center pharmacy with a goal of minimizing wait time. In the most operational iteration, the walk-in patients wait time reduced by 32% to 36%.

4 - Impact of the Value of Information in ICU Admissions and Capacity Planning
Imran Hasan, Gradute Research Assistant, Purdue University, United States of America, ihasan@purdue.edu

Emergency Department(ED) Crowding has become a major problem in ED's all across the US over the past decade or so. One of the reasons commonly cited as a cause for this problem is the unavailability/ lack of beds in the intensive care unit (ICU). There is a wide body of literature on the development of models for the prediction of length of stay (LOS), in both inpatient units and ICUs. However, there has been no research pertaining to the advantages of such predictive models. Our goal is to evaluate the impact of knowing the LOS in advance, and how it can help in the planning of admissions and capacity decisions in the ICU.

■ SC36

H-Sapphire B, Fourth Floor

Impacting Health Policy through Operations Research

Sponsor: Health Applications
Sponsored Session

Chair: Elvira Loredo, Researcher, Full, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90404, United States of America, loredo@rand.org

1 - Software to Optimize the Location of Points-of-Dispensing (PODs)
Paul Sorensen, Operations Researcher, RAND, 1776 Main Street, Santa Monica, CA, 90404, United States of America, sorensen@rand.org

In the event of a major public health emergency, local public health departments will receive appropriate countermeasures from the Strategic National Stockpile and then set up a network of PODs (points of dispensing) to distribute the medications to the population. In this presentation we will discuss and demonstrate a spatial optimization tool designed to assist local health departments in the task of selecting an efficient and operationally feasible set of POD locations.

■ SC37

H-Sapphire C, Fourth Floor

Supply Chain Management and Fast Fashion

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu

Co-Chair: Felipe Caro, University of California, Los Angeles, CA, fcaro@ucla.edu

1 - Quick Response and Retailer Effort
Harish Krishnan, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Harish.Krishnan@sauder.ubc.ca

If a manufacturer initiates quick response (QR) and reduces inventory levels at a downstream retailer, this will induce the retailer to exert less effort when demand realization is low. QR can therefore lead to lower sales of the manufacturer's product and higher sales of competing products. Take-or-pay provisions, advance purchase discounts and exclusive dealing can ensure that QR does not hurt the manufacturer. We present evidence from recent anti-trust cases in support of our results.

2 - Strategic Assortment Rotation
Felipe Caro, Assistant Professor, UCLA Anderson School, 110 Westwood Plaza, Los Angeles, CA, 90085, United States of America, fcaro@anderson.ucla.edu, Victor Martinez de Albeniz

Fast fashion retailers are known for their quick response to market changes. This allows them to change the assortment more frequently, which induces repeated visits to the store, which in turn increases sales. We propose a customer consumption model with satiation and multiple competing retailers. The model implies that consumers will spend more at retailers that revise their assortment more often. We then determine the competitive equilibrium and the optimal assortment duration.

3 - Connecting Lead Time and Sales in Fast Fashion
Victor Martinez de Albeniz, Assistant Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu, Alejandro Lago, Philip Moscoso

The paper studies empirically if differences in supply lead-times exert an influence on product sell-thru in fast fashion companies. POS sell-thru data for over a thousand SKUs in one particular company are analyzed. We show taht shorter supply lead-times generally improve product sales, but assortment decisions may mitigate the effect.

4 - Distribution-Free Inventory Management in Fast Fashion
Michael Wagner, CSUEB, 25800 Carlos Bee Blvd, Hayward, United States of America, michael.r.wagner@gmail.com

In this talk we present an inventory management framework that models fast fashion products as perishable items. Since new fashion items do not have historical data with which to create demand forecasts, we assume the demand for these items is unknown without a characterizing probability distribution. We study this problem from a worst case perspective and provide robust procurement quantities for fast fashion products.

■ SC38

H-Sapphire D, Fourth Floor

Assemble-to-order Production/Inventory Systems

Cluster: Inventory Management
Invited Session

Chair: Mustafa Kemal Dogru, Researcher, Alcatel-Lucent Bell Labs, Blanchardstown Industrial Park, Blanchardstown, Dublin, 15, Ireland, dogru@alcatel-lucent.com

1 - Priority and Reservation Based Inventory Policies for Assemble-to-Order Systems
Marty Reiman, Alcatel-Lucent Bell Labs, 600 Mountain Ave., Murray Hill, NJ, United States of America, marty@research.bell-labs.com, Qiong Wang, Mustafa Kemal Dogru

We use a single-period stochastic programming model to guide the development of a priority and reservation based inventory policy for multi-period Assemble-to-Order (ATO) systems including both continuous and periodic review cases. The effectiveness of this approach is demonstrated by numerical tests on some well-known ATO structures such as the W and M systems.

2 - The Value of Component Commonality under Non-Holdback Allocation Rules
Junmin Shi, Rutgers University, 180 University Ave, Newark, NJ, 07102, United States of America, jshi@pegasus.rutgers.edu, Yao Zhao

We study the impact of component commonality in a continuous-time assemble-to-order system with positive lead times, base-stock policy and non-holdback allocation rules. We prove that the total backorder and total on-hand inventory decrease with probability one as the degree of commonality increases. We also derive approximations on the long-run average cost and study the impact of commonality on it.

3 - Control of a High-Volume Assemble-to-Order with Maximum Leadtime Quotation
Amy Ward, USC, Marshall School of Business, BRI401H, 3670 Trousdale Parkway, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu, Erica Plambeck

For an assemble-to-order system with a high volume of prospective customers arriving per time unit, we show how to set nominal component production, quote prices and maximum leadtimes for products, and then, dynamically, sequence orders for assembly and expedite components. We further discuss a complication that arises when customers are heterogeneous in their delay tolerance, and the system manager attempts to implement price discrimination through leadtime differentiation.

■ SC39

H-Sapphire E, Fourth Floor

Management of Product Variety

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Muge Yayla-Kullu, Asst. Professor, Lally School of Mgmt. & Tech., RPI, Troy, NY, 12180, United States of America, yaylah@rpi.edu

1 - Product Variety, Pricing and Differentiation in a Supply Chain
Sampath Rajagopalan, srajagop@marshall.usc.edu, Nan Xia

The costs and benefits of product variety vary across different players in a supply chain and this has interesting ramifications. Motivated by observations in the DVD industry, we present a model wherein a manufacturer sells product variants at a wholesale price to two competing but differentiated retailers. We provide results on the impact of retailer differentiation, manufacturer and retailer costs, etc. on variety, prices and margins. We also explore some coordination issues in the channel.

2 - Vertical Differentiation and Capacity Planning when the Market's Potential and Size are Uncertain
Sergio Chayet, Olin Business School, Washington University in St Louis, One Brookings Drive, St. Louis, 63130, United States of America, chayet@wustl.edu, Panos Kouvelis, Dennis Yu

We study the quality level and capacity planning decisions of a firm facing a market of heterogeneous customers in their design quality valuations. Both the size and overall potential of such market are uncertain. The firm makes capacity and design quality level decisions for vertically differentiated products ex ante, and makes pricing decisions once demand has been realized. We discuss key tradeoffs and insights generated by our model.

3 - Commonality in Product Line Design under Negatively Correlated Preference Structure
Dilip Chhajed, Professor, University of Illinois, 1206 S. Sixth Street, Champaign, IL, 61820, United States of America, chhajed@illinois.edu, Kilsun Kim

We present a model of product line design with two attributes for which consumer segments exhibit opposite preference ordering and study the implications of making an attribute common. Our results show that commonality strategy, when it saves cost, i) can intensify or relieve cannibalization problem, ii) can make a first best solution implementable even when it is not under non-commonality strategy, and iii) can reduce product differentiation along the attribute that is not common.

4 - Asymmetric Competition in Vertically Differentiated Markets
Muge Yayla-Kullu, Asst. Professor, Lally School of Mgmt. & Tech., RPI, Troy, NY, 12180, United States of America, yaylah@rpi.edu, Jay Swaminathan

We study an asymmetric Stackelberg competition in a vertically differentiated market. The products are differentiated by their quality, unit cost and resource consumption levels. Customers are heterogeneous in their willingness to pay for quality. In this context, we investigate how a traditional incumbent would respond to a focused strategy entrant that has to make capacity investments. We discuss the implications on product variety and capacity choices.

■ SC40

H-Sapphire H, Fourth Floor

Advances in Financial Engineering Methods

Sponsor: Financial Services
Sponsored Session

Chair: Jim Primbs, Asst. Professor, Stanford, 444 Terman Engr. Ctr., Stanford, CA, 94305-4026, United States of America, japrimbs@stanford.edu

1 - Optimal Hedging of Illiquid Asset Derivatives Using Additive Models
Yuji Yamada, Associate Professor, University of Tsukuba, 3-29-1 Otsuka, Bunkyo-ku, Tokyo, 112-0012, Japan, yuji@gssm.otsuka.tsukuba.ac.jp

We consider a minimum variance hedging problem for a derivative security with untraded underlyings using liquidly traded assets. We provide a two step algorithm in which we compute the additive sum of smooth functions of traded assets that minimizes the mean square error from the payoff of the derivative security. We show that the problem is reduced to a system of linear operator equations that can be solved efficiently.

2 - Option Pricing in Incomplete Markets: Computation and Convergence
Farid AitSahlia, University of Florida, 303 Weil Hall, Department of Industrial & systems engg, Gainesville, FL, 32611, United States of America, farid@ise.ufl.edu

I present a new approach to deal with option pricing in incomplete markets. Its discrete form relies on matroid theory to determine minimal-entropy martingale pricing measures through corresponding independent bases. Convergence to associated continuous models is obtained through nonstandard analysis, which helps to seamlessly move between discrete and continuous models.

3 - A Linear Control Framework for Dynamic Hedging
Jim Primbs, Asst. Professor, Stanford, 444 Terman Engr. Ctr., Stanford, CA, 94305-4026, United States of America, japrimbs@stanford.edu

Using a combination of basis functions and Monte Carlo sampling, we reformulate the multi-dimensional dynamic hedging problem as a linear quadratic control problem. This allows us to use standard linear control methods such as Riccati equations and receding horizon control to solve the hedging problem, even in the presence of transaction costs and other constraints. Numerical examples demonstrate the efficiency and accuracy of the linear control approach.

4 - Fragility of CVaR in Portfolio Optimization
Gah-Yi Vahn, PhD Student, UC Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, CA, gyvahn@berkeley.edu, J. George Shanthikumar, Andrew Lim

We evaluate conditional value-at-risk (CVaR) as a risk measure in data-driven portfolio optimization. We show that portfolios obtained by solving empirical mean-CVaR problems are fragile due to estimation errors of CVaR and/or the mean, which are aggravated by optimization. This problem is exacerbated as the tail of the return distribution is made heavier. We conclude that data-driven mean-CVaR problem is fallible, and propose alternative approaches to using CVaR in portfolio optimization.

■ SC41

H-Sapphire L, Fourth Floor

Sustainability and Co-value Creation

Sponsor: Korea Chapter-INFORMS (KINFORMS)
Sponsored Session

Chair: Sang Hyung Ahn, Professor, Seoul National University, School of Business, Seoul, Korea, Republic of, shahn@snu.ac.kr

1 - Value Code Assessment in Korea Prieum Business Firms
Chang Won Lee, Operations and Service Management, School of Business, Hanyang University, Seoul, 133-791, Korea, Republic of, leecw@hanyang.ac.kr, Sang Hyung Ahn

Value code assessment in Korean firms is a strategic investment decision making. Data envelopment analysis (DEA) is utilized for business efficiency in Korean firms. The DEA model uses four input and four output variables to assess the business efficiency of the firms. The model identifies the best and non-best firms. The study provides the management with more valuable insights in order to make better investment decisions in the global business environment.

2 - A Case Study of Servitizatioin for Korean Manufacturing Companies
Youn Sung Kim, Professor, Inha University, Korea, 253 Yonghyun-dong, Nam-ku, Incheon, 402-751, Korea, Republic of, keziah@inha.ac.kr, Seungwook Park

We analyzed multiple Korean manufacturing companies to understand how they transformed their business models for servitization which enabled them to change from making a product to serving it. Woongin, like GE and Rolls Royce transforming their business model successfully, invented a new business model for product servitization. In this paper, the reasons and purposes of Woongin's servitization are investigated throughout its reinvented business model.

3 - Operational Efficiency, Perceived Service Quality and Business Performances of Bank Branches
Hong-il Kim, Ph.D. Candidate, Korea University, Anam-Dong, Seongbuk-Gu, Korea University Business School A516, Seoul, 136-701, Korea, Republic of, itlime@korea.ac.kr, Hosun Rhim, Shijin Yoo

We examine the relationship among operational efficiency, perceived service quality and business performance of bank branches. Data indicating operational performances of branches have been collected. Perceived service qualities of customers and employees have been surveyed with SERVPERF questionnaire. We use DEA to evaluate operational efficiency of the branches and SEM to investigate the relationship.

4 - Models for Scheduling Business Jet Aircraft
Hongsuk Yang, Seoul National University, 599 Gwanangno Gwanak-gu, Seoul, 151-916, Korea, Republic of, hongsuk@snu.ac.kr, Jiyoung Park

The purpose of this research is to design the optimal models for Korean Business Jet companies. They are planning to run a business jet covering North Asian countries such as Korea, China and Japan. We suggest a simple model considering the operating cost, repair and maintenance cost, airport fee, crew payrolls, etc. By using distance between cities and estimated passenger data, we develop cost minimizing fleet/flight schedules for business jet operators.

5 - The Ownership Structure of Foreign Subsidiaries: The Effect of Institutional Distance
Naoki Ando, Associate Professor, Hosei University, 2-17-1 Fujimi Chiyoda-ku, Tokyo, 1028160, Japan, nando@hosei.ac.jp, Nobuya Fukugawa

This study examines how institutional distance between a host and a home country influences the ownership structure of foreign subsidiaries. The study shows that internationally experienced firms tend to have a larger portion of equity ownership in institutionally distant countries. This study also reveals that when a parent firm has substantial international and host country experience, the greater institutional distance leads to the greater ownership level.

■ SC42

H-Sapphire P, Fourth Floor

Nicholson Student Paper Prize Competition, I

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Michael Ferris, Professor, University of Wisconsin, Department of Computer Sciences, 1210 W. Dayton Street, Madison, WI, 53706-1685, United States of America, ferris@cs.wisc.edu

1 - Summary of the 2009 Nicholson Prize
Michael Ferris, Professor, University of Wisconsin-Madison, Madison, WI, United States of America, ferrism@cs.wisc.edu

A brief overview of the review process used, along with a list of finalists will be given.

2 - Small Approximate Pareto Sets for Bi-objective Shortest Paths and Other Problems
Ilias Diakonikolas, Columbia University, 469 Computer Science Building, New York, NY, 10027, ilias@cs.columbia.edu, Mihalis Yannakakis

We investigate the problem of computing a minimum set of solutions that approximates within a specified accuracy ϵ the Pareto curve of a multi-objective optimization problem. We show that for a broad class of bi-objective problems (containing many important widely studied problems such as shortest paths, spanning tree, matching and many others), we can compute in polynomial time an ϵ-Pareto set that contains at most twice as many solutions as the minimum such set. Furthermore we show that the factor of 2 is tight for these problems, i.e., it is NP-hard to do better. We present upper and lower bounds for three or more objectives, as well as for the dual problem of computing a specified number k of solutions which provide a good approximation to the Pareto curve.

3 - Manipulation Robustness of Collaborative Filtering Systems
Xiang Yan, Stanford University, Packard 274, Stanford, CA, United States of America, robbie.yan@cs.stanford.edu, Benjamin Van Roy

A collaborative filtering system recommends to users products that similar users like. Collaborative filtering systems influence purchase decisions, and hence have become targets of manipulation by unscrupulous vendors. We provide theoretical and empirical results demonstrating that while common nearest neighbor algorithms, which are widely used in commercial systems, can be highly susceptible to manipulation, two classes of collaborative filtering algorithms which we refer to as linear and asymptotical ly linear are relatively robust. These results provide guidance for the design of future collaborative filtering systems.

4 - A Price-dependent Demand Substitution Rule and its Applications
Ye Lu, MIT, Cambridge, MA, 02139, United States of America, yelu@mit.edu, David Simchi-Levi

In a multi-product market, if one product stocks out, consumers may substitute to competing products. In this research, we apply an axiomatic approach to characterize a price-dependent demand substitution rule, and provide a sufficient and necessary condition for demand models where our demand substitution rule applies. Our results can serve as a link between the pricing and inventory literature, and enable the study of joint pricing and inventory coordination as well as retail competition.

■ SC43

H-Room 400, Fourth Floor

Pricing and Supply Uncertainties in Supply Chain Design

Cluster: Supply Chain Models
Invited Session

Chair: Yimin Wang, Assistant Professor, Arizona State University, Department of Supply Chain Mgmt, P.O. Box 874706, Tempe, AZ, 85287, United States of America, yimin_wang@asu.edu

1 - The Impact of Yield-Dependent Costs on Pricing and Production Planning under Supply Uncertainty
Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, 721 University Avenue, Syracuse, NY, 13244, United States of America, bkazaz@syr.edu, Scott Webster

This paper considers the impact of yield-dependent purchasing cost and salvage revenue on the choice of the selling price and production quantity for an agricultural firm operating under supply uncertainty. It shows the conditions under which the use of a static cost exaggerates the value gained from a secondary purchase option, concluding that supply uncertainty presents a higher risk for agricultural firms than businesses who operate under static cost parameters.

2 - Joint Bidding and Procurement Strategies under Fluctuating Purchase Prices
Xiaofeng Nie, Postdoctoral Research Fellow, Desautels Faculty of Management, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, xiaofeng.nie@mail.mcgill.ca, Saibal Ray, Dan Zhang, Tamer Boyaci, Mehmet Gumus

We consider a single firm selling a product periodically by submitting bids. Facing stochastic procurement prices, the firm needs to decide on both the bidding price and the procurement quantity with the objective of maximizing total expected discounted profit. A dynamic programming formulation is proposed and some numerical results are presented.

3 - Market Share Competition on Initial Investment and Production
Jin Kyung Kwak, Cornell University, 201 Sage Hall, Ithaca, NY, 14853, United States of America, jkk37@cornell.edu, Nan Yang

This study investigates competition on initial investment and production to gain market shares. By analyzing a single-period game where each firm competes on its initial investment and production to maximize its expected profit, we show the existence of a unique equilibrium and give an efficient algorithm to compute the equilibrium. We also compare the firms' optimal decisions in this decentralized setting with those in a centralized setting.

4 - Supply Disruption and Restoration
Xinxin Hu, Assistant Professor, Indiana University, 1309 East 10th Street, Bloomington, IN, 47405, United States of America, hux@indiana.edu, Ling Wang, Haresh Gurnani

The possible catastrophic disruption will fail the supplier's capacity. Even with the supplier's effort to restore his capacity, the retailer still faces the risk of the insufficient supply, since such restoration effort is usually more costly and unpredictable. Basing on the single wholesale price contract, we study how the retailer places orders and proposes the incentive ordering price to push desired effort level invested by the supplier to sufficiently restore his capacity.

■ SC44

H-Room 402, Fourth Floor

Workforce Management: Problems and Models

Sponsor: Service Science
Sponsored Session

Chair: Tarun Kumar, Senior Research Engineer, IBM Research, 1101, Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ktarun@us.ibm.com

1 - Interesting Packing/Covering Formulations of a Flexible Staffing Problem Arising in Service Delivery
Pranav Gupta, IBM - India Research Lab, Vasant Kunj Inst Area, Delhi, India, prguptan@in.ibm.com, Gyana Parija, Sambuddha Roy

This paper addresses the business problem of recommending optimal mix of core & part-time employees, their daily schedules to meet incoming varying demand. We propose a MIP for this problem, which is a generalized version of covering a rectilinear polygon with axis parallel rectangles (Chaiken et al. gave a P time algorithm for special cases); here we can use only two types of rectangles (with associated weights) with the objective of minimizing the weighted combination of the rectangles chosen.

2 - Optimatch: Assignment and Capacity Planning of Highly Skilled Employees Using Constraint Programming
Sigal Asaf, IBM, Haifa University Campus, Haifa, Israel, SIGALAS@il.ibm.com, Will Riddle, Michael J. McInnis, Crystal L. Conner, Yael Ben-Haim, Yossi Richter, Yehuda Naveh, Donna L. Gresh, Daniel P. Connors, Julio Ortega

Matching highly skilled people to positions is a high-stakes task that requires careful consideration by experienced managers. A wrong decision may result in significant losses. We present Optimatch, a Constraint Programming (CP) solution that generates near-optimal assignment and supports the capacity planning process. CP is well-suited for dealing the field's complex constraints and can support thousands of positions and resources. Optimatch is deployed throughout IBM's services organizations.

3 - Analytics for Semi-automated Screening of Candidates for Recruiting in Growth Markets
Nanda Kambhatla, Senior Researcher, IBM India Research Lab, Block D, Embassy Golf Links, Koramangala, Bangalore, 560071, India, kambhatla@in.ibm.com, Vijil Chentamarakshan, Swati Challa

In growth markets, companies often receive thousands of resumes for job openings. Screeners review the candidates to shortlist a few. We present a system that ranks candidates for each job opening, allowing screeners to reject candidates en-mass and shortlist a few of them. The ranking is done by text analysis of resumes and free text portions of job descriptions. This results in increased productivity of recruiters, a more uniform screening process, and identification of better candidates.

4 - Stochastic Modeling Approach for Prescribing Optimal Workforce Levels for BPO Industry
Tarun Kumar, Senior Research Engineer, IBM Research, 1101, Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ktarun@us.ibm.com, Gyana Parija, Vinayaka Pandit

We present a stochastic programming model for optimal workforce hiring and deployment decisions for non-voice processes for Business Process Outsourcing companies. The model uses MILP approach to optimize on a multitude of business objectives. It uses scenario trees to model stochastic demand. We further present usage scenarios that can help the companies provide differentiated services by entering into revenue sharing agreement with the clients.

■ SC45

H-Room 410, Fouth Floor

Incentive Issues in Product Design and Development

Cluster: New Product Development
Invited Session

Chair: Sreekumar Bhaskaran, Asst. Professor, SMU-Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, sbhaskar@mail.cox.smu.edu

1 - Impact of the Cost of Components and Demand Risk in the Selection of a Product Platform
Saurabh Bansal, UT Austin, Austin, Austin, TX, United States of America, Saurabh.Bansal@phd.mccombs.utexas.edu, Genaro Gutierrez

We explore conditions under which a common platform is preferred over separate platforms when these platforms are to be coupled with vertically differentiated components manufactured by a co-production system. We model the two tradeoffs between the higher cost of the common platform and its two benefits: (i) downward substitution of the co-produced component, and 2)

operational hedge. We identify the co-production yields, and the demand uncertainties under which the common platform is preferred.

2 - Strategic Information Disclosure in Competitive R&D Projects
Yi Xu, Assistant Professor, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, yxu@rhsmith.umd.edu, Manu Goyal

Firms often form beliefs on how lucrative an R&D project is based on competing firms' R&D spending and success. We analyze such a scenario where a Leader firm's R&D effort is interpreted by a Follower firm to customize its own research foray. Thus the Leader firm strategically distorts its R&D effort in an attempt to mislead the Follower firm the distortion depends crucially on whether the uncertainty is on the technological dimension of the R&D project, or on the market potential.

3 - Platform Feature Investment in the Presence of Network Externalities
Burcu Tan, PhD Candidate, University of Texas at Austin, IROM, B6500, 1 University Station, Austin, TX, 78712, United States of America, Burcu.Tan@phd.mccombs.utexas.edu, Geoffrey G. Parker, Edward G. Anderson Jr.

We examine the development of product platforms in markets that exhibit network externalities. We focus on the trade-offs firms must make between investing new product development resources to increase a platforms core functionality versus investments designed to change or leverage the platforms network externalities. Abstracting from examples drawn from multiple industries, we use a strategic model to gain intuition about how to make such trade-off decisions.

4 - How Should Universities Participate in the Profits of University Spinouts?
Nicos Savva, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nsavva@london.edu, Niyazi Oztoprak

We examine how should a University participate in the profits of a venture capital (VC) backed spin-out company that commercialises the outcome of academic research. We assume that the VC is better informed about the cost of development than the University. We examine the trade-offs of royalty and equity participation under asymmetric information and identify mechanisms that incentivise the VC to reveal the true cost estimates.

■ SC46

H-Room 411, Fourth Floor

Technology Management under Risk

Sponsor: Technology Management
Sponsored Session

Chair: Leonardo Santiago, Federal University of Minas Gerais, Production Engineering Deparment, Av. Antonio Carlos, 6627 - Pampulha, Belo Horizonte, MG, Brazil, lsantiago@ufmg.br

1 - The Impact of Risk Management in Project Performance
Marly Monteiro Carvalho, Associate Professor, University of S„o Paulo, Av Professor Almeida Prado, trav 2, 128, S„o Paulo, 05508-900, Brazil, marlymc@usp.br, Roque Rabechini Jr

The main focus of this study is the impact of risk management in project performance. We identified in ISI Web of Science database 70 articles that contained 'risk management', 'project' and 'performance' or 'success'. We identified 15 key issues in risk management. The hypotheses were tested based on a field study with 257 projects. The results show that high degree of risk management implementation may result in project's success, since significant differences were identified.

2 - Learning in Online Communities. The Case of Rooster Teeth
Stefan Haefliger, Researcher, ETH Zurich, Kreuzplatz 5, Zurich, 8032, Switzerland, shaefliger@ethz.ch, Peter Jaeger, Georg von Krogh

Communities of users or consumers generate insights about products that may help other users or inspire manufacturers to learn about trends in the market and innovate. Little is known about the value creation in communities of consumption. We analyze a large online customer community of a Machinima production company that produces animated shorts in computer games. A significant amount of users provided comments with specialized feedback that eventually lead to innovation.

3 - A Qualitative Approach for Economic Evaluation of Technological Project Risks
Jose Luis Ribeiro, Dr., UFRGS, Av. Osvaldo Aranha 99, 5o Andar, Porto Alegre, Brazil, ribeiro@producao.ufrgs.br, Rogerio Miorando

This paper presents a qualitative approach for risk assessment of technological projects. The approach uses matrices to identify potential risks and probabilities. The main contribution of the proposed approach is the procedure used to quantify potential profits associated to technological projects under evaluation. The approach converts the different aspects of technological projects to financial units, allowing a complete an innovative analysis of the alternatives involved.

4 - On the Time Uncertainty of New Product Development Projects
Thiago Augusto Oliveira Silva, Graduate Student, Federal University of Minas Gerais, Belo Horizonte, Brazil, thiagoaos@ufmg.br, Leonardo Santiago

In this paper we compare two different approaches to the problem of capturing the impact of time uncertainty in the payoff of technology projects. The first considers the project payoff vis-ver-vis the notion of a window of opportunity, while the second one tackles project payoff as a function of a commodity's price. Implications of these two approaches are discussed.

■ SC47

H-Room 412, Fourth Floor

Doing Good with Good OR Student Competition II

Cluster: Doing Good with Good OR Student Competition
Invited Session

Chair: Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu

Co-Chair: Cynthia Barnhart, Associate Dean for Academic Affairs, MIT, School of Engineering, Cambridge, MA, 02139, United States of America, cbarnhart@MIT.EDU

1 - Doing Good with Good OR Student Competition
Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu, Cynthia Barnhart

"Doing Good with Good OR Student Competition" is a new INFORMS sponsored competition to encouraging student research and practice with societal impact. This competition is intended to recognize student-led projects with real-world clients that generate significant societal impacts beyond increased profits or reduced costs. The finalists session will feature the most exciting work performed by students in partnership with public and private organizations that results in tangible, beneficial outcomes for individuals, communities and organizations. The winner of the competition will be decided after the presentations and announced at the awards ceremony on Sunday night.

2 - Using Models of Hepatitis B to Influence Public Health Policy
David Hutton, Stanford University, Terman 496, 380 Panama Way, Stanford, CA, 94305, United States of America, billdave@stanford.edu

We have used Markov models to analyze the cost-effectiveness of several interventions to combat hepatitis B. In sharing the results of these models, we have helped change US policy to encourage screening of millions of people and we hope to influence policymakers in China to enact guidelines to provide catch-up vaccination for hundreds of millions of children.

3 - At What Lipid-ratios Should a Patient with Type 2 Diabetes Initiate Statins?
Murat Kurt, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, muk7@pitt.edu, Nilay Shah, Steven Smith, Andrew Schaefer, Brian Denton

Lipid abnormalities elevate the risks of coronary heart disease (CHD) and stroke for patients with Type 2 diabetes and can be treated by statins with adverse side effects. We formulate the optimal timing of statin initiation problem as an infinite-horizon Markov decision process and explore several structural properties of the resulting treatment policies. We analyze the sensitivity of these policies with respect to varying risk factors and present computational results based on clinical data.

■ SC48

H-Sapphire Green Room, Fourth

Complex Decision Making in Service Operations

Sponsor: Service Science
Sponsored Session

Chair: Christian Wernz, Assistant Professor, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, wernz@vt.edu

1 - Making Complex Decisions with Experiments
Victor Tang, Researcher, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, victor.w.tang@gmail.com

The fundamental challenges in decision making in complex systems services are: One:the multidisciplinary nature of the decision problem. Two, the uncertainty

associated with the decision and its potential outcomes. In this presentation we present an analytic approach to address this problem. The approach is presented with an example to make it easy to understand.

2 - Computational Thinking of Service Systems: An Operational Perspective

Robin Qiu, Penn State, 30 E. Swedesford Road, Malvern, United States of America, gxq102@gv.psu.edu

Using computational thinking, we propose an approach, which shall provide with the means to explore, model, capture, and manage systemic behaviors, interactions, connections, complex relations, and interdependencies of service systems, resulting in the better understanding of what constitutes an effective and robust service systems and under what conditions and agile transformation service systems' performance and potential would be more predictable, controllable, competitive, and sustainable.

3 - The Interaction of Positive Externalities and Congestion Effects in Online Services

Ramesh Johari, Stanford University, ramesh.johari@stanford.edu, Sunil Kumar

Motivated by online services such as virtual communities and massively multiplayer online games, we study a system where a service is shared by many identical customers. Each customer experiences congestion due to all users' utilization of a common resource. In addition, we assume each customer experiences a positive externality from other users. We characterize the "club" formed by self-interested users, as well as the optimal decision of a service manager who controls access but not usage.

4 - Multiscale Decision-Making for a Maintenance Service Problem

Christian Wernz, Assistant Professor, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, wernz@vt.edu, Andrew Henry

Decisions in service operations are complex since they involve various interdependent agents at different hierarchical levels. A three-level maintenance service problem is analyzed using the multiscale decision-making model. The multiscale decision-making model fuses game theory, stochastic modeling and dependency graphs into a unified framework. In this service application, we identify incentive mechanisms that align the interests of account managers with maintenance supervisors and workers.

■ SC49

H-Room 300, Third Floor

Software Project Management

Cluster: Project Management
Invited Session

Chair: Yong Tan, Associate Professor of Information Systems, University of Washington, Foster School of Business, ytan@u.washington.edu

1 - The Effects of Free Trials and Product Ratings on Software Trial under Information Diffusion

Young Jin Lee, University of Washington, Foster School of Business, Box 353200, Seattle, WA, 98195, United States of America, younglee@u.washington.edu, Yong Tan

Distributing free trials of software in public is a common practice of most commercial publishers in software market. We develop an empirical framework to analyze the impact of two types of free trials and the ratings on consumer software sampling under the Bass type diffusion setting. Our results show that freeware is not always a dominant strategy in software sampling and third-party rating sends much stronger signals to potential users when the rating is at or above 4-star on a 5-star scale.

2 - Learning From Past Failures: An Empirical Study of Security Vulnerabilities

Guoying Zhang, Assistant Professor, Midwestern State University, 3410 Taft Blvd., DB273, Wichita Falls, TX, 76308, United States of America, grace.zhang@mwsu.edu, Yong Tan

We investigate software vendors' learning activities from security vulnerabilities. We are interested in whether learning from past failures helps software vendors achieve better security quality of software products and, if so, which characteristics of vulnerabilities are important for effective learning. Three models are applied to discover the learning process. We find that vendors' learning process is dynamic, and is best represented by a hidden Markov model.

3 - The Impacts of Shared Experiences in Software Development: Are They homogeneous?

Keumseok Kang, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, kangk@purdue.edu, Jungpil Hahn

Shared experience (i.e., experience working together) among software project team members is known to affect a project team's performance. However, are the impacts of shared experiences homogeneous? We investigate this question. We empirically find that the impacts of shared experience among project team members on a project's performance may vary by the outcomes of shared experience (e.g., successful vs. unsuccessful) as well as project roles (e.g., project managers) in the current project.

4 - The Impact of Knowledge Transfer on Quality and Productivity in Software Development

Min-Seok Pang, Ph.D. Candidate, University of Michigan, Stephen M. Ross School of Business, 701 Tappan St., R0400, Ann Arbor, MI, 48109, United States of America, mins.pang@gmail.com

In developing a software product, developers utilize their expertise and apply their knowledge into the product. We expect that active knowledge transfer between software developers and their effective knowledge application into software projects can lead to an improvement in quality and productivity. We intend to find answers to two research questions - how does knowledge transfer influence on quality and productivity and what factors facilitate knowledge transfer of software developers.

■ SC50

H-Room 302, Third Floor

Economics of Information Systems

Sponsor: Information Systems
Sponsored Session

Chair: Amit Mehra, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, India, Amit_Mehra@isb.edu

1 - Advertising Strategies for Competing Internet Retailers

Ram Bala, Assistant Professor, Indian School of Business, Hyderabad, India, Ram_Bala@isb.edu, Amit Mehra, Jagmohan Raju

We consider duopoly competition between retailers who have the option of using cost per impression (CPM) and/or cost per click (CPC) advertising to reach their customers. We analyze the relative use of CPM and CPC by both firms at equilibrium as a function of the market size and whether the retailer is known or unknown. Under some conditions, the profits of both retailers may increase if the known retailer uses its website as a portal and charges a fee per transaction from the unknown retailer.

2 - Emergence of Opinion Leaders in Online Review Communities

Param Singh, Assistant Professor, CMU, 5000 Forbes Avenue, Pittsburgh, United States of America, psidhu@andrew.cmu.edu, Yingda Lu, Kinshuk Jerath

We study the drivers of the emergence of reviewers as opinion leaders in a large online movie review community (epinions.com). We find that while the "rich gets richer" phenomenon and review characteristics such as objectivity, comprehensiveness, Fog index are significant drivers of the emergence of a reviewer as an opinion leader, their combined effect is substantially weaker than that of a process whereby reviewers choose those reviewers as opinion leaders who have been more active recently.

3 - Buyer-seller Networks and Market Outcomes in Software Development Contracting

Siva Viswanathan, Associate Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States of America, sviswana@rhsmith.umd.edu, Mingfeng Lin

IT has led to the increased the use of markets for software development projects, but uncertainties remain high due to the "credence" nature of software development. Using data from an online marketplace for software projects, we study the creation, maintenance, and decay of different types of vendor-client relationships, and how they impact outcomes.

4 - Optimal Seeding Strategies in the Presence of Network Effects

Jacomo Corbo, Postdoctoral Research Fellow, The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, Jacomo@wharton.upenn.edu

We discuss how seeding can be used to help drive adoption of technologies with positive network effects. We look at optimal seeding strategies, involving giving away the product for free to a subset of customers and show that while such strategies can be hard to compute, certain heuristic strategies perform well. We also show how the benefits of seeding and the choice of seeded customers report are inextricably tied to the structure of spillovers.

■ SC51

H-Room 303, Third Floor

Optimization and Complementarity: Algorithms and Applications

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Che-Lin Su, The University of Chicago Booth School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, Che-Lin.Su@chicagogsb.edu

1 - Decentralized Risk Management of a Financial Conglomerate
Adam Speight, Assistant Professor, Georgia State University, 197 15th St NW, Atlanta, GA, 30318, United States of America, aspeight@gmail.com

I present a new framework for measuring the aggregate risk profile of a firm based only on inputs provided by individual business units. The value-maximizing firm's problem subject to regulatory constraints is decentralized and shown equivalent to a nonlinear complementarity problem. Dual variables coordinate prices in an intra-firm market for capital and risk limits among diverse business units using heterogeneous models.

2 - A Globally Convergent Filter Method for MPECs
Todd Munson, Scientist, Argonne National Lab, United States of America, tmunson@mcs.anl.gov, Sven Leyffer

We propose a new method for mathematical programs with complementarity constraints that is globally convergent to B-stationary points. The method solves a linear program with complementarity constraints to obtain an estimate of the active set. It then Åxes the activities and solves an equality-constrained quadratic program to obtain fast convergence. The method uses a Ålter to promote global convergence. We establish convergence to B-stationary points.

3 - Verifiable Conditions of L1-recovery of Sparse Signals with Sign Restrictions
Fatma Kilinc Karzan, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, fkilinc@gatech.edu, Anatoli Juditsky, Arkadi Nemirovski

We propose necessary&sufficient conditions for a sensing matrix to be s-semigood - to allow for exact L1-recovery of sparse signals with at most s nonzero entries under sign restrictions. We express error bounds for imperfect L1-recovery in terms of these characteristics. These, despite being difficult to evaluate, lead to verifiable sufficient conditions and efficiently computable upper bounds on those s for which a given matrix is s-semigood.We study their properties and limits of performance.

■ SC52

H-Room 304, Third Floor

Product Design and Assortment

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Sezer Ulku, Assistant Professor, Georgetown University MSB, 37 & O St, Washington, DC, 20057, United States of America, SU8@msb.edu

1 - The Decision-making on Product Specifications and Priority Uncertainty
Zhijian Cui, PhD Candidate, INSEAD, 40 Ave. Alfred Roll, Bois le Roi, 77590, France, Zhijian.CUI@insead.edu, Christoph Loch

Our study looks at the "gaming" among various stakeholders behind product specification decisions. Previous research mainly discusses how firms incorporate new information into design as external uncertainty resolves.However,the issue of how firm's internal uncertainty drives false definition, over-specification has been overlooked. By comparing outputs under different power allocation, our study shows how stakeholders "priority uncertainty" affects product design and design failure.

2 - Assortment Selection in Dual Sales Channels
Betzabe Rodriguez, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, betzabe@umich.edu, Goker Aydin

We consider a build-to-order manufacturer who sells an assortment of products through both a direct channel and an independent retailer (e.g., Dell selling through BestBuy). We study the tension between the retailer's and the manufacturer's preferences regarding the retailer's assortment. We find that the retailer may wish to carry a smaller assortment in an effort to curb the manufacturer's wholesale price.

3 - On the Interaction between Retail Pricing, Assortment, and Inventory Decisions
Shiguang Xie, PhD Candidate, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, ryanxie@vt.edu, Bacel Maddah

We study pricing, assortment and inventory decisions for horizontally differentiated items. We analyze the effect of inventory costs on pricing and variety. We find that (i) accounting for inventory limits variety even if pricing is endogenous, and (ii) the optimal price is adjusted up or down from the riskless price.

4 - Upgrade Choice: Modular Upgrade vs. Full Product Replacement
Sezer Ulku, Assistant Professor, Georgetown University MSB, 37 & O St, Washington, DC, 20057, United States of America, SU8@msb.edu, Glen Schmidt, Claudiu Dimofte

Modularity allows buyers to adapt products over time in line with changing needs and technological improvements; it can also alleviate environmental problems. We examine how consumers upgrade modular products, and show that such products are often replaced in full. We show that it is possible to encourage modular replacements through the use of certain levers which either reduce the perceived effort, or increase the utility associated with the modular alternative.

■ SC53

H-Room 305, Third Floor

Advances in Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Ricardo Fukasawa, Assistant Professor, Univeristy of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, rfukasaw@math.uwaterloo.ca

1 - Generalized MIR Cuts: Results and Computation
Jean-Philippe Richard, Associate Professor, Department of Industrial and Systems Engineering of University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611-6595, United States of America, richard@ise.ufl.edu, Young Park, Santanu Dey

We study an extension of the simple MIR set that has an arbitrary number of unstructured constraints and that contains two integer and one continuous variable. We describe a polynomial algorithm to generate the facet-defining inequalities of the convex hull of mixed integer solutions to this set, and shows that it yields a polynomial algorithm to generate cuts that consider multiple rows of the problem simultaneously. We report on our computational experience with these new cutting planes.

2 - Strengthening Lattice-free Based Cuts Using Nonnegativity
Ricardo Fukasawa, Assistant Professor, Univeristy of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, rfukasaw@math.uwaterloo.ca, Oktay Gunluk

Borozan and Cornuejols (2008) and Andersen et.al (2007) recently studied valid inequalities for mixed-integer sets defined by multiple rows where each row has exactly one integer variable which is not restricted in sign. Cutting planes based on this approach have already been used for general mixed-integer problems and show promise to be useful. In this work, we require the integer variables to be non-negative and show how to obtain stronger cuts by exploiting such requirement.

3 - Constrained Infinite Group Relaxations of MIPs
Santanu Dey, CORE, Louvain-La-Neuve, Belgium, Santanu.Dey@uclouvain.be, Laurence Wolsey

One method of generating cutting planes for general MIPs is to use extreme inequalities of its group relaxations. Recently, there has been renewed interest in studying the continuous infinite group relaxation -a set involving m equality constraints with m free integer variables and non-negative continuous variables. In this talk we consider a stronger relaxation of general MIPs by allowing constraints, such as bounds, on the free integer variables in the continuous group relaxation.

■ SC54

H-Room 306A, Third Floor

Optimization in Metric Spaces

Sponsor: Optimization/Networks
Sponsored Session

Chair: Aleksandrs Slivkins, Researcher, Microsoft Research (SVC), 1065 La Avenida, Mountain View, CA, 95134, United States of America, slivkins@microsoft.com

1 - A Computational Theory of Clustering

Maria Florina Balcan, Assistant Professor, Georgia Institute of Technology, School of Computer Science, Atlanta, GA, 30332, ninamf@cc.gatech.edu, Avrim Blum, Santosh Vempala

In this work we propose a new general framework for analyzing clustering from similarity information that directly addresses the question of what properties of a similarity measure are sufficient to cluster accurately and by what kinds of algorithms. We show that in our framework a wide variety of interesting learning-theoretic and game-theoretic properties can be used to cluster well, and we design new efficient algorithms that are able to take advantage of them.

2 - Nearly Tight Low Stretch Spanning Trees

Ittai Abraham, Researcher, Microsoft Research (SVC), 1065 La Avenida, Mountain View, CA, 95134, United States of America, ittaia@microsoft.com, Yair Bartal, Ofer Neiman

We prove that any graph G on n vertices has a distribution over its spanning trees such that for any edge (u,v) the expected stretch E_T[d_T(u,v)] is bounded by \tilde{O}(\log n). Our result is obtained via a new approach of building ``highways" between portals and a new strong diameter probabilistic decomposition theorem.

3 - Approximating Geometric Steiner Forest

Glencora Borradaile, Oregon State University, Corvallis, OR, United States of America, glencora@eecs.oregonstate.edu, Claire Mathieu, Philip Klein

Given a set of pairs of points, what is the minimum-length network that connects each pair of points? This is the geometric Steiner forest problem. In graphs and high-dimension Euclidean space, the problem admits no polynomial-time approximation scheme and the best known approximation is 2. For fixed epsilon, we give an O(n polylog n)-time algorithm that finds a (1+epsilon)-approximation for instances in the Euclidean plane. Joint work with Philip Klein and Claire Mathieu.

4 - Multi-armed Bandits in Metric Spaces

Aleksandrs Slivkins, Researcher, Microsoft Research (SVC), 1065 La Avenida, Mountain View, CA, 95134, United States of America, slivkins@microsoft.com, Robert Kleinberg, Eli Upfal

In a multi-armed bandit problem, an online algorithm chooses from a set of strategies in a sequence of trials so as to maximize the total payoff of the chosen strategies. We study a very general setting for the multi-armed bandit problem, motivated by practical applications such as online auctions and web advertisement, in which the strategies form a metric space, and the payoff function satisfies a Lipschitz condition with respect to the metric.

■ SC55

H-Room 306B, Third Floor

Dynamic Auctions

Sponsor: Optimization/Networks
Sponsored Session

Chair: Liad Blumrosen, Department of Economics, The Hebrew University, Jerusalem, 91905, Israel, blumrosen@gmail.com

1 - Efficient Metadeliberation Auctions

Ruggiero Cavallo, University of Pennsylvania, 114 S. 19th St., #1A, Philadelphia, PA, 19103, United States of America, cavallo@seas.upenn.edu, David Parkes

We consider a resource allocation scenario in which the interested parties can, at a cost, individually (and privately) research ways of using the resource, potentially increasing the value they would achieve from obtaining it. There is a value-improvement/cost tradeoff. We reduce computing the optimal research/allocation policy to computing Gittins indices for multi-armed bandits, and apply a modification of the dynamic-VCG mechanism to yield truthful participation in an ex post equilibrium.

2 - Self-Correcting Sampling-Based Dynamic Multi-Unit Auctions

Florin Constantin, Harvard University, 33 Oxford St, Cambridge, United States of America, florin@eecs.harvard.edu

We present the first use of online stochastic optimization for incentive-compatible dynamic auctions with partially patient, multi-unit demand bidders. We achieve strategyproofness via a self-correcting procedure applied to a heuristic version of the Consensus algorithm. We show empirically that the price of strategyproofness is limited with respect to both performance and computation requirements.

3 - Peer Influence and Information Diffusion in Online Social Networks: An Empirical Analysis

Rajiv Garg, Carnegie Mellon University, 4800 Forbes Ave, Suite 242, Pittsburgh, PA, 15213, United States of America, rg@cmu.edu, Mike Smith, Rahul Telang, David Krackhardt

Over the last few years, online networks have been gaining popularity and allowing community members to share and exchange information. But due to information overload the traditional modes of diffusion have been losing effectiveness. With the increase in online trust, online social networks are becoming the platform of choice for product advertising and discovery. We found that the online peers indeed influence other peers and enable discovery of niche music on social networks.

■ SC56

H-Room 307, Third Floor

Global Optimization in the Presence of Errors

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Omid Nohadani, MIT, 77 Massachusetts Ave, E40, Cambridge, MA, 02139, United States of America, nohadani@mit.edu

1 - The Nested Event Tree Model with Application to Combating Terrorism

Brian J. Lunday, Ph.D. Candidate, Grado Department of Industrial and Systems Engineering, Virginia Polytechnic Institute and State, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, lunday@vt.edu, Theodore S. Glickman, Hanif D. Sherali

We present a nested event tree optimization framework for minimizing the expected loss inflicted by a terrorist organization by allocation of capability-, intent-, vulnerability-, and consequence-related resources. For the resulting specially structured nonconvex factorable program, we develop three algorithms (each with a special-case variant) that attain a global optimal solution and demonstrate all six strategies to outperform the commercial software BARON in extensive testing.

2 - Deterministic Global Optimization of Semi-Infinite Programs

Alexander Mitsos, Assistant Professor, Massachusetts Institute of Technology, Department of Mechanical Engineering, 77 Massachusetts Avenue, MIT 3-158, Cambridge, MA, 02139, United States of America, mitsos@MIT.EDU

A deterministic algorithm is proposed for the global solution of SIPs without any convexity/concavity assumptions. The algorithm employs an upper bound based on a restriction of the right-hand-side of the constraint and a discretization of the parameter set and a lower bound based on discretization of the parameter set. Finite termination is proved and the advantages of the proposed algorithm over existing algorithms are demonstrated by numerical examples.

3 - Scatter Search in Process Engineering Optimization

Jose A. Egea, Dr., IIM-CSIC, Eduardo Cabello, 6, Vigo, 36208, Spain, jegea@iim.csic.es, Julio R. Banga

Scatter search has proved to be efficient and robust to solve optimization problems from process engineering. Here we present a scatter search-based method for solving continuous global optimization problems in that area. We will illustrate the capabilities of the method by applying it to a set of process engineering optimization problems and comparing its results with those obtained by other state-of-the-art global optimization methods.

4 - Robust Optimization with Simulated Annealing

Omid Nohadani, MIT, 77 Massachusetts Ave, E40, Cambridge, MA, 02139, United States of America, nohadani@mit.edu, Dimitris Bertsimas

An optimized solution can become suboptimal or even infeasible, when errors are encountered. We present a robust simulated annealing algorithm that does not require any knowledge of problem structure. This is necessary in many engineering applications where solutions are not explicitly known and obtained via simulations. Our method is computationally efficient and warrants for a global optimum which is robust against uncertainties. We demonstrate it on a high-dimensional nanophotonic problem.

■ SC57

H-Room 308, Third Floor

Disease Modeling

Sponsor: Health Applications
Sponsored Session

Chair: Pinar Keskinocak, Associate Professor, Georgia Tech, School of Industrial and Systems Enginee, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, pinar@isye.gatech.edu

1 - A Non-homogenenous Agent-based Simulation Predict Disease Spread in a Pandemic Outbreak

Dionne Aleman, University of Toronto, Department of Mechanical and Industrial Engin., 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca, Brian Schwartz, Theodorus Wibisono

The need for accurate disease spread data was highlighted during the Severe Acute Respiratory Syndrome (SARS) outbreak in 2002-2003. Previous studies of disease spread make overly simplistic assumptions and assume that all people are identical. We propose an agent-based simulation model that treats each member of the population as unique. The results of the model are output to geographic information system (GIS) software for visualization. A pilot study of the model is tested on Toronto, Canada.

2 - Modeling of the Spread of Methicillin-resistant Staphylococcus Aureus (MRSA)

Bruce Lee, Assistant Professor of Medicine, Epidemiology, and Biomedical Informatics, University of Pittsburgh, 200 Meyran Ave., Suite 200, Pittsburgh, PA, 15213, United States of America, BYL1@pitt.edu

Methicillin-resistant Staphylococcus aureus (MRSA), an antibiotic-resistant bacteria, is a major problem in many countries, resulting in significant morbidity, mortality, and rising health care costs and capturing the attention of public health officials, lawmakers, and health care administrators. This session will present computer models that simulate the spread of MRSA throughout a county and the potential effects of various prevention and control strategies and interventions.

3 - Modeling Seasonality and Strain Mutation in a Pandemic Influenza

Pengyi Shi, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30318, United States of America, shipengyi@gmail.com, Pinar Keskinocak, Bruce Lee, Julie Swann

Multiple waves of attack in a pandemic influenza has been observed in the past. We investigated the reasons of such multi-attacks by modeling two potential factors: seasonal change and strain mutation. Based on a spatial-temporal disease spread model incorporated with the two factors, our simulation showed that multiple attacks may happen under the joint effect of seasonality and mutation. We reproduced a mortality pattern with 3 peaks similar to the one observed in 1918.

4 - Balancing HIV Treatment with Harm Reduction for Injection Drug Users in Ukraine

Sabina Alistar, Student, Stanford University, MS&E Department, Terman Building, Stanford, CA, 94305, United States of America, ssabina@stanford.edu, Margaret Brandeau

Ukraine has the fastest growing IDU-driven HIV epidemic in Europe. With limited resources, the tradeoff between expanding access to treatment and scale-up of harm reduction programs (methadone substitution) is a relevant question for decision makers. We describe a dynamic compartmental model to investigate the cost-effectiveness of multiple strategies to manage the epidemic.

■ SC58

H-Room 309, Third Floor

Scheduling Operations in Manufacturing/Service Systems

Cluster: Scheduling
Invited Session

Chair: Chelliah Sriskandarajah, Professor, The University of Texas at Dallas, 800 West Campbell Rd. SM30, School of Management, Richardson, TX, 75080, United States of America, chelliah@utdallas.edu

1 - Throughput Optimization in Robotic Cells under Circular Layout is NP-Hard

Tharanga Rajapakshe, UTD, 800 W. Campbell Road, Richardson, Tx, 75080, United States of America, tkr051000@utdallas.edu, Milind Dawande, Chelliah Sriskandarajah

We consider the problem of optimizing throughput in single-gripper, bufferless robotic cells that produce identical parts under the free-pickup criterion and the additive-travel-time metric. The problem of finding an optimal 1-unit cycle is shown to be NP-hard for cells under circular layout. We also provide a polynomial-time 5/3-approximation algorithm .

2 - Pool-Point Distribution of Zero-Inventory Products

Neil Geismar, Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, NGeismar@mays.tamu.edu, Milind Dawande, Chelliah Sriskandarajah

A production facility with an adjustable production rate uses pool-point (or hub-and-spoke) distribution for its limited-lifetime product, which cannot be inventoried. Each pool point may require multiple truckloads. The delivery of the product is done by identical trucks, each having limited capacity and non-negligible traveling time between the plant and the pool points. Our objective is to coordinate the production and transportation operations so that the total cost is minimized.

3 - Emerging Inventory Models in the Cash Supply Chain

Yunxia Zhu, University of Texas at Dallas, 800 West Campbell Rd, SM 30, Richardson, tx, 75080, United States of America, yxz067000@utdallas.edu

We devise and analyze novel inventory models resulting from the new currency recirculation policy introduced in 2007 by the U.S. Federal Reserve. Our analysis provides managers of depository institutions (banks) with optimal or efficient currency management strategies under all possible cost structures and demand patterns.

4 - Optimal Scheduling of Mobile Advertisements

Subodha Kumar, Assistant Professor, Texas A&M University, Mays Business School, 301-F Wehner Building, 4217 TAMU, College Station, TX, 77843, United States of America, subodha@tamu.edu, Tridib Bandyopadhyay, Milind Dawande, Vijay Mookerjee

Mobile wireless devices are increasingly becoming powerful platform for advertising because they can be used to track physical location of its users. However, the ineffective advertisements not only increase the cost to the advertisers, but may also create a negative value for the item. Hence, the firms need to make the advertising decisions judiciously. We optimize the decisions for a large marketing firm which needs to maximize the effectiveness of advertisements in a given planning horizon.

■ SC59

H-Room 310, Third Floor

Tutorial: Supply Chain Management in the Context of Humanitarian Disasters

Cluster: Tutorials
Invited Session

Chair: Luk Van Wassenhove, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, luk.van-wassenhove@insead.edu

1 - Supply Chain Management in the Context of Humanitarian Disasters

Luk Van Wassenhove, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, luk.van-wassenhove@insead.edu

Disaster logistics differ from business logistics because of dynamic environments and the need for impartiality, neutrality and humanity. Funding is declining, and disasters become more frequent, humanitarians increasingly rely on private organizations for help, although collaboration is difficult. We introduce disaster supply chain management, outline the need for better preparedness and response, discuss opportunities for effective collaboration, and highlight opportunities for research

■ SC60

H-Room 311, Third Floor

Some Advances in Conic Optimization

Cluster: Large Scale Optimization (In Honor of Jean-Louis Goffin)
Invited Session

Chair: Mohammad Oskoorouchi, College of Business Administration, California State University San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA, 92096, United States of America, moskooro@csusm.edu

1 - An Interior Point Constraint Generation Method for Semi-infinite Linear Programming

Mohammad Oskoorouchi, College of Business Administration, California State University San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA, 92096, United States of America, moskooro@csusm.edu, Hamid Ghaffari, Tamas Terlaky

We present an interior point constraint generation algorithm for semi-infinite linear optimization and prove that the algorithm converges to an ε-solution after a finite number of constraints is generated. We implement our algorithm to solve second-order cone optimization (SOCO) problems and compare our numerical results with that of SeDuMi and show that our method outperforms classical primal-dual interior point methods on a class of large-scale SOCO problems.

2 - Full-Newton Step Polynomial-time Methods for LO Based on Locally Self-concordant Barrier Functions

Kees Roos, TU Delft, Mekelweg 4, Delft, Netherlands, C.Roos@tudelft.nl, H. Mansouri, G. Lesaja

Recently, several interior-point methods were introduced by using barrier functions that are based on kernel functions. These barrier functions are not self-concordant. Near the central path, however, they behave as being self-concordant. Using this we prove that for full-Newton step variants of these methods the iteration bound is the currently best known bound for LO.

3 - Relationships Among Some Geometric Measures of Convex Cones

Levent Tuncel, Professor, University of Waterloo, Department Combinatorics and Optim., 200 Unversity Avenue, West, Waterloo, ON, N2L3G1, Canada, ltuncel@math.uwaterloo.ca, Hugo Lara

We study geometric measures of convex cones and present various relationships among the width, the norm approximation coefficient, Caratheodory number and Goffin-Cheung-Cucker measure of convex cones.

■ SC61

H-Room 312, Third Floor

Competitive Location

Sponsor: Location Analysis
Sponsored Session

Chair: Tammy Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, tdrezner@fullerton.edu

1 - A Competitive Location Model: Improving Attractiveness of Chain Facilities

Pawel Kalczynski, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, pkalczynski@fullerton.edu, Zvi Drezner, Tammy Drezner

In this paper we apply cover models to competitive facility location models. The cover radius of a facility depends on its attractiveness. The cost of constructing a facility is a function of its radius. We investigate both constructing new competing facilities and upgrading one's chain facilities or a combination of both by allocating a given budget among existing and/or new chain facilities.

2 - Locating Capacity and Reactive Banks in Electrical Power Networks

Vladimir Marianov, Professor, Universidad Catolica de Chile, Santiago, Chile, marianov@ing.puc.cl, Felipe Tapia, Luis Vargas

We propose a procedure to locate capacity and reactive banks in an electrical network so to supply the demand over a time horizon and keep quality and reliablity standards, under different failure and demand scennarios, at a minimum cost. The procedure is tested on a network serving six million people.

3 - Hotelling Models with Asymmetry

H. A. Eiselt, University of New Brunswick, New Brunswick, Canada, haeiselt@unb.ca, Vladimir Marianov

This presentation considers a variety of standard Hotelling models with firms that have different objectives. We first study the sensitivity of the models as far as Nash locational equilibria are concerned, and we then examine von Stackelberg solutions and determine when a first mover advantage exists.

4 - Big Segment Small Segment Global Optimization Algorithm on Networks

Zvi Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@Fullerton.edu, Oded Berman, Dmitry Krass

The branch and bound procedures: Big Square Small Square and the Big Triangle Small Triangle were proposed to solve single facility location problems in the plane. We propose a similar branch and bound approach to solve single facility location on the network when the facility can be located anywhere on the network.

■ SC62

H-Room 313, Third Floor

Human Behavior in Supply Chains

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Karen Donohue, Associate Professor, Carlson School, University of Minnesota, 321 19th Ave S, 3-150 CSOM, Minneapolis, MN, 55455, United States of America, donoh008@umn.edu

1 - Simple Reactive Strategies in Repeated Interactions between Supplier and Retailer

Yaozhong Wu, NUS Business School, 1 Business Link, Singapore, Singapore, bizwyz@nus.edu.sg

It has been observed that supply chain transactions between suppliers and retailers often take simple forms, for example, linear wholesale price transaction. This research studies how simple reactive strategies evolve and affect performances in repeated supply chain coordination games.

2 - Is the Newsvendor "Pull-to-Center" Finding an Experimental Artifact

Neil Bearden, Assistant Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, neil.bearden@insead.edu, Nils Rudi, David Drake

One common objection to experimental studies of the newsvendor problem is that the assumption of a (perfectly) known demand distribution is too strong. We report results from an experiment in which subjects face a newsvendor problem with an unknown demand distribution (neither its form nor its moments are known). We find that whether the demand distribution is known or not has little effect on order quantities. We conclude with a linguistic analysis of the term "bias."

3 - Decision Making Behavior for Pooled Inventory: Learning to Share

Karen Donohue, Associate Professor, Carlson School, University of Minnesota, 321 19th Ave S, 3-150 CSOM, Minneapolis, MN, 55455, United States of America, donoh008@umn.edu, Tony Cui, Arthur Hill, Brent Moritz

It is well known that pooling inventory can allow one to reduce inventory investments while maintaining or even increasing service levels. Despite these theoretical benefits, we find that supply chain managers in practice often resist moving to a centralize system and giving up local inventory control. We examine this disconnection between theory and practice by uncovering potential behavioral issues that influence one's ability to effectively share inventory.

■ SC63

H-Room 314, Third Floor

Convex Hull Approximations for Integer and Global Optimization

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Suvrajeet Sen, Professor, The Ohio State University, 1971 Neil Ave, Columbus, OH, 43210, United States of America, sen.22@osu.edu

1 - On Polytopes Associated with Products of Discrete Variables

Warren Adams, Professor, Clemson University, Martin Hall, Clemson, SC, 29634, United States of America, wadams@clemson.edu, Stephen M Henry

Linearizations of quadratic binary terms have been well-studied. However, little is known for the discrete case. We characterize desirable extreme point traits of discrete polytopes, and establish fundamental results relative to dimension and facial structure. Convex hull representations are obtained for special instances, and partial such results in general.

2 - Exploiting Multilinearity in Global Optimization Relaxations

Mohit Tawarmalani, Associate Professor, Krannert Graduate School of Management of Purdue University, 4026, RAWLS Hall, 100, S. Grant, West lafayette, IN, 47907, United States of America, mtawarma@purdue.edu, Nick Sahinidis, Xiaowei Bao

We use the convex extensions theory to derive a column-generation algorithm for generating facets of the envelopes of a multilinear function. We provide preliminary computational experience on a variety of global optimization problems. We compare the strength of various commonly used relaxations for the multilinear expressions, discuss generalizations to multilinear sets.

3 - Finite Disjunctive Programming Characterizations for General Mixed-Integer Linear Programs

Binyuan Chen, PhD Students, University of Arizona, SIE Department, Tucson, AZ, 85721, United States of America, bychen@email.arizona.edu, Simge Kucukyavuz, Suvrajeet Sen

We give a finite disjunctive programming procedure to obtain the convex hull of bounded general mixed-integer linear programs. We propose a sequential disjunctive cutting plane algorithm that converges to an integral optimal solution in finitely many iterations. We illustrate the proposed algorithm on three well-known examples in the literature.

■ SC64

H-Room 202A, Second Floor

2009 INFORM-ED Case Competition I

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Mike Racer, Associate Professor, University of Memphis, 302 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

1 - 2009 INFORM-ED Case Competition

Mike Racer, Associate Professor, University of Memphis, 302 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

This session will host the presentations of the finalists for this annual competition. A panel of judges from INFORM-ED will select the winners.

■ SC75

C-Room 32A, Upper Level

Next Generation Car Scheduling Systems I

Sponsor: Railroad Applications
Sponsored Session

Chair: Dharma Acharya, AVP - Operations Research, CSX Transportation, 500 Water St. J315, Jacksonville, FL, 32082, United States of America, Dharma_Acharya@CSX.com

1 - Next Generation Car Scheduling System at Norfolk Southern

Dan Plonk, Director Transportation Planning, Norfolk Southern Coporation, 1200 Peachtree St. NE, Box 158, Atlanta, GA, 30309, United States of America, dan.plonk@nscorp.com

In this presentation, I'll start with an overview of our existing car scheduling system, Algorithmic Blocking & Classification or ABC. I'll describe what ABC is and how it works. Then, I'll focus on the next generation ABC which extends the current ABC algorithms to incorporate shipment delivery time and individual train capacity. The new system will allow us to improve customer service and better utilize capacity. Lastly, I'll outline the next steps.

2 - Current and Future Car Scheduling System at CSX

Cary Helton, VP Service Planning, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32202, United States of America, Cary_Helton@csx.com

In this presentation, we will describe the features and short comings of the existing car scheduling system. We will then describe the desired features/functionalities of the future car scheduling system.

3 - Capacitated Car Scheduling on a Time/Space Network

Chip Kraft, ckraft@temsinc.com

Capacitated Car Scheduling on a Time/Space Network provides an opportunity for railroads to boost capacity by utilizing train capacity that might otherwise go to waste. In an era of rising fuel prices, it may also provide an opportunity to introduce a "Time Definite" service offering into the railroad product mix. We will describe a real-time process control algorithm, based on a revenue management "Bid Price" framework, that has been implemented to make this possible.

Sunday, 4:30pm - 6:00pm

■ SD01

C-Room 21, Upper Level

Decision Analysis Society Practice Award Finalists

Sponsor: Decision Analysis
Sponsored Session

Chair: J. Eric Bickel, Assistant Professor, The University of Texas, 1 University Station, C2200, ETC 5.128D, Austin, TX, United States of America, ebickel@mail.utexas.edu

1 - SPRINT: A Decision Analysis Based System for Prioritizing R&D Investments at Baxter Healthcare

Phil Beccue, Director, Baxter Healthcare, One Baxter Way, Westlake Village, CA, 91362, United States of America, phil_beccue@baxter.com, Chris Dalton

Baxter invests nearly $1B annually on innovative science to develop specialty therapies and medical products. SPRINT was developed to bring financial rigor and insights to the tradeoffs required in R&D decision-making. As a unique portfolio system combining spreadsheets and decision analysis software, SPRINT captures technical and commercial uncertainty, and is based on an efficient web-based design to collect, manage, and analyze R&D data.

2 - Decision Support for Patients at the UCSF Breast Care Center

Jeff Belkora, Director, Decision Services, University of California, San Francisco, 3333 California Street, Suite 265, San Francisco, CA, 94118, United States of America, jeff.belkora@ucsfmedctr.org, Shelley Volz, Meredith Loth, Alexandra Teng

Decision Services provides decision support to over 500 patients a year weighing the uncertain risks and benefits of breast cancer treatments at UCSF. The support interventions are based on decision analytic theories and practices and associated with increased patient knowledge. The attending surgeons and oncologists have integrated Decision Services into the clinic workflow. Premedical interns deliver the interventions and carry their decision analytic training into medical school and beyond.

3 - Modular Influence Diagrams and Warranty Cost Reduction

Robert Bordley, Technical Fellow, General Motors, 305500 Mound Road, Warren, United States of America, robert.bordley@gm.com

Certain influence diagram packages (e.g. Analytica) allow the influence diagram to be decomposed into influence diagram modules with the high-level level diagrams assessed by executives and the lower-level influence diagram modules asssessed by subject matter experts familiar. The resulting influence diagram can identify opportunities that cut across functional silos. We illustrate these benefits with a very successful, high-impact application to warranty cost reduction at the author's company

■ SD02

C-Room 22, Upper Level

Non-Expected-Utility Theories

Sponsor: Decision Analysis
Sponsored Session

Chair: Aurelien Baillon, Assistant Professor, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000DR, Netherlands, baillon@ese.eur.nl

1 - Experience, Belief, and Preferences in Decision under Uncertainty

Craig Fox, Professor, UCLA Anderson School, 110 Westwood Plaza #D511, Los Angeles, CA, 90095-1481, United States of America, craig.fox@anderson.ucla.edu

In this paper we critically examine the conditions under which experience-based decision making diverges from description-based decision making. Next we develop an integrative account of decision under uncertainty that incorporates the role of experience, beliefs, risk- and ambiguity-preferences. We use this model to explain several empirical patterns of choice under uncertainty previously identified in the literature and to characterize the impact of increasing experience on decisions.

2 - Testing Critical Properties of Descriptive Models of Decision Making

Michael Birnbaum, Professor, California State University, Fullerton, Department of Psychology, CSUF H-830M, Fullerton, CA, 92834-6846, United States of America, mbirnbaum@fullerton.edu

Critical properties are theorems implied by a model that are violated by at least one other model. The model predicting violations (with parameters) is used to design the test. Systematic violations rule out all models satisfying the property. Failure of violations to materialize means both classes can be retained, but parameters are constrained. Empirical evidence regarding more than a dozen such critical properties is reviewed to compare models of decision making.

3 - Revisiting the Gains-Loss Separability Assumption in Prospect Theory

David Budescu, Professor, Fordham University, Dealy Hall, 441 East Fordham Road, Bronx, NY, 10458, United States of America, budescu@fordham.edu, Han Hui Por

Prospect theory assumes that people encode outcomes as gains/losses. The subjective value of mixed prospects is assumed to be the sum of their corresponding positive and negative components. Previous research (Wu & Markle, 2008 using choices; Budescu & Templin, 2009 using CEs) found different rates of violations of this assumption. We report a new study using both elicitation methods and randomly selected prospects and document the extent (and consistency) of the violations in the two tasks.

4 - Are Subjective Probabilities Sign-dependent?

Aurelien Baillon, Assistant Professor, Erasmus University Rotterdam, P.O. Box 1738, Rotterdam, 3000DR, Netherlands, baillon@ese.eur.nl, Han Bleichrodt

We conducted an experiment in which we elicited subjective probabilities through choices. For several events we determined the probability such that a subject is indifferent between getting an outcome with this probability (or nothing otherwise) and getting the same outcome if the event occurs. We used both gains and losses implemented with real incentives. We discuss which model can accommodate our findings.

■ SD03

C-Room 23A, Upper Level

Extensions of Nash Equilibrium Problems

Cluster: Game Theory
Invited Session

Chair: Uday Shanbhag, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States of America, udaybag@illinois.edu

1 - Advances in Modeling Dynamic Network User Equilibrium

Taeil Kim, PhD Candidate, Pennsylvania State University, 244 Leonhard Building, University Park, PA, United States of America, tzk115@psu.edu, Changhyun Kwon, Tao Yao, Terry Friesz

In this talk, we report on a fixed point algorithm for computing a continuous time dynamic user equilibrium (DUE) for a variety of network loading submodels, including the point queue model and the cell transmission model. A proof of convergence is presented for non-monotonic path delay operators. The results of several numerical experiments for a variety of test problems are also reported.

2 - Risk-averse Nash Equilibrium Problems

Uday Shanbhag, Industrial and Enterprise Systems Engineering, University of Illinois at Urbana-Champai, Urbana, IL, 61801, United States of America, udaybag@illinois.edu, Uma Ravat

We introduce the risk-averse Nash equilibrium problem in which agents have nonsmooth objectives arising from CVaR measures. Under fairly mild assumptions, we prove the existence of equilibria and examine the properties of the smoothed game. Smoothing-based computational schemes for these problems are also studied.

3 - On Functional Evolutionary Variational Inequalities

Lanshan Han, Visiting Assistant Professor, University of Illinois at Urbana Champaign, 117 Transportation Building, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, hanlsh@uiuc.edu, Jong-Shi Pang

We consider a class of dynamic systems whose equilibrium set is the solution set of a static finite-dimensional variational inequality. Various properties of these dynamic systems, such as trajectory convergence property, stability, and mode switching behavior are studied in this paper. We also consider applications in transportation equilibrium analysis.

4 - Refinement of the Generalize-Nash Equilibrium

Ankur Kulkarni, Industrial and Enterprise Systems Engg, UIUC, Urbana, IL, United States of America, akulkar3@uiuc.edu, Uday Shanbhag

Facchinei et al in 2007 showed that a solution to a related variational inequality provides an equilibrium (called a variational eq (VE)) to the generalized Nash game with shared constraints. We investigate when the existence of a generalized Nash Eq (GNE) imply the existence of a VE, i.e. the VE is a refinement of the GNE. We provide conditions for such a refinement to exist in primal and primal dual setting. A comparison is made with the approaches of both Harker and that of Facchinei et al.

■ SD04

C-Room 23B, Upper Level

Optimization Approach for Mechanism Design

Cluster: Auctions
Invited Session

Chair: Peng Sun, Associate Professor, Duke University, One Towerview Rd, Durham, NC, 27708, United States of America, psun@duke.edu

1 - Linear Programming for Mechanism Design: An Application to Bidder Collusion at First-Price Auctions

Peng Sun, Associate Professor, Duke University, One Towerview Rd, Durham, NC, 27708, United States of America, psun@duke.edu, Leslie Marx, Giuseppe Lopomo

We use linear programming techniques to analyze the extent to which collusion in first-price auctions is detrimental to sellers' revenue and efficiency. Contrary to some prior literature, we assume that the cartel cannot prevent its members from bidding at the auction. We show that in certain environments collusion at a first-price auction is not profitable at all. Our results suggest that first-price auctions are more robust to collusion than previously believed.

2 - Multi-Dimensional Mechanism Design: Finite Dimensional Approximations and Efficient Computation

Shouqiang Wang, PhD Candidate, Fuqua School of Business, Duke University, 1 Towerview Dr., Durham, NC, 27705, United States of America, shouqiang.wang@duke.edu, Alexandre Belloni, Giuseppe Lopomo

This paper considers mechanism design problems with multi-dimensional types when the seller's cost function is not separable across buyers. We show that the associated infinite dimensional optimization problem posed by the theoretical model can be approximated arbitrary well by a sequence of finite dimensional linear programming problems. We are able to provide an efficient algorithm of solving this problem by implementing the cutting-plane method.

3 - Characterizing Optimal Adword Auctions

Garud Iyengar, Associate Professor, Columbia University, IEOR Department, New York, NY, 10027, United States of America, garud@ieor.columbia.edu, Anuj Kumar

We present a number of models for the adword auctions used for pricing advertising slots. We discuss two interesting special cases: slot independent valuation and slot independent valuation up to a privately known slot and zero thereafter. Next, we propose a new mechanism that we call the customized rank based allocation and report the results of a numerical study that compare the revenue and efficiency of the proposed mechanisms.

■ SD05

C-Room 23C, Upper Level

Panel Discussion: Curriculum Development in QSR

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 EN, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu

1 - Curriculum Development in QSR

The current QSR related curricula for graduate students are very diversified in different universities. We should have some efforts to make the QSR curricula more standardized/attractive. This panel will highlight the need for fundamental courses and multi-disciplinary instructions for graduate education in the quality and reliability engineering field. Laboratory facilities and equipment will also be highlighted. An overview of the recent development of quality and reliability education in east Asia region will also be discussed.

2 - Graduate Education in Quality and Reliability Engineering

Panelist: Elsayed Elsayed, Professor, Rutgers University, Industrial and Systems Engineering, Piscataway, NJ, 08854, United States of America, elsayed@rci.rutgers.edu

This talk will highlight the need for fundamental courses and multi-disciplinary instructions for graduate education in the quality and reliability engineering field. Laboratory facilities and equipment will also be highlighted.

3 - Recent Development of Quality and Reliability Education in Asia
Panelists: Fugee Tsung, Professor, Hong Kong University of Science and Technology, Department of IELM, Hong Kong University of Sci. & Tech., Hong Kong, Hong Kong - PRC, season@ust.hk

As the world becomes flatter, the convergence of technology and events to East Asia has allowed this region to become important part of the global supply chain for services and manufacturing. For that, the quality and reliability profession has made considerable progress in the East Asia region in recent years. This presentation will give an overview of the recent development of quality and reliability education in this region.

4 - Critical Components of a Quality and Reliability Engineering Graduate Program
Panelist: Douglas Montgomery, Professor, Arizona State University, Tempe, AZ, United States of America, doug.montgomery@asu.edu

The critical components of a graduate program in quality and reliability engineering program are discussed. These components include student preparation and prerequisites, core requirements, and elective opportunities. Participation with other campus programs is also discussed. Both on-campus and on-line masters degree programs are described, along with the opportunities and challenges associated with each type of program. The structure of a PhD program is also discussed.

■ SD06

C-Room 24A, Upper Level

Technometrics — Computer Experiments, Tuning and Optimization

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Steinberg, Professor, Tel Aviv University, Department of Statistics and, Operations Research, Tel Aviv, 69978, Israel, dms@post.tau.ac.il

1 - Robust Local Optimization via Hybrid Search and Sequential Monte Carlo
Matthew Taddy, Assistant Professor, University of Chicago Booth School of Business, 5807 South Woodlawn, Chicago, IL, 60605, United States of America, Matt.Taddy@ChicagoBooth.edu

By combining statistical search using tree-based regression models — fit sequentially via particle learning — with pattern search optimization, we are able to perform robust local optimization more efficiently and effectively than using either method alone. The approach is based on the augmentation of local search patterns with location sets generated through improvement prediction, and the improvement criteria can be chosen to suit either deterministic or stochastic objective functions.

2 - Simultaneous Determination of Tuning and Calibration Parameters for Computer Experiments
Gang Han, Research Scientist, H. Lee Moffitt Cancer Center & Research Institute, MRC/BIOSTAT, 12902 Magnolia Drive, Tampa, FL, 33612-9416, United States of America, Gang.Han@moffitt.org, Thomas Santner, Jeremy Rawlinson

Tuning and calibration inputs are set to enhance the representativeness of complex computer codes simulating physical experiments that are too difficult or costly to run. This talk proposes a new methodology to simultaneously set tuning and calibration inputs based on a Bayesian model. Our methodology significantly improves on the current commonly-used method both in an artificial example and in a biomechanical engineering application.

■ SD07

C-Room 24B, Upper Level

Design and Analysis of Life-testing Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Hon Keung Tony Ng, Associate Professor, Southern Methodist University, Department of Statistical Science, 3225 Daniel Ave., Dallas, TX, 75275, United States of America, ngh@mail.smu.edu

1 - Comparing Optimal Sampling Acceptance Plans for Mixed, Type I and Type II Censoring
Jianwei Chen, Assistant Professor, San Diego State University, Department of Mathematics and Statistics, 5500 Campanile Drive, San Diego, CA, 92182, United States of America, jchen@sciences.sdsu.edu

We investigate optimal acceptance sampling plans under Type I, Type II and mixed censoring and establish an optimal Bayes rule for life testing with mixed censoring. An explicit expression of the minimum Bayes risk for a polynomial decision loss function is derived. Optimal acceptance sampling plans under Type I and Type II censoring are obtained. A finite algorithm for searching an optimal sampling plan is provided and an example is used to illustrate the effectiveness of the proposed models.

2 - Robustness of Optimal ALT Plans
Rong Pan, Assistant Professor, Arizona State University, Industrial, Systems & Operations Eng., Tempe, AZ, 85287, United States of America, Rong.Pan@asu.edu, Hon Keung Tony Ng

In this talk, we discuss the model parameter dependency problem that often appears in accelerate life testing (ALT) planning. That is, in order to formulate the optimal test plan, one has to know the values of some model parameters even before the test. These values are typically assigned based on "prior knowledge" and sensitivity analysis is performed around these values afterward. The "prior knowledge" based on sample estimates of previous experiments is also subject to random error.

3 - Parametric Inference for System Lifetime Data with Signatures Available
Hon Keung Tony Ng, Associate Professor, Southern Methodist University, Department of Statistical Science, 3225 Daniel Ave., Dallas, TX, 75275, United States of America, ngh@mail.smu.edu

In this talk, the statistical inference of the lifetime distribution of component based on observing the system lifetimes with signature available is discussed. A general proportional hazard rate model for the lifetime of the components is considered, which includes some commonly used lifetime distributions. Different estimation methods for the proportional parameter are discussed. Monte Carlo simulation study is used to compare the performance of these estimation methods.

4 - Exact Inference for Progressively Type-I Censored Exponential Failure Data
David Han, Assistant Professor, University of Texas at San Antonio, Dept. of Management Sci. and Statistics, One UTSA Circle, San Antonio TX 78249, United States of America, David.Han@utsa.edu, N. Balakrishnan, G. Iliopoulos

In this talk, we consider a progressively Type-I censored life-test under the assumption of exponential distribution. For small to moderate sample sizes, a practical modification is proposed to guarantee a feasible test under this scheme. We then obtain the MLE of the mean parameter and derive its exact sampling distribution under the condition to ensure its existence. Using the exact distribution as well as the asymptotic and parametric bootstrap methods, we then discuss the construction of confidence intervals and their performance is assessed through Monte Carlo simulations.

■ SD08

C-Room 24C, Upper Level

Joint Session DM/HAS: Data Mining and Knowledge Discovery in Healthcare - I

Sponsor: Data Mining & Health Applications
Sponsored Session

Chair: Durai Sundaramoorthi, Assistant Professor, Steven L. Craig School of Business, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu

1 - Early DRG Classifcation of Inpatient Data in Hospitals
Daniel Gartner, PhD student, TUM Business School, TU München, Arcisstr. 21, München, 80333, Germany, daniel.gartner@wi.tum.de, Rainer Kolisch, Rema Padman, Daniel B. Neill

When a patient is discharged from a hospital, Diagnosis-related groups (DRGs) are calculated by using clinical, treatment, and demographic data. In this study we applied machine learning methods to classify DRGs at and after admission. The results show that DRGs can be predicted with higher accuracy than the current approach.

2 - Access Block And Overcrowding In Emergency Departments: A Correlated Hazard Approach
Anurag Sharma, Research Fellow, Centre for Health Economics, Monash University, Bld 75, rm 2102, Monash University, Clayton, VI, 3800, Australia, anurag.sharma@buseco.monash.edu.au, Anthony Harris, Brett Inder

This study models the hazard of wait in the ED as an outcome of a related multi-episode process comprising of three episodes: i) duration of wait from arrival to first seen by doctor, ii) duration of wait from treatment to bed request and iii) duration of wait from bed request to admission.

3 - Physician Performance Modeling in a Healthcare Organization
Lori Pelletier, Worcester Polytechnic Institute, Manufacturing Engineering, 100 Institute Road, Worcester, MA, 01566, United States of America, loripell@wpi.edu, Sharon Johnson, Alan Krinsky, Edward Westrick, Elaine Fontaine, Qi Zhou

Physician measurement is gaining increasing attention as healthcare organizations seek incentives to improve outcomes. A hierarchical composite model was created with multiple measures and domains supporting small sample sizes and reliable measurement across primary care physicians. The physician measurement model was developed using claims data from a large, multi-clinic organization; the methodology provides a foundation for other healthcare organizations to build similar measurement models.

■ SD09

C-Room 25A, Upper Level

Joint Session Applied Probabilty/Queueing: Dynamic Control of Many Server and Parallel Server Systems

Sponsor: Applied Probability & Queueing
Sponsored Session

Chair: Amy Ward, USC, Marshall School of Business, BRI401H, 3670 Trousdale Parkway, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu

1 - The c mu / theta rule - An Optimal Scheduling Policy in Presence of Abandonment
Rami Atar, Technion, Department of Electrical Engineering, 32000 Haifa, 32000, Israel, atar@ee.technion.ac.il, Chanit Giat, Nahum Shimkin

We will present a simple index priority rule for a multiclass many-server queueing system, and argue that it asymptotically minimizes holding costs as the number of servers grows without bound.

2 - Abandonment vs. Blocking in Many-server Queues: Asymptotic Optimality in the QED Regime
Ananda Weerasinghe, Professor, Department of Mathematics, 396, Carver hall, Iowa State University, Ames, IA, 50011, United States of America, ananda@iastate.edu, Avishai Mandelbaum

A cost minimization problem of a large telephone call center is considered by using a G/M/n/B+M type queueing model. Costs are proportional to queue-length, number of blocked and abandoning customers and the number of idle servers. The queue capacity is the control variable. Using Halfin-Whitt heavy traffic limit, we obtain a diffusion control problem and solve it explicitly. It is used to derve an asymptotically optimal queue capacity for the queueing control problem.

3 - On Dynamic Scheduling of a Parallel Server System with Certain Graph Structure
Vladimir Pesic, vpesic@ucsd.edu, Ruth Williams

Assuming the server-buffer graph associated with a parallel server system has a certain structure, we give sufficient conditions for a least control process to be the optimal solution of the equivalent workload formulation of the approximating Brownian control problem. Under these conditions, we report on some preliminary analysis of a threshold-type policy that we conjecture is asymptotically optimal for the parallel server system.

4 - Dynamic Scheduling of an N-System with Impatient Customers
Samim Ghamami, University of Southern California, 3215 Overland Ave, Apt # 7176, Los Angels, 90034, Los Angeles, CA, 90034, United States of America, ghamami@usc.edu, Amy Ward

We consider a parallel server system known as an N system, in which there are two customer classes and two servers. Customers in both classes are impatient. Our objective is to schedule waiting jobs onto available servers so as to minimize the sum of holding and abandonment costs. We propose a control policy (which differs from Bell-Williams), and show that it is asymptotically optimal in the heavy traffic regime in Bell-Williams.

■ SD10

C-Room 25B, Upper Level

Stochastic Models of Manufacturing and Service Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Ivo Adan, Technical University of Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, iadan@win.tue.nl

1 - Impact of Delay Signals on Ambulance Traffic Operations
Masha Shunko, PhD Candidate, Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, mshunko@andrew.cmu.edu, Alan Scheller-Wolf, Soo-Haeng Cho

Ambulance crews' decisions regarding which hospital to transport patients to is impacted by the crew's expectations about the current delay at candidate hospitals' emergency departments. Hospitals, based on their own incentives, have the ability to influence the crew's expectations by sending real-time delay signals. We model a setting with two competing hospitals, derive their optimal delay signaling strategies, and analyze the impact of these strategies on the system performance.

2 - Synchronized Periodic Admission and Workforce Decisions Under a Lead Time Performance Constraint
N.C Buyukkaramikli, PhD Candidate, Technical University of Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, N.C.Buyukkaramikli@tue.nl, Will Bertrand, Henny van Ooijen

We analyze a system that faces random demand and service requirements which operates under a lead time performance constraint.We first introduce periodic admissions(PA) to the system,which have positive effects upto a period length and have negative effects after that period length.If decisions on the use of contingent workforce are taken at the admission points,further savings can be achieved depending on the service level,cost of contingent workforce,lead time and period length.

3 - Planning of Guaranteed Targeted Display Advertising
John Turner, PhD Candidate, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, jgt@andrew.cmu.edu

When planning how to serve ads on web pages and in online video games, a common objective is to proportionally spread impressions (ad views) across viewer types as much as capacity constraints allow. We show this objective tends to maximize the number of unique viewers while minimizing variability of service. By using an aggregation heuristic used to solve large transportation problems, we allocate impressions to ad campaigns to satisfy this objective at an appropriate planning granularity.

4 - Aggregate Modeling of Multi-processing Workstations
Ivo Adan, Technical University of Eindhoven, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, iadan@win.tue.nl, Marcel van Vuuren, Pascal Etman, Koos Rooda, Adam Wierman, Ad Kock

To model manufacturing systems consisting of flow lines with finite buffers and parallel servers at an aggregate level, we propose a multi-server station with process times depending on the work in process (WIP). An algorithm is developed to measure the WIP-dependent process times directly from industrial data such as arrival times at and departure times from the manufacturing system. Simulation results show that the aggregate model accurately predicts the mean flow time.

■ SD11

C-Room 25C, Upper Level

Protection of Critical Infrastructure

Cluster: Homeland Security and Counterinsurgency
Invited Session

Chair: John F (Jack) Keane, Johns Hopkins University/Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, Jack.Keane@jhuapl.edu

1 - Optimal Diversion Planning and Protection in Infrastructure Networks
Christopher Cullenbine, PhD Student, Colorado School of Mines, Golden, CO, 80401, United States of America, ccullenb@mines.edu, Alexandra Newman, Kevin Wood

Diversionary requirements arise when planning infrastructure network attacks. The network-diversion problem (NDP) requires identification of a minimum-weight s-t cut that includes at least one "diversion edge." We improve upon a specialized branch-and-bound algorithm for NDP. The ability to divert optimally then enables optimal protection against diversion: we demonstrate how.

2 - How to Assess the Value of Critical Infrastructure
David Alderson, Assistant Professor, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, dlalders@nps.edu, Matthew Carlyle, Gerald Brown

We assess the value of a critical infrastructure system by modeling its function. We assume when system components fail, or are intentionally damaged, the surviving components will be operated to maximize residual function. We quantify the consequence of a disruption in terms of the combined, synergistic ability of surviving components to function as a damaged system. We identify worst-case disruptions by assessing how these components might be maximally damaged by an intelligent adversary.

3 - Critical Infrastructure Inspection Management System (CIIMS)
Jeffery Brush, Johns Hopkins University/Applied Physics Laboratory, 11100 Johns Hopkins Road, Laurel, MD, 20723, United States of America, jeffery.brush@jhuapl.edu, Stephen Wright

The Critical Infrastructure Inspection Management System (CIIMS) is a software application utilized by aerial borne police officers to collect information on identified critical infrastructure and key resources (CI/KR) for use by intelligence analysts. CIIMS allows state fusion centers to access airborne "collection" assets to inspect CI/KR by creating inspection metrics. These metrics are then sent to CIIMS tablets where they populate the software until the inspection is complete.

4 - Army Research Office - New Decision Sciences Program
Janet H. Spoonamore, PhD Program Manager, Army Research Office, Decision Sciences Program, P.O.Box 1221, Research Triangle Park, NC, 27709, United States of America, janet.spoonamore@us.army.mil

Army Research Office (ARO) announces a new research program which addresses decision sciences - to assist Land Component Commanders in making decisions in complex environments. The goal of this new program is to develop theoretical foundations, models, and algorithms to support timely, robust, near-optimal decision making in highly complex, dynamic systems, operating in uncertain, resource-constrained environments with incomplete information against a competent thinking adversary.

■ SD12

C-Room 26A, Upper Level

Complementarity, Conality, and SDP - Algorithms and Applications

Sponsor: Computing Society
Sponsored Session

Chair: Robert Vanderbei, Professor, Princeton University, Sherrerd Hall, Room 106, Princeton, NJ, 08544, United States of America, rvdb@princeton.EDU

1 - A Disjunctive Programming Approach to LPCC
Bin Yu, Graduate student, Rensselaer Polytechnic Institute, CII5015 Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, 12180, United States of America, yub@rpi.edu, John Mitchell

A linear program with complementarity constraints (LPCC) can be modeled as a disjunctive program. By imposing one pair of disjunctive constraints at a time, we are able to use a cut generating LP to generate a disjunctive cut for the LPCC problem. We present a branch and cut algorithm to globally solve the LPCC problem. The algorithm is able to characterize infeasible and unbounded LPCC problems as well as solve problems with finite optimal value.

2 - Optimization over the Doubly Non-Negative Cone
Akiko Yoshise, Professor, University of Tsukuba, Tsukuba, Ibaraki 305-8573, Ibaraki, Japan, yoshise@sk.tsukuba.ac.jp, Yasukaki Matsukawa

While many studies on semidefinite relaxation for combinatorial optimization problems force the solution matrix to be symmetric and positive semidefinite, we often see that it is meant to be non-negative. We call the set of such matrices the doubly non-negative cone. Aiming to develop new algorithms for solving optimization problems over the cone, we provide some basic properties of the doubly non-negative cone focusing on barrier functions on its interior and its duality.

3 - Solving an Image Deconvolution Problem
Robert Vanderbei, Professor, Princeton University, Sherrerd Hall, Room 106, Princeton, NJ, 08544, United States of America, rvdb@princeton.EDU

A recent paper by A. Leshem shows how high resolution imaging in radio astronomy can be formulated as a block 2x2 semidefinite programming problem. In this talk, I will describe the problem and show how it can be solved efficiently as a convex optimization problem.

4 - Interior-Point Methods for MPECs
Hande Benson, Assistant Professor, Drexel University, 3141 Chestnut St, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu, David Shanno, Arun Sen

Penalty approaches for interior-point methods have been favored to handle the unbounded multipliers when solving mathematical programs with equilibrium constraints (MPECs). Even without this remedy, interior-point methods are quite successful at solving many MPECs in practice. In this talk, we will present a globally convergent interior-point method which uses a penalty approach and analyze its numerical performance on MPECs. Comparisons to non-penalty interior-point methods will be provided.

■ SD13

C-Room 26B, Upper Level

Social Network Analysis

Sponsor: Computing Society
Sponsored Session

Chair: Matthew Galati, Optimization Interface Lead, SAS Institute, Philadelphia Regional Office, Suite 201, 1400 Morris Drive, Chesterbrook, PA, 19087, United States of America, matthew.galati@sas.com

1 - ORA: A Network Analysis Tool
Terrill Frantz, Carnegie Mellon University, ISR/SCS 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, terrill@org-sim.com, Kathleen Carley

ORA is a socio-technical network analysis tool used for the analysis of organizations, according to the relationships among personnel, knowledge, resources, and tasks. These entities and relationships are reflected by over 100 network measures. ORA is a network visualizer and can generate formatted reports viewable on screen or stored in data files. ORA works with multiple data formats to allow interoperability with other network and statistical analysis packages.

2 - Algorithms for Maximum K-plexes in Power-law Graphs
Balabhaskar Balasundaram, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, baski.balasundaram@okstate.edu, Sergiy Butenko

A k-plex is a graph-theoretic clique relaxation introduced in social network analysis for finding cohesive subgroups. In this talk we discuss exact algorithms for finding a largest k-plex in arbitrary graphs. Power-law degree distribution is frequently observed in social and biological networks, and the problem is solved to optimality on such instances by a suitable combination of preprocessing and an exact algorithm.

3 - Influence of Social Networks on Physician Adoption of Technological Innovations
Rema Padman, Professor, Heinz College, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, rpadman@cmu.edu, Kai Zheng, Michael Johnson, David Krackhardt

We developed a survey to delineate three types of physician social networks in an ambulatory primary care practice: professional, friendship, and perceived influence on intention to use technology, to study how they relate to an individual physician's usage of an electronic health records system. The results show that social influence affecting technology adoption behavior by physicians is primarily conveyed through friendship interactions rather than professional relationships.

4 - Community Identification via Structured Concurrent Flow
Richard Goodrum, Lecturer, Department of Computer Science and Engineering, University of North Texas, P.O. Box 311366, Denton, TX, 76203-1366, United States of America, Richard.Goodrum@unt.edu, David Matula, Eli Olinick

We present a new divisive algorithm for community identification in social networks. The algorithm focuses on a hierarchy of flow levels and neither removes edges prematurely nor ignores previously absorbed capacity while dividing communities. We compare and contrast the community structures identified by our algorithm with previously proposed approaches across social network data from the literature.

5 - On the Topology of Large Clusters and Duality of Cuts and Paths
Patrick Plewes, Southern Methodist University, 1415 Kaitlyn Ln, Keller, TX, 76248, United States of America, pplewes@smu.edu

Good community structure analysis of social networks can be obtained by partitioning in a succession of sparsest cuts (Mann, et al). We focus on two aspects of this succession. The first is that of large clusters ,Ä' the topology of clusters as we progress through the first cuts in a hierarchy. The second aspect of focus is the duality of cuts and paths. The interplay of the flow paths and the cut hierarchy provide for interesting visualization of the clustering of vertices in social networks.

■ SD14

C-Room 27A, Upper Level

Software for OR/MS I

Sponsor: Computing Society
Sponsored Session

Chair: Robert Fourer, Professor, Northwestern University, Department of Industrial Eng & Mgmt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@iems.northwestern.edu

1 - New Features in Xpress-Mosel
Alkis Vazacopoulos, Vice President, FICO, 202 Parkway, Harrington Park, NJ, 07640, United States of America, alkisvazacopoulos@fico.com

Xpress-Mosel allows you to formulate your optimization problem, solve it with a suitable solver engine, and analyze the solution, using a fully-functional programming language specifically designed for the purpose. In this talk we will present new very innovative features Of Xpress-Mosel that allows the user to solve a wide range of complicated optimization problems.

2 - Extending NIDR for GUI Preparation of Program Input
David M. Gay, Sandia National Labs, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, dmgay@sandia.gov

DAKOTA is a program for uncertainty quantification and optimization of separately specified problems. To simplify maintenance, we developed a facility, NIDR, for processing DAKOTA input in a way independent of DAKOTA and meant to be useful in other contexts. A graphical interface, JAGUAR, is being developed for DAKOTA. To help this effort, we have extended NIDR to convey extra details and documentation pointers to JAGUAR. This talk briefly describes DAKOTA, NIDR, and extensions for JAGUAR.

3 - Using IBM ILOG OPL as a Development/Debugging Tool in Creating CPLEX and/or CP Models
Carol Tretkoff, Technical Account Manager, IBM, 9662 Masterworks Drive, Vienna, VA, 22181, United States of America, tretkoff@us.ibm.com

IBM ILOG Optimization Decision Manager (ODM) is available as an add-on to OPL Development Studio; it can be used effectively to speed up the process of creating and debugging optimization models using CPLEX and/or CP Optimizer. We will provide several examples of how prototype generation, data visualization, and scenario editing can be useful during the model development process.

■ SD15

C-Room 27B, Upper Level

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Microsoft Solver Foundation
John Oberon, Director of Program Management, Microsoft, One Microsoft Way, 4.2194, Redmond, WA, 98052, United States of America, joberon@microsoft.com, Nathan Brixius, Min Wei

Solver Foundation is a pure, managed code runtime for mathematical programming, modeling, and optimization. This session will focus on our computational integer programming effort. Our MIP solution is a branch and cut solver based on Dual Simplex, and is designed to enable 64bit and multi-core computation environments. We will go into some level of detail around advanced presolve, Gomory mixed integer cuts, mixed integer rounding cuts, and local search heuristics.

2 - Palisade Corp. - Decision Tools Suite Software Introduction
Stephan Beeusaert, Palisade Corp., 798 Cascadilla Street, Ithaca, NY, 14850, United States of America, sbeeusaert@palisade.com

Palisade's DecisionTools Suite includes 7 software packages that can be used by a wide variety of departments and individuals within any organization, to better assess risk and make well-informed decisions. This comprehensive example demonstrates how all the components of the Suite can be used together to assess the likelihood of success of a new product launch, determine critical variables to limit risk exposure, optimize the inclusion of the new product into existing manufacturing facilities, and plan for the expansion of both production and distribution networks.

■ SD16

C-Room 28A, Upper Level

Social Networking

Sponsor: Information Systems
Sponsored Session

Chair: Vallabh Sambamurthy, Michigan State University, N231 BCC, East Lansing, MI, 48824, United States of America, sambamurthy@bus.msu.edu

1 - Social Networks and the Diffusion of User-Generated Content: Evidence From YouTube
Anjana Susarla, Assistant Professor, University of Washington, 336 Mackenzie, Box 353200, Seattle, WA, 98195, United States of America, asusarla@u.washington.edu, Jeong-ha Oh, Yong Tan

Using a unique data set of video information and user information collected from YouTube, we analyze content diffusion in online social networks. Econometrically, the problem in identifying social influence is that individuals' choices depend in great part on the choices of other individuals, referred to as the 'reflection problem'. Another problem in identification is to distinguish between social contagion and user heterogeneity in the diffusion process.

2 - The Debate on Net Neutrality: A Policy Perspective
Hsing Cheng, University of Florida, hkcheng@ufl.edu, Subhajyoti Bandyopadhyay, Hong Guo

The principle of net neutrality is under fierce debate. We find that if the principle of net neutrality is abolished, the broadband service provider stands to gain from the arrangement. Content providers are left worse off. Under net neutrality, the broadband service provider always invests in broadband infrastructure at the socially optimal level, but either under- or over-invests in infrastructure capacity in the absence of net neutrality.

3 - Blog, Blogger, and the Firm: Can Negative Posts by Employees Benefit Firms?
Rohit Aggarwal, Assistant Professor, University of Utah, David Eccles School of Business, University of Utah, Salt Lake City, UT, 84113, United States of America, rohit.aggarwal@business.utah.edu, Ram Gopal, Ramesh Sankaranarayanan

The business world is beginning to realize that employee blogs can cast a firm in either a positive or a negative light. Paradoxically, under certain conditions negative postings by employees can actually help the overall reputation of the firm. The explanation for this is that readers perceive an employee blogger to be honest and helpful when they read negative posts on the blog, and recommend the blog more to their friends, who will then also be exposed to the positive posts on the blog.

■ SD17

C-Room 28B, Upper Level

Internet Based Information Intermediaries

Sponsor: Information Systems
Sponsored Session

Chair: Animesh Animesh, McGill University, 1001 Sherbrooke St. W., Montreal, QC, H3A 1G5, Canada, animesh.animesh@mcgill.ca

Co-Chair: Jason Kuruzovich, Assistant Professor of Management Information Systems, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180-3590, United States of America, kuruzj@rpi.edu

1 - Identifying and Overcoming Self-Selection Biases in Online Product Reviews
Paul Pavlou, Associate Professor of Information Systems, Marketing, and Management, Temple University, 1810 N. 13th St., Philadelphia, PA, United States of America, pavlou@temple.edu, Nan Hu, Jennifer Zheng

Online product reviews help consumers infer product quality, and the mean rating is often used as a proxy for quality. However, we identify two self-selection biases that may render the mean rating a biased estimator that cannot be used to either infer a product's own quality in absolute terms or to compare relative quality across products.

2 - Recommender Systems and their Effects on Consumers: The Fragmentation Debate
Kartik Hosanagar, Professor, The Wharton School, United States of America, kartikh@wharton.upenn.edu

Recommender systems help consumers find products that best match their interests. This ability to focus on one's interests has spawned criticism that recommenders will fragment consumers, i.e. cause consumers to have less in common with one another. We present an empirical study and find that users become more similar to one another in terms of their purchases. Consumers have more in common both because they change what they buy and also because they simply purchase more.

3 - Retailer Resources and the Use of Infomediaries
Jason Kuruzovich, Assistant Professor of Management Information Systems, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180-3590, United States of America, kuruzj@rpi.edu

Information about prospective customers is an important input into the personal selling and direct marketing processes. Specialized online sites know as referral infomediaries provide organizations with the opportunity to purchase prospect information directly. In this research, we examine the role of firms'resources in driving both the investment in prospective customer information (i.e., referrals) and the sales resulting from these investments.

4 - A Model of Intelligent Recommenders: The Role of Sponsored Result
Jane Feng, Assistant Professor, University of Florida, 360 Stuzin Hall, Gainesville, FL, 32611, United States of America, jane.feng@cba.ufl.edu, Hemant Bhargava

We develop an economic model of sponsored search on intelligent recommenders, in a setting where consumers cannot a priori discern low and high quality merchants. We find that an intelligent recommender not only makes consumers better-informed, but also causes merchants to modify their price-advertising strategies that affects consumer welfare.

■ SD18

C-Room 28C, Upper Level

Recent Developments in Vehicle Routing

Sponsor: Computing Society
Sponsored Session

Chair: Ed Wasil, American University, 4400 Massachusetts Ave, NW, Washington, DC, 20016, United States of America, ewasil@american.edu

Co-Chair: Bruce Golden, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, bgolden@rhsmith.umd.edu

1 - Vehicle Routing with Compartments
Ulrich Derigs, Universiy of Cologne, Department of IS and OR, Cologne, Germany, derigs@informatik.uni-koeln.de, Michael Piesche, Ulrich Vogel

We present a suite of heuristic components for solving the vehicle routing problem with compartments. The suite covers a broad range of alternative approaches for construction, local search, large neighborhood search and meta-heuristics. We identify the best algorithmic setup as well as essential components for achieving high solution quality. A comparison on instances taken from the literature reveals that our approach is able to produce better solutions on most instances.

2 - Routing Models for Humanitarian Logistics
Kiran Panchamgam, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, kpanch@gmail.com, Bruce Golden, Ed Wasil

We seek to design efficient delivery routes for humanitarian relief operations. In particular, mathematical programming models are developed to determine routes for the delivery of emergency supplies to numerous locations based upon demand and urgency. The routes are evaluated with respect to performance metrics relevant to humanitarian logistics.

3 - Incorporating Operational Complexity in the Period Vehicle Routing Problem
Karen Smilowitz, Associate Professor, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, ksmilowitz@northwestern.edu, Tingting Jiang, Maciek Nowak

We explore the addition of operational complexity to the Period Vehicle Routing Problem (PVRP). The PVRP extends the vehicle routing problem by serving customers according to set visit frequencies over a time period. When routes operate over multiple days, issues of operational complexity arise. Operational complexity captures the difficulty of implementing a solution for service providers and customers. We add complexity to the PVRP and evaluate the impact of complexity on solutions.

4 - An Integer Programming-based Heuristic for Solving the Period Vehicle Routing Problem
Damon Gulczynski, University of Maryland, Department of Mathematics, College Park, MD, 20742, United States of America, damon@math.umd.edu, Bruce Golden, Ed Wasil

We describe a heuristic that uses an integer program to solve the period vehicle routing problem (PVRP). Our heuristic produces solutions that are competitive with the best results reported in the literature. We consider a variant of the PVRP that includes a constraint motivated by routing practice and adapt our heuristic to solve this new variant.

■ SD19

C-Room 28D, Upper Level

Advances in Network Equilibrium Models II

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Marco Nie, Assistant Professor, Northwestern University, Evanston, United States of America, y-nie@northwestern.edu

1 - Domain Distributed Dynamic Traffic Assignment Model for Mega-Scale Problems
Yi-Chang Chiu, Assistant Professor, University of Arizona, 1209 E. Second Street, P.O. Box 210072, Tucson, AZ, 85721-0072, United States of America, chiu@email.arizona.edu, Jorge Villalobos, Pitu Mirchandani

Scalable, multi-computational capabilities are required to model mega-scale traffic networks. A computationally effective network partitioning method as well as a Recurring On-line Load Balance algorithm (ROLB) have been developed. This talk presents the model algorithmic structure and computational results.

2 - Equilibrium Analysis of Macroscopic Traffic Oscillations
Marco Nie, Assistant Professor, Northwestern University, Evanston, United States of America, y-nie@northwestern.edu

This paper studies under what conditions traffic oscillations may be initiated and propagated in a traffic stream. We show that periodic traffic oscillations do not arise from Wardrop equilibria or Boston equilibria. However, periodic oscillations are likely to emerge when 1) transitions between stable and unstable equilibria take place, and more importantly, 2) drivers make decisions based on out-of-date information of traffic conditions.

■ SD20

C-Room 28E, Upper Level

Delivering Humanitarian Aid

Sponsor: Transportation Science and Logistics
Sponsored Session

Chair: Monica Villarreal, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, monica.v@gatech.edu

1 - Transportation Mode Decision Making in Humanitarian Supply Chains
Lesley Strawderman, Assistant Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, strawderman@ise.msstate.edu, Russ Williams, Han Zhang, Burak Eksioglu

The purpose of this study is to describe the use of intermodal transportation in disaster relief operations, including the amount of intermodal operations, factors impacting mode selection, and frequency of use for different modes. An online survey quantifying transportation modes decision making factors and modes utilization frequencies was completed by 145 disaster relief personnel. Detailed results will be presented, along with directions for implementation and future work.

2 - Equity Considerations in Relief Routing
Michael Huang, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, Michael-Huang@u.northwestern.edu, Burcu Balcik, Karen Smilowitz

We study the effects of routing decisions on equitable service provision in disaster relief. We explore the implications of different objectives on the performance (efficiency, effectiveness and equity) of aid distribution. We develop a formulation and a solution approach and compare the solutions obtained with the different objectives. We present computational analysis with a set of problem instances that capture a variety of network structures.

3 - Debris Clearance During Disaster Response Operations
Jose Antonio Carbajal, Georgia Institute of Technology, School of Industrial and Systems Engineering, 765 Ferst Drive, NW, Atlanta, GA, 30318, United States of America, acarbajal@gatech.edu, Pinar Keskinocak, Monica Villarreal, Ozlem Ergun

Debris is the waste resulting from a disaster and, according to FEMA, debris removal operations account for approximately 27% of the disaster recovery costs. We have identified the main activities to perform during each stage of a debris management plan and developed an MIP formulation for the debris collection problem right after a disaster strikes. We investigate the performance of several solution methodologies and present computational results on a series of test instances.

■ SD21

C-Room 30B, Upper Level

Traffic Simulation and Modeling

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Sharif Melouk, The University of Alabama, smelouk@cba.ua.edu

1 - A Day-to-day Traffic Dynamic Model in Discrete/Continuum Transportation Networks
Xiaolei Guo, University of Minnesota, guoxl@umn.edu, Henry Liu

A discrete/continuum transportation network consists of a discrete link-node freeway network and a two-dimensional continuum of dense surface streets, with the freeway network superimposed on the continuum and connected with it at a limited number of points (freeway ramps). We propose a day-to-day traffic dynamic model suitable for this discrete/continuum representation of urban transportation networks, and provide numerical examples to demonstrate the effectiveness of our model.

2 - Stability Analysis of Traffic Trajectory Data
Seyed Mohammad Nourbakhsh, PhD Student, UIUC, B156, 205 N. Mathews Avenue, Civil & Environmental Engineering, Urbana, IL, 61801, United States of America, nourbak1@illinois.edu, Yanfeng Ouyang, Xiaopeng Li

The stability analysis of car-following models is seldom verified with empirical data. This study proposes stability measures for traffic trajectory data, and analyzes stability characteristics of field data. The analysis results are used to calibrate microscopic behaviors of car-following models.

3 - Using Simulation Optimization to Mitigate Traffic Congestion
Sharif Melouk, The University of Alabama, Culverhouse College of Commerce,smelouk@cba.ua.edu, Christopher Armbrester, Burcu Keskin

Traffic congestion has grown considerably in the United States over the past 20 years. In this research, we develop a robust decision support tool based on simulation optimization to evaluate and recommend congestion mitigation strategies to transportation system decision-makers. A tabu search-based optimizer determines different network design strategies on the road network while a traffic simulator evaluates the goodness of fit. The tool is tested with real-world traffic data.

■ SD22

C-Room 30C, Upper Level

Transportation Surveillance and Traveler Information

Sponsor: Transportation Science and Logistics: Urban Transportation
Sponsored Session

Chair: Xiaopeng Li, University of Illinois at Urbana-Champaign, 205 North Mathews Ave, B156, Urbana, IL, 61801-2352, United States of America, li28@uiuc.edu

1 - Traffic Forecast in a Stochastic Networks with Incident Risks
Yupo Chan, Professor, University of Arkansas at Little Rock, Department of Systems Engineering, Little Rock, AR, 72204, yxchan@ualr.edu, Adeyemi Fowe

To support Advanced Traveler Information System, we forecast traffic based on real-time data acquisition and interpolation. Specifically, we present a new mathematical model to estimate network traffic over time based on limited sensor readings. Of specific interest is the exploitation of spatial properties inherent in a network, and the use of such short-term traffic forecast to estimate time-dependent incident probabilities.

2 - Urban Tomography for Security in Transportation Environments: Smartphones as Embedded Networked Vide
Moo-Ryong Ra, mra@usc.edu, Martin Krieger, Ramesh Govindan, Jeongyeup Paek

Law-enforcement personnel are now using multiple video-smartphones for security and intelligence at a major transportation site in the Los Angeles region. We will report on the system and how it is used in practice. The smartphones' connectivity allow for automatic uploading of time/GPS-tagged videos, so creating multi-aspectival records of events in urban places. Challenges include energy/battery constraints and interface design to make the video corpus readily usable.

3 - How Does Inter-and Intra-Personal Variation of Value of Time Influence the Evaluation of Transportation
Lin Qiu, Planning Analyst, Wilbur Smith Associates, Fairfax, VA, lin.w.qiu@gmail.com, Lei Zhang

Value of time (VOT) varies across individuals. The distributions of inter- and intra-personal VOT are likely to be asymmetric and skewed. This paper quantifies the degree to which the use of a single average VOT for all individuals at all times bias the efficiency and equity analysis of transportation projects and policies, especially those sensitive to VOT (e.g. congestion pricing, managed lanes, and modal improvements).

4 - Reliable Sensor Location for Network Traffic Surveillance
Xiaopeng Li, University of Illinois at Urbana-Champaign, 205 North Mathews Ave, B156, Urbana, IL, 61801-2352, United States of America, li28@uiuc.edu, Yanfeng Ouyang

This†study establishes a reliable sensor location design framework for traffic surveillance where sensors are subject to probabilistic failures. The objective is to maximize the total expected benefits from traffic flow inspection and O/D travel times estimation, under normal and failure scenarios. Numerical examples demonstrate the application of the proposed model and insights are drawn.

■ SD23

C-Room 30D, Upper Level

DIME/PMESII Modeling Issues

Sponsor: Military Applications Society
Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Understanding the Dynamic Information Landscape of Violent Ideologies and Religious Extremism over Time
Dipak Gupta, Professor, San Diego State University, 5500 Campanile Dr., San Diego, CA, 92182, United States of America, dgupta@mail.sdsu.edu, Ming-Hsiang Tsou

In this project, we propose an innovative method for identifying both the semantic and space-time dimensions of the spread of violent ideologies, specifically Islamic extremism.

2 - VV&A for Human, Social, Cultural Behavior (HSCB) Models
Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

VV&A is required for models within DoD. Many see it as a requirement to be checked-off or as an attempt to discredit their model. Given the large uncertainties in the basic social theories, there is fear of VV&A within the HSCB domain. However, the proper application of VV&A is the generation of knowledge of the model. Arguably, this knowledge is more important in an uncertain domain than in a well-understood domain. The application of VV&A to HSCB models, while difficult, is not impossible.

3 - Political Effectiveness, Provincial Perspective on Terrorism, Stability and Growth
Mark Abdollahian, Professor, Claremont Graduate University, 170 East 10th Street, Claremont, CA, 91711, United States of America, maa@sentiagroup.com, Jacek Kugler, Marina Arbetman-Rabinowitz, Kyungkook Kang

Political effectiveness of governments and oppositions constrains policy implementation. Works on political extraction, reach and allocations determine which political actions can succeed. The general equilibrium POFED 2008 approach anticipates stability, terrorist success, policy implementation by the government or opposition, and long term economic growth and demographic change. The forecasted policy actions disclose how to deter terrorists. Sudan and Pakistan cases are presented.

■ SD24

C-Room 30E, Upper Level

OR/MS for Enterprise Transformation II

Sponsor: Military Applications Society
Sponsored Session

Chair: B.J. Thornburg, President, Management Analysis Technologies, Inc, 5 Pritchard Court, Stafford, VA, 22554, United States of America, thornbj@mat-inc.net

Co-Chair: Greg Parlier, SAIC, 255 Avian Lane, Madison, AL, 35758, United States of America, greg.h.parlier@saic.com

1 - Strategic Measurement, Assessment and Reporting Tool SMART
William Wallace, Strategic Assessments Branch Chief, U.S. Africa Command, CMR 489 Box 1014, Stuttgart/Mohringen, APO, AE, 09751, Germany, william.wallace@africom.mil

US Africa Command must provide the Secretary of Defense an annual assessment of the Command's theater objectives and strategic effects. The Strategic Capabilities and Assessment Division mapped out a methodology to assess the Theater Campaign Plan, including numerous programs and activities

inherited from the other COCOMS. To conduct this assessment the Division is developing a process and SMART. This briefing describes the progress to date, and provides some example assessments.

2 - Effective and Efficient Simulation
Tom Donnelly, SAS Institute Inc., 27 Farmingdale Ln, Newark, DE, 19711-4392, United States of America, tom.donnelly@jmp.com

Design of Experiments (DOE) methods for efficiently extracting the most useful information from simulations will be demonstrated. A sequential design approach will show how to run the fewest simulations needed to do sensitivity analysis or to develop a fast-running surrogate model. Solutions will include the application of both traditional DOE to discrete event and agent-based simulations and space-filling designs to more complex physics-based simulations using Computational Fluids Dynamics.

3 - Legacy Systems Replacement Paradigm and ERP Systems
Tim Elkins, Department of Systems Engineering, United States Military Academy, Bldg 752, 422 Mahan Hall, West Point, NY, 10996, United States of America, timothy.elkins@usma.edu, Matt Dabkowski

Emphasis is being placed on improving the government's IT systems in order to better run the business of government. However, replacement seems to have been the paradigm. As a result, the larger set of functionalities of an ERP system have been sectioned out to align with legacy functions and in the process the goodness of an ERP system lost. We assesses the value provided by the implementation of multiple, fragmented ERP instances versus several alternatives, including a single instance.

4 - Enterprise Archtecture Influence on Endogenous Stakeholder-Value Creation Influence
Doug Matty, LTC, MIT / US Army, dmatty@mit.edu, Deborah Nightingale

The emerging field of engineering systems is being focused on the domain of extended enterprises. The interaction of the enterprise stakeholders and value creation are endogenous to the enterprise architecture. This paper presents preliminary findings of enterprise architecture attributes, their influence on stakeholder salience and value creation. These results are based on mixed methods research using both qualitative and quantitative methods.

■ SD25

C-Room 31A, Upper Level

Joint Session AAS/TSL: Scheduling and Sequencing in Air Transportation

Sponsor: Aviation Applications & Transportation Science and Logistics
Sponsored Session

Chair: John-Paul Clarke, Associate Professor, Georgia Institute of Technology, School of Aerospace Engineering, 270 Ferst Drive NW, Atlanta, GA, 30332, United States of America, johnpaul@gatech.edu

1 - Joint Optimization of Aircraft Arrival and Departure Schedules
Ahmed Ghoniem, aghoniem@som.umass.edu, Hojong Baik, Hanif D. Sherali, Antonio Trani

We examine the sequencing of arrivals and departures for runway operations in the Terminal Management Area. The problem is modeled as a variant of the TSP with time-windows. Preprocessing strategies and an application of the Reformulation-Linearization Technique are investigated in order to derive a tighter representation. Computational results are presented.

2 - A Fuel Optimal and Reduced Controller Workload Optimization Model for Conflict Resolution
Adan Vela, Georgia Institute of Technology, 279 Ferst Drive, Atlanta, GA, United States of America, aevela@gatech.edu, Senay Solak

In this study, we consider the air traffic conflict resolution problem in regards to controller workload. An optimization model for determining the maneuvers that minimize fuel costs for a fixed number of aircraft commands, is compared to the L-1 norm approximation of the problem. The L-1 approximation, is similar to the previous formulation, however the number of aircraft commands is a free variable, and appended to the cost is the weighted L-1 norm of all aircraft maneuvers.

3 - Optimization of Airport Taxiway Operations
Hanbong Lee, Graduate Student, Massachusetts Institure of Technology, 77 Massachusetts Avenue, 35-217, Cambridge, MA, 02139, United States of America, hanbong@MIT.EDU, Hamsa Balakrishnan

This talk describes an approach for optimizing taxiway operations to minimize aircraft taxi times and emissions at congested airports. The integer programming-based approach is illustrated using a study at Detroit airport. Operations are optimized by utilizing different control points on the airport surface, including gates and various intersections on the taxiway system. Results from a simulation-based effort to assess the benefits of such surface optimization techniques are also presented.

4 - Rapidly Generated Complexity Maps: Principles and Applications
Erwan Salaun, Georgia Institute of Technology, 270 Ferst Drive, Atlanta, United States of America, erwan.salaun@gatech.edu, Adan Vela

We present a methodology for rapidly generating complexity maps for various configurations to determine a measure of airspace capacity. The complexity map is based on analytical expressions, validated through simulations, of aircraft maneuver distributions between two flows at an intersection under automated conflict resolution. By synthesizing the results to the sector level, complexity is expressed as a function of the overlapping areas of these distributions for multiple intersecting flows.

■ SD26

C-Room 31B, Upper Level

Panel Discussion: Aviation Applications Section Industry Panel

Sponsor: Aviation Applications
Sponsored Session

Chair: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

1 - Aviation Applications Section Industry Panel
Moderator: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

Major tarmac delays (on the order of several hours), although statistically rare, nonetheless do occur, with tremendous impact on the affected passengers. More commonly, shorter but still inconvenient delays occur on a regular basis as a result of airport and airspace congestion. Issues such as the Passenger Bill of Rights and slot controls in the NY area are currently being debated, both in Washington and in the press, with high emotion and anecdotal evidence capturing most of the attention. The operations research community has a tremendous opportunity to play a role in these debates, bringing analysis and reason to such charged discussions. We present a panel-led discussion of the causes, impacts, and opportunities for improving these key challenges.

■ SD27

C-Room 31C, Upper Level

Simulation and Performance Analysis of Call Center Processes

Sponsor: INFORMS Simulation
Sponsored Session

Chair: Vijay Mehrotra, Associate Professor, University of San Francisco, School of Business and Management, 2130 Fulton St., San Francisco, CA, 94117-1080, United States of America, drvijay@sbcglobal.net

1 - Hiring and Retention of Heterogeneous Workers
Alessandro Arlotto, OPIM Dept - Wharton - Penn, 3730 Walnut Street, Suite 500, Philadelphia, PA, 19104, United States of America, alear@wharton.upenn.edu, Stephen Chick, Noah Gans

Motivated by preliminary results on call-center data, we study how learning a ects worker heterogeneity and, as a consequence, how this influences hiring and retention decisions. We propose a screening method that uses an infinite-armed-bandit model in which each arm (i.e. each potential hiree) has a random lifetime, and we study its properties.

2 - An Optimization-simulation Approach for Assigning Work to Agents
Geoff Ryder, Ph.D. Candidate, UC-Santa Cruz, 4190 Sophia Way, San Jose, CA, 95134, United States of America, gryder@gmail.com, Kevin Ross

We describe a two-step, optimization and simulation approach to assigning work to call center agents who learn by doing. A nonlinear program with nonlinear constraints generates routing targets for agents to maximize a utility function of the total skill level at the center. We then describe the results from using the solver's outputs as targets in Monte Carlo simulations of routing rules. The model parameters used by the solver and the simulator are taken from empirical data.

3 - Empirical Analysis of Skill Based Routing in Call Centers: A Queueing-Science Perspective

Itai Gurvich, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu, Pablo Liberman, Avishai Mandelbaum

In this study we take an empirical view of the call center as a network of queues. We analyze transactional data from three different call centers and perform a detailed analysis of this data. Our objectives are two-fold: (a) validate or refute some of the prevalent assumptions that are made in the literature on Skills-Based Routing (SBR) and (b) identify phenomena that have not been considered in that literature but that seem central to the operations of the call center.

4 - Real-Time Delay Announcements in Call Centers

Rouba Ibrahim, Columbia University, 500 West 120th Street 313 Mudd, New York, NY, 10027, United States of America, rei2101@columbia.edu, Ward Whitt

We develop new improved real-time delay estimators in many-server service systems with time-varying arrivals and customer abandonment. These delay estimators may be used to make delay announcements. Our estimators effectively cope with time-varying arrivals together with non-exponential service-time and abandonment-time distributions, which are often observed in practice. We use computer simulation to verify that our proposed estimators outperform several natural alternatives.

■ SD28

H-Room 500, Fifth Floor

Strategic Consumer Behavior in Revenue Management

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Costis Maglaras, Professor, Columbia Business School, New York, United States of America, c.maglaras@columbia.edu

1 - Revenue Maximization in a Market Where Buyers Post Their Price

Nur Ayvaz, Columbia University, IE & OR department Rm. 313 Mudd Building, 500 W 120th street, New York, NY, 10027, United States of America, na2191@columbia.edu, Soulaymane Kachani, Costis Maglaras

We study a revenue management problem for a monopolist that operates in a setting where the buyers strategically post their prices (BPP) that the seller has to accept or reject. The goal is to maximize the seller's revenues in a variety of informational settings. Our motivating application is the real-estate developer's revenue maximization problem for multi-unit residential projects. The model, results and insights are applicable in many other settings.

2 - Distributed Learning in Revenue Management

Omar Besbes, Columbia University, Graduate School of Business, 3022 Broadway, Uris Hall, New York, 10027, United States of America, ob2105@columbia.edu, Johannes Horner, Gad Allon

We consider a revenue maximizing retailer with multiple points of sale (POS) facing an uncertain demand environment. We investigate the impact of information pooling across POSs on the depth of learning of an optimal policy as well as how learning is distributed as a function of the remaining inventories.

3 - Consumer Stockpiling and Dynamic Pricing

Xuanming Su, University of California, Berkeley, Haas School of Business, Berkeley, CA, 94720, United States of America, xuanming@haas.berkeley.edu

For products with stable consumption patterns (e.g., household goods), strategic consumers can stock up for future consumption. We study the firm's dynamic pricing problem and characterize the optimal pricing strategies. We identify conditions under which it is optimal for firms to use periodic price promotions to price discriminate between different consumers.

■ SD29

H-Room 501, Fifth Floor

Energy, Environment and Regulation

Sponsor: Energy, Natural Res & the Environment/Energy
Sponsored Session

Chair: Yihsu Chen, University of California, Merced, 5200 N. Lake Rd, Merced, CA, 95343, United States of America, yihsu.chen@ucmerced.edu

1 - Oligopolistic Electricity Market Simulation with Massive Wind-based Generation Penetration

Julian Barquin, Comillas University, Aberto Aguilera 23, Madrid, 28015, Spain, julian.barquin@iit.upcomillas.es, Efraim Centeno, Alvaro Lopez-Pena, Miguel Vazquez

The stupendous growth of wind-based electricity generation and its intermittent character is causing that the remaining generation technologies operate very differently than in the past. This fact requires the development of new simulation models, and in particular of those that intend to represent the strategic interaction between the agents. We introduce a model that aims to fulfill this task based on a conjectural price response representation of the agents' behavior.

2 - Analysis of Market Penetration of Renewables in an Uncertain and Carbon Constrained World

Ozge Kaplan, Research Fellow, US Environmental Protection Agency, 109 TW Alexander Dr., Mail Drop: E305-02, Research Triangle Park, NC, 27711, United States of America, Kaplan.Ozge@epamail.epa.gov

This study investigates how U.S. energy system might evolve over time under the effects of the uncertainty in the climate-change policy decisions, fossil fuel supply and prices, and availability and cost of renewable energy technologies. Two-staged stochastic decision making methods in U.S. EPA's MARKAL modeling system will be utilized to generate various scenarios under uncertain and carbon constrained world.

3 - Investment Decision under Tradable Permits and Carbon Tax Policies

Chung-li Tseng, University of New South Wales, Australian School of Business, Sydney, Australia, c.tseng@unsw.edu.au

Two market-based instruments are commonly considered by policy makers to control CO2 emissions: tradable permits and tax. Whereas the level of tax is fixed and decided by authorities, tradable permits price is uncertain and driven by the market dynamics. Both policies are market-based, but offer firms different long-run investment incentives. This talk presents preliminary results of optimal investment decisions when a firm faces these two distant but related instruments using real options.

4 - Metamodeling of Integrated Planning Model Runs for Prediction and Tradeoff Analysis

Jeremy Hargreaves, The Johns Hopkins University, 3400 N Charles St, Ames Hall, Rm 313, Baltimore, MD, 21218, United States of America, jhargreaves@jhu.edu, Elliot Lieberman, Benjamin Hobbs

Methods are developed to interpolate, within constrained input variable ranges, outputs of the Integrated Planning Model (IPM) - a large scale LP model of the US power industry used by the EPA. Statistical modeling techniques are adapted to fit the data from previous model runs using prior knowledge of model structure. Using an LP approach, bounds on output values are obtained when outputs are convex functions of input variables.

5 - Modeling Biofuel Input Costs in the National Energy Modeling System (NEMS)

Michael Cole, Operations Research Analyst, Energy Information Administration, 1000 Independence Ave., SW, Washington, DC, 20585, United States of America, Michael.Cole@eia.doe.gov

Biofuels such as ethanol and biodiesel will play an important role in the U.S. energy economy as we strive to increase use of renewable fuels, reduce imported oil, and reduce emission of greenhouse gases. This presentation will discuss how biofuel input costs, such as feedstock costs, are modeled in NEMS. The Energy Information Administration, part of the U.S. Dept of Energy, uses NEMS to construct the widely-referenced Annual Energy Outlook and to answer requests for analysis from Congress.

■ SD30

H-Room 502, Fifth Floor

Forestry II: Reserve Site Selection

Sponsor: Energy, Natural Res & the Environment/ Forestry
Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Ave, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Habitat Reserve Selection for Territorial Disperser Species
Bala Krishnamoorthy, Washington State University, Pullman, WA, United States of America, kbala@wsu.edu, Natalie Baerlocher, David Allen

We study the problem of selecting habitat reserve areas to support territorial disperser species, such as the Northern Spotted Owl. We develop a population predictive index (PPI) function to estimate the occupancies of the species in patches of a habitat landscape. The decisions of which patch is to be sustained and which cleared from among candidate ones is modeled as a non-linear integer program (IP) that maximizes the overall PPI. We solve piecewise-linear versions of this IP.

2 - Modeling Useful Habitat with the Anti-covering Location Problem
Richard Church, Professor, Department of Geography, University of California Santa Barbara, Santa Barbara, United States of America, church@geog.ucsb.edu, Matt Niblett

In this paper we show how the anti-covering location problem can be used to model the amount of useful habitat of a territorial species. This model is applied to a region of the Sierra Nevada Mountains to estimate the habitat of the California Spotted Owl. Technical issues of how the model is solved for a very large data set are covered and both heuristic and optimal approaches are explored.

3 - Dynamic Reserve Selection: Modeling the Land Price Feedback Effect in Strategic Land Retentions
Sandor Toth, College of Forest Resources, University of Washington, Seattle, WA, United States of America, toths@u.washington.edu, Luke Rogers, Robert Haight

Urban growth compromises open space and ecosystem functions. Reserve selection models to aid open space protection assume that acquisitions have no impact on land prices outside the reserves. Our proposed optimization model relaxes this assumption and accounts for land price feedback effects that might arise in markets where conservation acquisitions compete with development. The mechanics of the approach will be illustrated in real land retention contexts in Washington State, USA.

4 - Endogenous Price Effects in Dynamic Conservation Reserve Site Selection: A MIP Approach
Hayri Onal, University of Illinois, Urbana-Champaign, IL, United States of America, h-onal@illinois.edu, Sahan Dissanayake

Land values around conservation reserves increase particularly because of the demand for urban development. We present a 2-period MIP model for reserve site selection incorporating spatial and ecological criteria along with endogenous price feedback effects inherent in the problem. We compare the empirical results with the results of an iterative static model.

■ SD31

H-Room 503, Fifth Floor

The Revenue Management-Marketing Interface

Sponsor: Revenue Management and Pricing
Sponsored Session

Chair: Wei Ke, Columbia University, 226 W 97th St, Apt 5D, New York, NY, 10025, United States of America, wke10@gsb.columbia.edu

1 - Case Study in Causal Demand Forecasting with Discrete Choice Models
Wei Ke, Columbia University, 226 W 97th St, Apt 5D, New York, NY, 10025, United States of America, wke10@gsb.columbia.edu, Garrett van Ryzin

This project was conducted in conjunction with a local self-storage company. The objective was to design and implement a causal model that would forecast unit-level demand for a pilot facility. We found this a good opportunity to test the real-world effectiveness of demand forecasting with consumer choice models.

2 - Scope Insensitivity Across Time Perspectives: Affect as a Decision Making System of the Present
Hannah Chang, Assistant Professor of Marketing, Singapore Management University, 50 Stamford Rd. #05-01, Singapore, Singapore, hannahchang@smu.edu.sg, Michel Tuan Pham

We propose that the affective system is more likely to be engaged in decisions that are set in the present than in decisions that are set at distant times (past or future). As a consequence, people are more likely to exhibit a feature of this system in decisions—the scope insensitivity bias—for valuation decisions set in the present. Findings from four experiments are consistent with this proposition and show that this bias occurs in the present only when affective information is available.

3 - Competitive Pricing with Reference Effects
Srinivas Krishnamoorthy, Assistant Professor, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond St. N., London, ON, N6A 3K7, Canada, skrishnamoorthy@ivey.ca

We examine the effect of reference prices on the pricing strategies of two competing firms. We show that, in a two period game, the effect of reference prices motivates firms to price higher at equilibrium then they would if there was no reference pricing effect. The analogy drawn within the paper is to the MP3-Player market, wherein incumbents have large reference price advantages over effectively equivalent new entrants.

■ SD32

H-Room 504, Fifth Level

Modeling Financial Markets in a Dynamic World

Cluster: Financial Engineering
Invited Session

Chair: John Mulvey, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08540, United States of America, mulvey@princeton.edu

1 - Dynamic Asset Allocation for Hedging Downside Risk
Gerd Infanger, Research Professor, Stanford University, Department of Management Science and Eng, Palo Alto, CA, United States of America, infanger@stanford.edu

Conservative investors often wish to participate in the potentially higher returns of equities while trying to prevent capital loss. We show how dynamic asset allocation may balance long and short-term expected return-risk profiles. The approach is based on an application of approximate DP techniques. Numerical results detailing optimal global dynamic asset allocation strategies and evaluating the costs of hedging downside risk are presented.

2 - Investing in Turbulent Times: Applying Dynamic Portfolio Theory
John Mulvey, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08540, United States of America, mulvey@princeton.edu

The nature of markets during turbulent periods is dramatically different than normal economic periods. We show that the U.S. equity returns can be modeled as a three regime Markov process — normal, bubble, and crash. Empirical results show the benefits of the three regime model from the standpoint of performance.

3 - What is the Shape of the Risk-Reward Relation?
Allan Timmermann, Professor, University of California, San Diego, San Diego, CA, United States of America, atimmermann@ucsd.edu

Using a flexible approach that avoids restrictive parametric assumptions, we find evidence of a non-monotonic relation between risk and expected returns: At low-to-medium levels of conditional volatility there is a positive trade-off between risk and expected returns, but this relationship gets inverted at high levels of conditional volatility. Our findings helps resolve why some empirical studies find a negative risk-return relation, while others find a positive trade-off.

4 - Capital Growth with Security with Convex Loss Penalties
William Ziemba, Professor, University of British Columbia, Canada, ziemba@interchange.ubc.ca

The Kelly capital growth criterion has many desirable properties especially in the long run. A related model is the dynamic fractional Kelly strategy that blends cash with the log-optimal so that the wealth path is above a specified growth path with high probability and violations below that path are convex penalties of shortfall. This model provides advantages, as describe in several practical examples.

■ SD33

H-Room 505, Fifth Floor

Strategic Interactions in Supply Chains with Uncertainty

Cluster: Economic Models in Operations Management
Invited Session

Chair: Yunzeng Wang, Dr., University of California Riverside, 900 University Avenue, Riverside, CA, United States of America, yunzeng.wang@ucr.edu

Co-Chair: Xiang Fang, University of Wisconsin-Milwaukee, Sheldon B. Lubar School of Business, P.O. Box 742, 3202 N. Maryland Ave, Milwaukee, WI, 53201-0742, fangx@uwm.edu

1 - Requirement or Promise? Quality-based Supplier Selection Strategies

Xinghao Yan, Assistant Professor, The University of Western Ontario, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, xyan@ivey.uwo.ca, Kwei Tang, Hui Zhao

We explore two different supplier selection strategies: quality requirement (QR) and quality promise (QR) in which the buyer and competing suppliers are the first mover, respectively. We analyze how QR and QP affect the players' quality improvement efforts, supply chain cost, and social welfare. We find first-mover right does not always benefit the buyer. Further, both QR and QP fully exploit the first-mover's cost effectiveness, but restrict the second-mover in different ways.

2 - Infinite Horizon Strategies for Replenishment Systems with a General Pool of Suppliers

Nan Yang, Assistant Professor, Cornell University, ny38@cornell.edu, Awi Federgruen

We characterize the structure of optimal infinite horizon strategies in replenishment systems, with an arbitrary pool of suppliers with distinct prices and yield characteristics, under the discounted cost criterion and the average cost criterion. We design exact solution methods as well as simple but accurate heuristics.

3 - Store Brand and Supply Chain Power Structure

Jun Ru, PhD Candidate, The University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, jun.ru@utdallas.edu, Jun Zhang

We examine the impacts of store brand products on supply chain members' performance under different supply chain power structures. Contrary to the well accepted notion that store brand hurts the national brand manufacturer, we find that the manufacturer can benefit from the introduction of a store brand product by the retailer. Moreover, retailer's power in the supply chain plays a significant role on the store brand quality.

4 - Modeling Production and Pricing Decisions of Durable Goods Manufacturer

Vera Tilson, Simon School of Businees, University of Rochester, Rochester, NY, 14627, United States of America, vera.tilson@Simon.Rochester.edu, Xiaobo Zheng

The effects of production lead time and uncertainty in demand for the product has not received much attention in modeling the decisions faced by a manufacturer of durable goods. We create a model to investigate production and pricing decisions for a durable goods manufacturer who is producing a product of finite durability in the presence of second-hand market, significant production lead times, and uncertainty in demand.

■ SD34

H-Room 520, Fifth Floor

Miscellaneous Topics in Green Supply Chains

Cluster: Green Supply Chain
Invited Session

Chair: Eylem Koca, R.H. Smith School of Business, University of Maryland, CP, VMH 3330, College Park, MD, 20742, United States of America, ekoca@rhsmith.umd.edu

1 - Retailing Customized Products: Pricing, Inventory and Refund Policies

Alex Grasas, Assistant Professor, Universitat Pompeu Fabra, Ramon Trias Fargas, 25-27, Barcelona, 08005, Spain, alex.grasas@upf.edu, Elif Akcali, Aydin Alptekinoglu

We study optimal pricing, inventory, and refund policies of a customizing firm. We find that partial refunds are generally optimal. In a single-period setting, partial refunds allow the firm to charge a higher price than the price with no returns allowed. In a multiple-period setting, the firm passes some of the expected savings from being able to carry inventory from one period to another onto the customers, surprisingly, not in the form of higher refunds but of lower prices.

2 - Clean and Green: Balancing Economic and Environmental Interests in Equipment Maintenance Decisions

Thomas Sloan, University of Massachusetts Lowell, 1 University Ave, Department of Operations and Info. Sys., Lowell, MA, 01854, United States of America, Thomas_Sloan@uml.edu, Joseph Sarkis

The condition of a production system deteriorates over time, and this causes increased scrap, energy use, CO2 emissions, etc. More frequent maintenance (cleaning) reduces these impacts but increases economic costs. How can firms balance the economic and environmental concerns? We develop an MDP model to evaluate different objectives, using data from the Toxic Use Reduction Institute (TURI) to capture real-world environmental impacts.

3 - Return Policies and Informational Tools in Experience Good Markets

Eylem Koca, R.H. Smith School of Business, University of Maryland, CP, VMH 3330, College Park, MD, 20742, United States of America, ekoca@rhsmith.umd.edu, Gilvan Souza

We consider an experience good and analytically study the role of consumer return policies and informational tools in the market outcome by incorporating them in the seller's decision process along with pricing. Building a novel model of consumer learning over a two-period horizon, we show that return policies can be devised to effectively substitute for information, and that issuing no information can be optimal as well as allowing consumer dissatisfaction.

4 - Formative and Reflective Measurement Model for Competitive Capabilities in Operations Strategy

Choonho Ryu, Professor, Hongik University, 72-1 Sangsoo-dong Mapo-gu, Dep't of Business Administration, Seoul, 121-791, Korea, Republic of, ryuch@wow.hongik.ac.kr, Joungho Lee

High performance in one of the competitive capabilities of firms is posited to trade off for low performance in others. However, competitive progression theory posits that manufactures can achieve high performance in more than one capability simultaneously. This paper discusses the distinction between formative and reflective measurement models for the construct of competitive capabilities and provides empirical evidence for modeling reflective indicator construct of competitive capabilities.

■ SD35

H-Sapphire A, Fourth Floor

Treatment Management - Cancer

Sponsor: Health Applications
Sponsored Session

Chair: Chen-Han Sung, Professor, Texas A&M International University, 5201 University Boulevard, Laredo, TX, csung@tamiu.edu

1 - Novel Prognostic Ensemble Model for Robust Prediction of Survival in Breast Cancer Patients

Anupama Reddy, Graduate student, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, anupamar@gmail.com, Gyan Bhanot

We present a novel algorithm, "Ensemble Logical Analysis of Survival Datafor predicting survival of cancer patients based on patterns identified on gene expression data. This is a pattern-based method using the principles of LAD. We illustrate our method on a microarray dataset of 286 breast cancer samples. Our predictions are very well correlated with survival. We stratify the patients into risk groups and show that the survival distributions in the risk strata are significantly different.

2 - Evaluating Cervical Cancer Screening Strategies

Adriana Ley Chavez, The Ohio State University, ISE Department, Columbus, OH, United States of America, ley-chavez.1@osu.edu, Julia L. Higle

Oncogenic Human Papillomavirus (HPV) infections affect at least 25 per cent of US women over the course of their lifetime, and are a necessary cause for cervical cancer. Given that HPV is transmitted sexually, each patient's sexual behavior affects their probability of infection. In this presentation, we examine the effectiveness of alternative HPV screening strategies, including alternatives for screening based on consideration of risky behaviors.

■ SD36

H-Sapphire B, Fourth Floor

Recent Advances in OR Applications in Healthcare Decision Making

Sponsor: Health Applications
Sponsored Session

Chair: Gino Lim, University of Houston, Det. of Industrial Engr., E211 Engr. Bldg 2, Houston, TX, 77204, United States of America, ginolim@uh.edu

1 - A Local Search Method for Non-coplanar Beam Orientation Optimization in IMRT Treatment Planning
Dionne Aleman, University of Toronto, Department of Mechanical and Industrial Engin., 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca, Velibor Misic, Michael Sharpe

We consider the beam orientation optimization (BOO) problem for total marrow irradiation (TMI) using intensity modulated radiation therapy (IMRT). IMRT is not widely used in TMI treatment delivery due to the difficulties in designing treatments. We propose two versions of a neighborhood search algorithm which solve the BOO problem effectively when non-coplanar beams are considered. The algorithms are performed in an acceptable amount of time and lead to high-quality treatments.

2 - Multi-Objective Nurse Scheduling Problem under the Consideration of Patient Demand and Nurse Shift Preferences
Arezou Mobasher, PhD Candidate, Department of Industrial Engr., W228, Eng Buld 2, Houston, TX, 77004, United States of America, amobasher@uh.edu, Gino Lim, Murray CÙté

The purpose of this paper is to develop a nurse scheduling model that simultaneously considers various aspects of goals such as minimizing cost, patient dissatisfaction, nurse idle time, and maximizing job satisfaction of nurses by incorporating preferences into optimization models. Both shift preferences for employee job satisfaction and patient demand for customer satisfaction are considered using a 2-stage non-weighted goal programming approach to find an efficient solution for this problem.

3 - Diabetes Quality Measurement Data Collection and Reporting in Primary Care Practice
Murray Côté, Associate Professor, University of Colorado Denver, Health Care Policy & Research, 136111 E. Colfax Avenue, Suite 100, Aurora, CO, 80045, United States of America, murray.cote@uchsc.edu, Tiffany Radcliff, David West, Perry Dickinson

Performance measurement data collection has become a very important issue for primary care practices. Performance data reporting initiatives have great potential for improving health care delivery and rewarding and reimbursing practices through pay for performance. Using process flow mapping, we identified the direct and indirect costs of implementing and maintaining diabetes quality measurement data collection and reporting in small to medium-sized primary care practices.

■ SD37

H-Sapphire C, Fourth Floor

Data and Model-Driven Supply Chain Research

Sponsor: MSOM/ Supply Chain
Sponsored Session

Chair: Hau Lee, Professor, Stanford University Graduate School of Business, 518 Memorial Way, Stanford, CA, 94022, United States of America, haulee@stanford.edu

1 - Inventories and Value of Postponement under Price Volatility
Vishal Gaur, Associate Professor, Johnson School, Cornell University, vg77@cornell.edu, Sridhar Seshadri, Marti Subrahmanyam

We present an analytical model of the optimal inventory decision of a firm when prices and demand are both volatile and their forecasts evolve over time. We test the implications of our model using data for public listed firms, and investigate how inventories observed in practice correlate with price volatility.

2 - Carbon Footprint and the Management of Supply Chains
Gerard Cachon, The Wharton School, University of Pennsylvania, 3730 Walnut St, #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, cachon@wharton.upenn.edu

Environmental management will clearly be a top priority over the coming decades. Future supply chains will probably want to reduce their carbon footprint. This talk will discuss how this new objective is likely to influence supply chain operations and structures.

3 - Drivers of Sales and Satisfaction in a Fast Food Restaurant
Serguei Netessine, Associate Professor, The Wharton School, 3730 Walnut St. Suite 500, Philadelphia, PA, 19104, United States of America, netessin@wharton.upenn.edu, Marshall Fisher, Nicole DeHoratius

We describe research with a fast food restaurant chain that uses operating data, customer satisfaction survey results and in stock mystery shopping to identify drivers of sales and satisfaction. Particular attention is paid to the design of the restaurant process. This is part of a larger project with a number of retailers that aims to identify store operating policies that result in outstanding store execution, customer experience and financial performance.

4 - Rediscover the Bullwhip Effect: On the Measurement and Interpretation with Aggregate Data
Li Chen, Duke University, Fuqua School of Business, 1 Tower Drive, Durham, NC, 27708, li.chen@duke.edu, Hau Lee

Empirical studies have shown large magnitudes of the bullwhip effect at individual companies, but at a macro-level, that is not always the case. In this paper, we show how time aggregation could mask the magnitude of the bullwhip effect. We also study similar impacts when data is aggregated across products, and how the existence of order batching and seasonality could affect the measurement of the bullwhip effect.

■ SD38

H-Sapphire D, Fourth Floor

Forecasting for Inventory Management

Cluster: Inventory Management
Invited Session

Chair: Ruud Teunter, University of Groningen, Zernike Complex Building H, Rroom 669, P.O. Box 800, 9700 AV Groningen, Netherlands, r.h.teunter@rug.nl

1 - Forecasting and Inventory Management in Multi-echelon Systems
Ton de Kok, Full Professor, Technology University of Eindhoven, Department of Technology Management, P.O.Box 513, Eindhoven, 5600MB, Netherlands, a.g.d.kok@tue.nl

In this presentation we discuss a non-stationary demand framework that can be used to model real-life demand processes and their associated forecasting processes. Based on these demand and forecast models we derive analytical expressions for the performance characteristics of multi-echelon inventory systems. We discuss the conditions under which these expressions are valid. Based on these expressions we propose an efficient heuristic to determine control parameters.

2 - Effect of Forecast Error on Inventory Performance
Nezih Altay, Associate Professor of Operations Management, DePaul University, 1 E. Jackson Blvd., College of Commerce, Chicago, IL, 60604, United States of America, naltay@richmond.edu, Ibrahim Kurtulus, Aris Syntetos

In this empirical study we show the effects of forecast error on the optimal inventory policy for spare parts with compound Poisson demand using real and simulated data.

3 - The Effects of Integrating Management Judgement into Statistical Demand Forecasts
Aris Syntetos, Reader (Associate Prrofessor), University of Salford, Salford Business School, Maxwell Building, Manchester, M5 4WT, United Kingdom, a.syntetos@salford.ac.uk, John Boylan, Konstantinos Nikolopoulos

A number of research projects have demonstrated that the efficiency of inventory systems does not relate directly to demand forecasting performance, as measured by standard forecasting accuracy measures. In this paper we address, empirically, the issue of judgementally adjusting statistical demand forecasts and the implications of such interventions both in terms of forecast accuracy and stock control, the latter being measured through inventory volumes and service levels achieved.

4 - A New Method for Forecasting Intermittent Demand
Ruud Teunter, University of Groningen, Zernike Complex Building H, Rroom 669, P.O. Box 800, 9700 AV Groningen, Netherlands, r.h.teunter@rug.nl, Aris Syntetos, Mohamed Zied Babai

The Croston method updates demand size and demand interval in periods with positive demand, and uses their ratio as the forecast. So, periods with zero demand do not imply that forecasts are adjusted downwards. Therefore, demand information is not fully utilised and estimates of inventory obsolescence risk are biased. Our new method avoids these drawbacks by updating the demand interval in every period. Numerical studies on real-life datasets show that our method improves forecasting accuracy.

■ SD39

H-Sapphire E, Fourth Floor

Customer-oriented Operations Models

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Fuqiang Zhang, Assistant Professor, Washington University in St. Louis, FZhang22@wustl.edu

1 - Leveraging 'Buzz' Created by Product Stock-outs
Laurens Debo, Booth School of Business, University of Chicago, Chicago, IL, United States of America, laurens.debo@ChicagoBooth.edu, Garrett van Ryzin

We study how stock-outs influence consumer purchasing behavior for new or innovative products with unknown quality. Stock-outs can contain information about the propensity of other consumers to purchase the product and hence increase the willingness of marginally interested consumers to buy product. We discuss how a firm can leverage this phenomenon.

2 - Pricing and Quantity Decisions under Conspicuous Consumption
Senthil Veeraraghavan, Assistant Professor, The Wharton School, University of Pennsylvania, 3730 Walnut St., #500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Necati Tereyaoglu

We model the value of stockouts for products which are consumed or purchased conspicuously. We examine the influence of scarcity on the valuation of the customer for the product, leading to its effects on the demand, and pricing and production decisions of a monopolist. We find to signal scarcity, the producer may spend higher production cost on the product.

3 - Service Capacity Management with Strategic Customers
Haiyan Wang, Washington University in St. Louis, 38597 Vancouver CMN, Fremont, CA, 94536, United States of America, hwang27@wustl.edu, Tava Olsen

We consider a service provider managing capacity in the presence of demand surges. Under this strategy, some customers who arrive in the peak demand period are offered a discount if they are willing to be postponed to a non-peak period. However, some non-peak period customers are strategic and may pretend to be a peak period customer in order to obtain a discount. We analyze the effect of the strategic customers' behavior on the service provider's capacity decisions and postponement strategy.

4 - Advance Demand Information, Price Discrimination, and Pre-order Strategies
Cuihong Li, University of Connecticut, 2104 Hillside Rd, Storrs, United States of America, Cuihong.Li@business.uconn.edu, Fuqiang Zhang

Pre-order refers to the practice of a seller accepting customer orders before the product is released. From the seller's perspective, a pre-order strategy provides values of price discrimination and advance demand information. We analyze how these two values interact with each other under different environments.

■ SD40

H-Sapphire H, Fourth Floor

Computational Methods in Financial Engineering

Sponsor: Financial Services
Sponsored Session

Chair: Zhen Liu, Assistant Professor/Senior Visiting Scholar, Missouri S&T/Tsinghua University, 216 Engineering Management, 600 W. 14th St., Rolla, MO, 65409-0370, United States of America, zliu@mst.edu

1 - Pricing Asian Options under a Flexible Jump Diffusion Model
Ning Cai, Assistant Professor, Department of IELM, HKUST, Hong Kong, China, ningcai@ust.hk, Steven Kou

We derive a closed-form double-Laplace transform of the Asian option price under the hyper-exponential jump diffusion model (HEM) by studying the distribution of a related integral of the underlying asset price process. Compared with the existing methods to study the distribution of this kind of integral that apply only for the Black-Scholes model (BSM), our approach is much simpler and more robust in that it relies solely on Ito's formula and applies for both the BSM and the HEM.

2 - A Non-zero Game Approach to Convertible Bonds: Pricing, Optimal Strategy and Late Call
Nan Chen, Assistant Professor, Chinese University of Hong Kong, 709A, William Mong Engineering Building, Chinese University of Hong Kong, Shatin, Hong Kong - PRC, nchen@se.cuhk.edu.hk, Xiangwei Wan

Convertible bond is a hybrid security which embodies both characteristics of regular bond and equity. This mixed feature complicates the analysis of convertible bonds, especially in the presence of credit risk and corporate tax. In this paper, we are going to investigate the optimal strategies for both bondholders and shareholders using a non-zero game-theoretic approach. The obtained optimal call strategy enables us to provide a possible explanation to the empirical puzzle of "late call".

3 - Invert Characteristic Functions and Monte Carlo Simulation
Liming Feng, University of Illinois at Urbana-Champaign, 104 S Mathews Ave, Urbana, IL, 61801, United States of America, fenglm@uiuc.edu

We present an efficient method for the inversion of a characteristic function. Multiple values of the cdf of a distribution with analytic characteristic function can be computed accurately and efficiently. Applications of the method to monte carlo simulation will be shown.

4 - Energy Portfolio Management with Entry Decisions
Zhen Liu, Assistant Professor/Senior Visiting Scholar, Missouri S&T/Tsinghua University, 216 Engineering Management, 600 W. 14th St., Rolla, MO, 65409-0370, United States of America, zliu@mst.edu

Due to the fluctuations of energy prices energy companies will employ alternative power generating technologies to form an energy portfolio to diversify risks. We study the optimal time to build the alternative plant, and the optimal dispatch from the existing plant and the new plant. We decompose this problem into an optimal stopping and a stochastic control problem. Numerical results are presented to characterize the optimal policy.

■ SD41

H-Sapphire L, Fourth Floor

JFIG Paper Competition I

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Ananth Iyer, Purdue University, aiyer@purdue.edu

1 - On Mixing Sets Arising in Chance-constrained Programs
Simge Kucukyavuz, Ohio State University, Columbus, OH, 43202, United States of America, kucukyavuz.2@osu.edu

We consider the intersection of multiple mixing sets with common binary variables arising in the deterministic equivalent of mathematical programs with chance constraints. We propose a blending procedure that gives strong valid inequalities for the intersection of mixing sets. We also give the relationship between the blending coefficients and the p-efficient points defined for chance-constrained programs.

2 - Design Outsourcing in a Differentiated Product Market: The Role of Bargaining and Scope Economies
Annabelle Feng, Assistant Professor, University of Texas-Austin, McCombs School of Business, 1 Univresity Station B6500, Austin, TX, 78712-0201, United States of America, annabelle.feng@mccombs.utexas.edu, Lauren Xiaoyuan Lu

During the last two decades, original equipment manufacturers (OEMs) gradually extended their outsourcing activities beyond manufacturing and outsourced product design and development to original design manufactures (ODMs). This new outsourcing model shifts the control of product design from an OEM to an ODM. We develop a dynamic game to study how design outsourcing may impact product differentiation and downstream competition among OEMs.

3 - Personalized Dynamic Pricing of Limited Inventories
Goker Aydin, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, 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.

4 - Pricing with Markups in Industries with Increasing Marginal Costs
Nicolas Stier-Moses, Columbia Business School, 418 Uris, New York, United States of America, stier@gsb.columbia.edu, Jose Correa, Nicholas Figuerosa

We study a game in which producers adopt price functions proportional to their production costs by deciding which markups to charge. In a second phase, consumers learn the producers' price functions, which leads to an allocation of consumers to producers. We look at characteristics of the resulting equilibrium and show that its social cost is close to that of the optimal allocation. In particular, we study the worst-case inefficiency as a function of the competitiveness of the marketplace.

■ SD42

H-Sapphire P, Fourth Floor

Nicholson Student Paper Prize Competition, II

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Michael Ferris, Professor, University of Wisconsin, Department of Computer Sciences, 1210 W. Dayton Street, Madison, WI, 53706-1685, United States of America, ferris@cs.wisc.edu

1 - Approximation Algorithms for the Stochastic Lot-sizing Problem
Cong Shi, PhD Candidate, Massachusetts Institute of Technology, Apt 396C, 70 Pacific St, Cambridge, MA, 02139, United States of America, shicong@MIT.EDU, Retsef Levi

We develop new algorithmic approaches to compute provably near-optimal policies for multiperiod stochastic lot-sizing inventory models with stochastic, non-stationary and correlated demands that evolve over time. This is one of the core models in inventory theory that has challenged researchers and practitioners for several decades. The policies that we develop have worst-case performance guarantees and perform very close to optimal in computational experiments.

2 - Fluid Models of Many-server Queues with Abandonment
Jiheng Zhang, Georgia Institute of Technology, Atlanta, GA, jrz@gatech.edu

We study many-server queues with abandonment in which customers have general service and patience time distributions. The dynamics of the system are modeled using measure-valued processes, to keep track of the residual service and patience times of each customer. Deterministic fluid models are established to provide first-order approximation for this model. The fluid model solution, which is proved to uniquely exists, serves as the fluid limit of the many-server queue, as the number of servers becomes large. Based on the fluid model solution, first-order approximations for various performance quantities are proposed

3 - Random Decision Networks: Correlation Decay and Decentralized Optimization
Théophane Weber, MIT, Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, United States of America, theo_w@mit.edu, David Gamarnik

We consider a decision network in which each node corresponds to a decision variable, and each node and edge of the graph is associated with a reward function whose value depends only on the variables of the corresponding nodes. This model encompasses a variety of models, including maximum likelihood inference in graphical models or Markov random fields, and combinatorial optimization in graphs. The network is endowed with a probabilistic structure in which local costs are sampled from a distribution. Our aim is to identify sufficient conditions on the network structure and costs distribution to guarantee average-case polynomiality of the optimization problem; we also wish to characterize the efficiency of a decentralized solution generated on the basis of local information. We construct a new decentralized algorithm called Cavity Expansion and establish its theoretical performance for a variety of graph models and reward function distributions.

4 - Orbital Branching
James Ostrowski, University of Waterloo, jostrows@engmail.uwaterloo.ca, Stefano Smriglio, Fabrizio Rossi, Jeff Linderoth

We introduce orbital branching, an effective branching method for integer programs containing a great deal of symmetry. The method computes equivalent variables wrt the symmetry remaining in the problem. These groups of equivalent variables (orbits) are used to create a partitioning of the feasible region which reduces the effects of symmetry while still allowing a flexible branching rule. We also show how to exploit the symmetries present to fix variables throughout the tree.

5 - Fluid Model of the Resilient Packet Ring
Jian-Qiang Hu, Professor, Fudan University, Siyuan Building, Rm 508, 670 Guoshun Rd, Shanghai, 200433, China, hujq@fudan.edu.cn, Min Chen

In this paper, we develop a fluid model for the study of Resilient Packet Ring (RPR). The key characteristic of our proposed fluid model is that it has multiple classes of flows that are processed based on dynamic priority service disciplines. We derive the differential dynamic equations for the fluid model and demonstrate how the technique of perturbation analysis can be used in such a fluid model to perform sensitivity analysis with respect to key parameters of interest.

■ SD43

H-Room 400, Fourth Floor

Carbon Emissions and the Supply Chain

Cluster: Supply Chain Models
Invited Session

Chair: Saif Benjaafa, Professor, University of Minnesota, Industrial and Systems Engineering, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu

1 - Estimating Carbon Emissions From Transportation: The Shipper's Perspective
Edgar Blanco, Executive Director, MIT Center for Latin-American Logistics Innovation, MIT, 77 Massachusetts Ave, E40-295, Cambridge, MA, 02139, United States of America, eblanco@MIT.EDU, Anthony Craig, Yossi Sheffi

In the absence of direct monitoring of CO2 emissions a number of methods exist to estimate emissions based on fuel consumption. However, much of the information required to estimate fuel consumption is carrier dependent and unknown to the shipper ahead of time. In this research we compare the shipper's estimated emissions using several methods and assumptions regarding carrier performance.

2 - Carbon Emissions in Distribution Networks
Jan Fransoo, Professor, Eindhoven University of Technology, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, J.C.Fransoo@tue.nl, Tarkan Tan

We report on an empirical study to measure carbon emissions in European distribution networks, based on field work with four companies. We present the various available standards with their limitations, and also demonstrate the potential reductions in carbon emissions that can be obtained. We show cases where lower emissions result in lower cost and vice versa, and briefly discuss the consequences of new legislation.

3 - Addressing Carbon Emissions via Supply Chain Planning and Coordination: Insights From Simple Models
Saif Benjaafar, Professor, University of Minnesota, Industrial and Systems Engineering, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu, Yanzhi Li

We present models to support the design, planning, and coordination of supply chains with carbon emissions in mind. We show how operational decisions and supply chain coordination can have a dramatic impact on carbon emissions. We describe policy implications for how carbon emission targets should be set and how incentives for sharing the carbon emission burden across the supply chain be designed.

■ SD44

H-Room 402, Fourth Floor

Stochastic Analysis in Workforce Management

Sponsor: Service Science
Sponsored Session

Chair: Mark Squillante, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134/P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, mss@watson.ibm.com

Co-Chair: Yingdong Lu, IBM, 1101 Kitchawan RD, Yorktown Heighs, United States of America, yingdong@us.ibm.com

1 - Dynamic Worker Allocation in Capacity-constrained Systems
Salih Tekin, Georgia Institute of Technology, School of Industrial and Systems Eng, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, stekin@gatech.edu, Douglas Down, Sigrun Andradottir

Consider a stochastic system where workers are cross-trained and demand exceeds the capacity for service. We determine how the workers should be assigned to tasks to achieve a desired throughput for a given demand, provided that the throughput is feasible. This is accomplished using the solutions of linear programming problems, and the throughput guarantees are demonstrated using fluid model techniques. Several numerical examples will be discussed to illustrate key concepts.

2 - Optimal Call Center Staffing with Arrival Uncertainty II
Achal Bassamboo, Northwestern University, Kellogg School, 2001 Sheridan Road, Evanston, 60208, a-bassamboo@kellogg.northwestern.edu, Assaf Zeevi, Ramandeep Randhawa

We study the capacity sizing problem in a call center faced with an uncertain arrival rate. In a large system setting, we first characterize the solution to the first order fluid problem. We show that the fluid prescription can have an Order-1 optimality property. That is, its optimality gap does not increase with system size.

3 - Service Level Variability of Inbound Call Centers
Alex Roubos, VU University Amsterdam, De Boelelaan 1081A, Amsterdam, 1081 HV, Netherlands, aroubos@few.vu.nl, Raik Stolletz, Ger Koole

The Erlang C formula and its generalizations have often been used to find the number of agents that satisfy some service level (SL) criterion. These formulas assume that the system has reached stationarity; this is not true in reality where SLs are aggregated over intervals no longer than 24 hrs. In such small intervals the SL is a random variable. We propose a simple formula for the standard deviation of the SL and use this together with a normal approximation to show highly accurate results.

4 - Stochastic Workforce Optimization via a General Stochastic Loss Network
Yingdong Lu, IBM, 1101 Kitchawan RD, Yorktown Heights, United States of America, yingdong@us.ibm.com, Ana Radovanovic, Mark Squillante

Modeling workforce dynamics as a loss network under general arrivals, we derive an asymptotically exact Gaussian fixed-point approximation for the network loss probabilities. We then formulate and solve single-period, multi-period and dynamic stochastic capacity planning optimization/control problems based on our FPA, whose solutions are also shown to be asymptotically exact. Numerical studies illustrate approximation accuracy and solution dependencies on demand variability and cost structure.

■ SD45

H-Room 410, Fouth Floor

Research, Development, Architecture and Complexity

Cluster: New Product Development
Invited Session

Chair: Jurgen Mihm, Assistant Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, jurgen.mihm@insead.edu

1 - Complexity and Efficiency of Globally Distributed Vehicle Design
Bilal Gokpinar, Lecturer, University College London, United Kingdom, b.gokpinar@ucl.ac.uk, Seyed Iravani, Wallace Hopp

We study the vehicle development process of a large auto manufacturer, whose design teams span the globe. Using networks to characterize both the product architecture and design team coordination, we investigate the impact geographic separation of design teams has on the operational efficiency and product quality of the system. Our results suggest that splitting subsystem design across geographic boundaries can have a deleterious effect on performance.

2 - How Long Does it Take to Fix a Bug? Architecture and Bug Fixing Time in Open Source Software
Manuel Sosa, Associate Professor of Technology and Operations Management, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, manuel.sosa@insead.edu, Jurgen Mihm, Tyson Browning

We examine a large longitudinal sample of bugs associated with several open source applications developed by Apache. We study the link between software architectural properties and time to fix bugs. Our results suggest that some architectural properties of software applications are important determinants of bug fixing time.

3 - Strategy Deployment: Decentralized Decision Making and Innovation
Fabian Sting, INSEAD, Boulevard de Constance, Fontainebleau, France, fabian.sting@insead.edu, Christoph Loch, Jurgen Mihm

Strategy making and deployment are neither top-down nor bottom-up. In organizational search different kinds of decisions are made at different levels in the organization, and coordination happens through multiple methods. Innovation happens in a combination of target fulfillment and offering new solutions and combines products, processes and structures. We show a modeling representation of strategy deployment, and present multiple case study results.

■ SD46

H-Room 411, Fourth Floor

NPD and Knowledge Management

Sponsor: Technology Management
Sponsored Session

Chair: Gulru Ozkan, Assistant Professor, Clemson University, Department of Management, 117B Sirrine Hall, Clemson, SC, 29631, United States of America, gulruo@clemson.edu

1 - Product Platform Strategies Implications for Supply Chain Integration
Juliana Hsuan, Associate Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK, 2000, Denmark, jh.om@cbs.dk

A conceptual framework called Platform Product Matrix (PPM) is introduced to assess product platform strategies (i.e. product architecture modularity) with respect to supply chain integration (i.e. the application of inter-organizational systems, supplier involvement, and product customization). PPM provides insights into how product variants would influence supply chain design and resource allocation.

2 - Fusion Diffusion Confusion
Yuwen Chen, Assistant Professor of Supply Chain Management, University of Rhode Island, 7 Lippitt Road, Kingston, RI, 02881, United States of America, yuwen@mail.uri.edu, Janice Carrillo

As multifunction products (also referred to as fusion products) gain popularity, we observe that single-function products gradually disappear from the market as they are supplanted by fusion products. This paper presents a product diffusion model that captures the transition from two distinct single-function products into one fusion product. We investigate the optimal launch time of the fusion product and conduct a numerical analysis to demonstrate the dynamics among the three products.

3 - Managing New Product Development Knowledge between Competing Firms
Gulru Ozkan, Clemson University, United States of America, Gulruo@exchange.clemson.edu, Cheryl Gaimon

We introduce a two period stochastic game on KM for NPD of two competing firms. First, leader sets price for knowledge transfer (patents); follower decides how much knowledge to acquire. Next, firms pursue knowledge development (problem solving). Finally, both firms release new products. Insights include impact of uncertain market forces.

4 - Workforce Knowledge Management and the Implementation of New Technology
Cheryl Gaimon, Professor, Georgia Institute of Technology, 800 W. Peachtree St. NW, Atlanta, GA, 30308-0520, United States of America, Cheryl.Gaimon@mgt.gatech.edu, Karen Napoleon, Gulru Ozkan

We consider a firm's dynamic resource capabilities and demonstrate importance of managing workforce knowledge for a technology upgrade. We examine how workforce knowledge changes over time due to upgrade and independent from it. We capture knowledge depreciation, learning-before-doing, forgetting; showing dramatically different KM strategies are needed before/after an upgrade.

■ SD47

H-Room 412, Fourth Floor

Doing Good with Good OR Student Competition I

Cluster: Doing Good with Good OR Student Competition
Invited Session

Chair: Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu

Co-Chair: Cynthia Barnhart, Associate Dean for Academic Affairs, MIT, School of Engineering, Cambridge, MA, 02139, United States of America, cbarnhart@MIT.EDU

1 - Doing Good with Good OR Student Competition
Ozlem Ergun, Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, oergun@isye.gatech.edu, Cynthia Barnhart

"Doing Good with Good OR Student Competition" is a new INFORMS sponsored competition to encouraging student research and practice with societal impact. This competition is intended to recognize student-led projects with real-world

clients that generate significant societal impacts beyond increased profits or reduced costs. The finalists session will feature the most exciting work performed by students in partnership with public and private organizations that results in tangible, beneficial outcomes for individuals, communities and organizations. The winner of the competition will be decided after the presentations and announced at the awards ceremony on Sunday night.

2 - Network Design for Middle East Water Distribution
Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, 23229, United States of America, jpbrooks@vcu.edu, Rachel Bullene, Ed Boone

This project involves building a model to aid decision-makers in designing an optimal water distribution network in the Middle East. Our model incorporates a Bayesian simulation wrapped around a deterministic optimization model to represent uncertainty. The output of the model is a most-probable least-cost network design and network component probabilities.

3 - Catch-up Scheduling for Childhood Immunization
Faramroze Engineer, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, fenginee@isye.gatech.edu, Larry K. Pickering, Pinar Keskinocak

We outline the development of an optimization based decision support tool to help providers and caretakers in constructing catch-up schedules for childhood immunization. These schedules ensure that a child continues to receive timely coverage against vaccine preventable diseases in the likely event that one or more doses have been delayed. The tool is advocated by both the CDC and AAP as a means of encouraging caretakers and providers to take a more proactive role in ensuring timely coverage.

4 - Optimal Learning for Drug Design in Ewing's Sarcoma
Diana Negoescu, Stanford University, Management Science and Engineering Department, Palo Alto, CA, United States of America, negoescu@princeton.edu, Peter Frazier, Warren Powell

Developing a new drug involves a time-consuming sequence of experiments in which new molecules are synthesized and tested, and the results used to choose which molecule to test next. Choosing molecules to test in a wise way reduces the number of experiments that must be performed, and makes drug development efforts more likely to succeed. In collaboration with a pediatric oncology group at Georgetown University, we develop a new Bayesian decision-theoretic method for making these choices.

■ SD48

H-Sapphire Green Room, Fourth

Organization Science: The Journal and the State of the Art

Sponsor: Organizational Science
Sponsored Session

Chair: Kyle Lewis, Associate Professor, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, kyle.lewis@mccombs.utexas.edu

1 - Intra-organizational Networks, Inter-organizational Networks and the Impact of Central Inventors
Srikanth Paruchuri, University of Florida, Warrington College of Business Administr, P.O. Box 117165, Gainesville, FL, 32611, United States of America, paruchur@ufl.edu

This paper proposes that a mechanism through which a firm's location in the inter-organizational network influences the firm's internal innovation activities is by modifying the amount of information flowing within the firm. Consequently, I hypothesized that the relationship between an inventor's centrality and his impact on a firm's innovation activities is moderated by the firm's centrality and span of structural holes in the inter-firm network.

2 - External Learning Activities and Team Performance: A Multimethod Field Study
Henrik Bresman, INSEAD, 77305 Fontainebleu, Cedex, France, henrik.bresman@insead.edu

This paper reports on a study of external team learning activities and their performance effects. Qualitative data from six teams in one pharmaceutical firm are used to develop measures. Survey data from 62 additional teams in six other pharmaceutical firms are used to test the proposed model. The paper contributes by distinguishing between different kinds of external learning activities and showing that they put different demands on teams to be effective.

3 - Securities Analysts and Incumbent Response to Radical Technological Change
Mary Benner, Management Department, The Wharton School, Philadelphia, PA, 19104, United States of America, benner@wharton.upenn.edu

Research has studied the factors that impede firms' responses to radical technological change, but little work in the technological change literature considers the role of equity markets or securities analysts in incumbent firms' responses to technological change. This paper empirically explores how analysts react to different strategies undertaken by incumbent firms faced with radical technological change, and illuminates the nature and direction of possible pressures from analysts.

4 - The Next Generation: Technology Adoption and Integration through Internal Competition
Alva Taylor, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States of America, alva.taylor@dartmouth.edu

This paper examines the impact of internal competition that occurs when new technology challenges a firm's existing products. Evidence from a field study on new-technology product development shows that internal competition influences existing-technology product development groups to integrate the new technology into the next generation of their products. These existing groups shift their search toward the new technology, and gain access to information through internal worker mobility.

■ SD49

H-Room 300, Third Floor

Panel Discussion: Teaching Modern Project Management

Cluster: Project Management
Invited Session

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

1 - Teaching Modern Project Management
Moderator: Nicholas Hall, Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall.33@osu.edu, Panelists: Brian Tomlin, Vijay Mehrotra

Panel members will share their project management teaching experiences regarding: benefits and challenges of teaching this course, instructor workload, marketing the course to potential students, prerequisite courses, overall course design, technical level of the course, managing students' expectations, cases, student presentations, games and simulation exercises, software support, guest speakers, final exams, integration with other courses, and teaching the course in an online environment.

■ SD50

H-Room 302, Third Floor

Online Resources for Teaching a POM Course with Balanced Service and Supply Chain Content

Cluster: Service Operations Management
Invited Session

Chair: Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu

1 - Online Resources for Teaching a POM Course with Balanced Service and Supply Chain Content
Rohit Verma, Professor, Cornell University, School of Hotel Administration, 338 Statler Hall, Ithaca, NY, 14853, United States of America, rv54@cornell.edu, Ken Boyer

Increasing core POM courses are designed to provide a balanced overview of manufacturing and service operations along with supply chain management concepts. Furthermore, there seems to be a greater need to incorporate online learning resources for various instructional needs (e.g. assignments, multi-media cases, etc). This workshop will review some of the new resources available for instructors of core POM classes.

■ SD51

H-Room 303, Third Floor

Matrix Rank Minimization: Theory and Algorithms

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Maryam Fazel, Assistant Professor, University of Washington, Campus Box 352500, Univ of Washington, Seattle, WA, 98195, United States of America, mfazel@u.washington.edu

1 - Matrix Completion From A Few Entries

Andrea Montanari, Professor, Standord University, Packard Bldg, Stanford, CA, 94025, United States of America, montanar@stanford.edu, Raghunandan Keshavan, Sewoong Oh

We consider the use of low-rank models in collaborative filtering (the `Netflix problem'). Given M, a n x n `incoherent' matrix of rank r, a random subset of its entries is observed. We describe an efficient algorithm that reconstructs M from O(rn) entries with arbitrarily small RMSE. If r = O(1), it reconstructs M exactly from O(n log n) entries. The algorithm is robust with respect to noise. In the case of gaussian noise, it appears to surpass approaches based on nuclear norm relaxation.

2 - Exact Matrix Completion via Convex Optimization

Emmanuel Candes, CalTech, emmanuel@acm.caltech.edu, Terence Tao

We observe a few entries from a matrix and ask whether we can complete the matrix and recover the entries we have not seen. This is the famous Netflix problem. We show that surprisingly one can recover low-rank matrices exactly from what appear to be highly incomplete sets of entries. Further, perfect recovery is possible by solving a semidefinite program. Our methods are optimal and succeed as soon as recovery is possible by any method whatsoever.

3 - Fixed Point and Bregman Iterative Methods for Matrix Rank Minimization

Shiqian Ma, Columbia University, 500 W. 120TH ST, Mudd Building, RM 313, New York, NY, 10027, United States of America, sm2756@columbia.edu, Donald Goldfarb

We consider in this talk the linearly constrained matrix rank minimization problem. We propose fixed point and Bregman iterative algorithms for solving the nuclear norm minimization problem, which is the tightest convex relaxation of this problem. Our algorithm can recover 1000 by 1000 matrices of rank 50 with a relative error of 1e-5 in about 3 minutes sampling only 20 percent of the elements. We know of no other method that achieves as good recoverability.

4 - Results on Low-rank Matrix Recovery From Noisy Data

Maryam Fazel, Assistant Professor, University of Washington, Campus Box 352500, Univ of Washington, Seattle, WA, 98195, United States of America, mfazel@u.washington.edu

We consider the problem of recovering a low-rank matrix from various classes of limited and noisy observations. We show that minimizing the nuclear norm of the matrix (i.e., the sum of its singular values) subject to the observations provides not only a provably good approximation of the unknown matrix, but also a way to estimate the correct rank and the singular spaces of the matrix.

■ SD52

H-Room 304, Third Floor

Marketing and Operations Decisions

Cluster: Operations Management/Marketing Interface
Invited Session

Chair: Kathryn Stecke, Ashbel Smith Professor, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, kstecke@utdallas.edu

1 - Pricing and Lead-time Decisions in a Duopoly Common Retailer Channel

Zhengping Wu, Singapore Management University, Lee Kiong Chain School of Business, Singapore, Singapore, zpwu@smu.edu.sg, Xiuming Niu, Scott Webster, Kum-Khiong Yang

We study a two-tier decentralized supply chain consisting of two suppliers and two common retailers facing a price- and lead-time-sensitive demand. We construct three different games to analyze the optimal price and lead-time decisions. We show the existence of a unique equilibrium in all games and discuss managerial implications of our modeling results.

2 - Requiring Minimum Sale Volumes to Trigger an Increase in Commissions under Competition

Guillermo Gallego, IEOR Department, Columbia University, 313, 500W, 120 St, New York, NY, 10027, United States of America, ggallego@ieor.columbia.edu, Masoud Talebian

We consider a game between two providers and a broker and study the effects of requiring minimum sale volumes to trigger commissions. With fixed commission margins, at least one provider has an incentive to impose thresholds at the expense of the broker. If the providers also compete with commission margins then in equilibrium the smaller provider loses and the broker benefits. Thresholds with variable margins is the only stable equilibrium but it is not Pareto optimal.

3 - Impact of Shared Capacity on Socially Efficient Product Lines

Jay Swaminathan, Kay and Van Weatherspoon Distinguished Professor of Operations, Technology and Innovation Management, Kenan-Flagler Business School, Campus Box 3490, McColl Building, Chapel Hill, NC, 27599, United States of America, msj@unc.edu, Muge Yayla-Kullu, Ali Parlakturk

We consider a social planner offering two products that differ in their quality and vary in their unit costs and capacity consumption. In particular, we study socially efficient product line choice, capacity allocation and pricing decisions. In contrast to the existing literature, we show that capacity constraint may induce a social planner to provide a quality level that is worse than a monopolist.

4 - Dynamic Pricing and Customer Relationships: Selling to Learn or Learning to Sell?

Rene Caldentey, Associate professor, New York University, rcaldent@stern.nyu.edu, Paulo Rocha e Oliveira, Gabriel Bitran

Knowing each customer's preferences enhances a firm's ability to design and offer the right selection and configuration of products and services. We use an axiomatic approach to develop a learning model that enables us to quantify the trade-off between the value and the cost of knowing the customers. This learning model is used to investigate how pricing policies can be used to speed up the learning process while maximizing the firm's financial performance.

■ SD53

H-Room 305, Third Floor

MIP Methodologies for Non-Convex Optimization

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Anureet Saxena, Research Associate, Axioma Inc, 2313 Charleston Place, Atlanta, GA, 30338, United States of America, asaxena@axiomainc.com

1 - Projected Formulations for Non-Convex Quadratically Constrained Programs

Anureet Saxena, Research Associate, Axioma Inc, 2313 Charleston Place, Atlanta, GA, 30338, United States of America, asaxena@axiomainc.com, Jon Lee, Pierre Bonami

A common way to produce a convex relaxation of a MIQCP is to lift the problem into a higher dimensional space by introducing additional variables to represent bilinear terms, and strengthening the resulting formulation using SDP constraint and disjunctive programming. In this paper, we study projection methods to build low-dimensional relaxations of MIQCP that capture the strength of these extended formulations.

2 - Global Optimization of MINLPs with BARON

Nick Sahinidis, John E. Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, United States of America, sahinidis@cmu.edu, Mohit Tawarmalani

We present extensive computational experience with a new version of BARON for the solution of MINLPs that possess convex or nonconvex relaxations when integrality requirements are relaxed. The approach incorporates MIP relaxations judiciously, in conjunction with cutting plane generation and range reduction, to significantly reduce computational requirements and expedite solution.

3 - Tighter Relaxations for Global Optimization Problem with Multilinear Terms

Jeff Linderoth, University of Wisconsin, 1513 University Ave, 3226 Mechanical Engineering Building, Madison, WI, United States of America, linderot@cae.wisc.edu, Jim Luedtke, Mahdi Namazifar, Andrew Miller

Multilinear functions appear in many global optimization problem. A common technique for creating relaxations of such terms is to decompose them into bilinear terms and then use a relaxation (the McCormick envelope) for each term separately. We study an approach that generates a relaxation directly from the multilinear term and show that in some cases this can lead to a tighter relaxation. Computational results will be presented.

■ SD54

H-Room 306A, Third Floor

Online Learning

Sponsor: Optimization/Networks
Sponsored Session

Chair: Satyen Kale, Postdoctoral Researcher, Microsoft Research, 1 Memorial Drive, Cambridge, MA, 02138, United States of America, satyen.kale@gmail.com

1 - Stochastic Linear Optimization under Bandit Feedback
Varsha Dani, University of New Mexico, Department of Computer Science, Albuquerque, United States of America, varshadani@gmail.com, Thomas Hayes, Sham Kakade

In the classical stochastic k-armed bandit problem, in a sequence of trials, a decision maker chooses one of k arms and incurs a cost chosen from an unknown distribution associated with that arm. The goal is to minimize "regretthe difference between the cost incurred by the algorithm and the optimal cost. We study an extension where the k arms correspond to vectors in R^n, and the cost functions are linear. We describe an algorithm that works well even for infinite decision sets.

2 - Online Learning for Sponsored Keyword Search with Budgets
Thomas Hayes, University of New Mexico, Department of Computer Science, Mail stop: MSC01 1130, Albuquerque, NM, 87108, United States of America, hayes@cs.unm.edu, Nikhil Devanur

We consider the problem of a search engine trying to assign a sequence of search keywords to a set of competing bidders, each with a daily spending limit. The goal is to maximize the revenue generated by these keyword sales, bearing in mind that, as some bidders may eventually exceed their budget, not all keywords should be sold to the highest bidder. We assume that the sequence of keywords (or equivalently, of bids) is revealed on-line.

3 - Strong Convexity and Strong Smoothness: Applications to Learning with Matrices
Ambuj Tewari, Research Assistant Professor, Toyota Technological Institute at Chicago, 6045 S Kenwood Ave, Chicago, IL, 60615, United States of America, tewari@tti-c.org, Sham Kakade, Shai Shalev-Shwartz

A number of online learning algorithms rely on strong convexity. Well-known examples are weighted majority and online gradient descent. The property of strong smoothness is dual to strong convexity. We point out some interesting consequences of this duality and also show how to construct strongly convex functions over matrices based on strongly convex functions over vectors. The newly constructed functions inherit the strong convexity properties of the underlying vector functions.

4 - Learning, Optimization and Bandits
Jacob Abernethy, PhD Student, University of California at Berkeley, 387 Soda Hall, Berkeley, CA, 94720, jake@cs.berkeley.edu

The problem of optimizing a sequence of functions in an online fashion, known as Online Convex Optimization (OCO) has gained considerable interest in recent years. The setting provides a generic framework for a host of problems including learning with expert advice, linear pattern recognition, and portfolio selection. In this talk, I will present a new technique for OCO and show how it leads to a new analysis for the "bandit setting". This is joint work with Alexander Rakhlin from UPenn.

■ SD55

H-Room 306B, Third Floor

Algorithmic Mechanism Design

Sponsor: Optimization/Networks
Sponsored Session

Chair: Moshe Babaioff, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, moshe@microsoft.com

1 - Economics and Differential Privacy
Mukund Sundararajan, Stanford University, 353 Serra Mall, Stanford, United States of America, mukous@gmail.com

Differential Privacy is a privacy framework that consists of a rigorous definition of privacy, along with mechanisms for diverse applications. We discuss: A. An economically motivated definition of utility, and identify optimal privacy mechanisms, i.e. mechanisms that optimize utility subject to privacy constraints. B. We discuss why privacy is a preference, and suggest a generalization of differential privacy as a meaningful definition.

2 - Complexity of Combinatorial Auctions: Putting the VC in VCG
Yaron Singer, UC Berkeley, 615 Soda hall, Berkeley, CA, 94709, United States of America, yaron@cs.berkeley.edu, Elchanan Mossel, Christos Papadimitriou, Michael Schapira

The existence of truthful, computationally-efficient protocols for combinatorial auctions with decent approximation ratios is a central and well studied open question in mechanism design. The only general technique known for the design of truthful mechanisms is the VCG scheme. We present a first-of-its-kind technique for proving computational-complexity inapproximability results for VCG mechanisms for combinatorial auctions via a generalization of the VC-dimension to k-tuples of disjoint sets.

3 - Characterizing Truthful Multi-Armed Bandit Mechanisms
Moshe Babaioff, Microsoft Research, 1065 La Avenida, Mountain View, CA, 94043, United States of America, moshe@microsoft.com, Yogeshwar Sharma, Aleksandrs Slivkins

We investigate how the design of multi-armed bandit algorithms is affected by the restriction that the resulting mechanism must be truthful. We find that truthful mechanisms have certain strong structural properties — essentially, they must separate exploration from exploitation — and they incur much higher regret than the optimal multi-armed bandit algorithms. Moreover, we provide a truthful mechanism which matches our lower bound on regret.

■ SD56

H-Room 307, Third Floor

Optimization Methods for Data Classification

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Hong Seo Ryoo, Associate Professor, Korea University, 1, 5-Ka, Anam-Dong, Seongbuk-Ku, Seoul, Korea, Republic of, hsryoo@korea.ac.kr

1 - Efficient Piecewise Linear Classifiers in Data Classification
Adil Bagirov, Dr, Centre for Informatics and Applied Optimization, School of Information Technology and Mathematical Sciences, University of Ballarat, University Drive, Mount Helen, Ballarat, 3353, Australia, a.bagirov@ballarat.edu.au

Algorithms for finding piecewise linear boundaries (PLB) between pattern classes are discussed. We introduce the notion of the max-min separability and nonsmooth optimization algorithms for finding PLBs. In order to reduce complexity in large datasets we use hypeboxes and polyhedral conic functions to identify data points which lie on or close to the boundary and compute a PLB using only those data points. PLBs are computed incrementally starting with one hyperplane.

2 - Integration of Support Vector Machines and Control Charts for Multivariate Process Monitoring
Seoung Bum Kim, Assistant Professor, Korea University, Anam-dong Seongbuk-Gu, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

We present a novel multivariate control chart that integrates a support vector machines (SVM) algorithm, a bootstrap method, and a control chart technique to improve multivariate process monitoring. A simulation study was conducted to evaluate the performance of the proposed SVM-PoC chart and to compare it with other data mining-based control charts and Hotelling's T2 control charts under various scenarios.

3 - An Implementation of LAD for Large-scale Datasets
Hong Seo Ryoo, Associate Professor, Korea University, 1, 5-Ka, Anam-Dong, Seongbuk-Ku, Seoul, Korea, Republic of, hsryoo@korea.ac.kr, In-Yong Jang

Analyzing large-scale datasets via an optimization-based methodology is a challenging task, owing in part to the requirement for extensive use of memory. In this talk, we develop a memory efficient data comparison scheme to yield an implementation of LAD for analyzing large-scale datasets. With extensive experiments on larger-size datasets from the literature, we demonstrate the utility of the proposed scheme and our implementation of LAD.

■ SD57

H-Room 308, Third Floor

Using Data and Models to Identify Risks and Improve Patient Care

Sponsor: Health Applications
Sponsored Session

Chair: David Hutton, Stanford University, Terman 496, 380 Panama Way, Stanford, CA, 94305, United States of America, billdave@stanford.edu

1 - Cost-Effectiveness Modeling and Exploratory Analysis in Medical Decision Making

Megan DeFauw, PhD Candidate, University of Michigan Industrial and Operations Engineering, 1201 Beal Ave., Ann Arbor, MI, 48109, United States of America, mcdefauw@umich.edu, Joseph Norman, Vijayan Nair

Cost-effectiveness analysis is often based on single number summaries such as the ratio of the cost of treatment to gains in quality-adjusted life years. Such simple summaries can hide critical information, such as effectiveness of a treatment for segments of the population, the effects of covariates and subjects' initial health status, and changes over time. We propose data analyses and graphical tools for exploring and discovering interesting information that may be useful to decision makers.

2 - Follow the Money: Analysing Cost in Claims Data for Drug Surveillance

Yihan Guan, Ph.D. Candidate, Department of Management Science and Engineering, Stanford University, Terman 393, 380 Panama Way, Stanford, CA, 94305, United States of America, yihan@stanford.edu, Margrét Bjarnadottir

Cost in claims data is a powerful summarizer of the general health status of an insured individual. We build a mathematical framework for monitoring costs to detect adverse events and show that we can detect adverse effects faster than monitoring individual adverse events. We assess the effectiveness of our model using data from 2.4 million insured individuals over 6 years. Our findings have the potential to improve FDA's post marketing prospective drug surveillance.

3 - Optimization Based Data Mining for Cancer Treatments

Allison Chang, Massachusetts Institute of Technology, 70 Pacific Street, Apt. 337B, Cambridge, MA, 02139, United States of America, aachang@MIT.EDU, Cynthia Barnhart, Dimitris Bertsimas

The goal of this work is to be able to identify chemotherapies that show potential for significantly improving the survival time of patients. We use mathematical programming to formulate the problem of ranking the effectiveness of various cancer treatments, and the optimal solutions give insights into the characterization of those treatments with the best results. With this information, we hope to optimize the process of proposing new drug combinations for future clinical trials.

4 - Determining When to Initiate Liver Cancer Screening for Asians with Chronic Hepatitis B

David Hutton, Stanford University, Terman 496, 380 Panama Way, Stanford, CA, 94305, United States of America, billdave@stanford.edu

Chronic Hepatitis B is a risk factor for liver cancer. As many Asians are infected with Hepatitis B early in life, liver cancer incidence rises at an earlier age for them. Current guidelines recommend screening Asian men at age 40 and women at age 50. However, many chronic carriers develop liver cancer prior to these ages. We examine historical patterns of liver cancer incidence and use it to analyze the cost-effectiveness of screening for liver cancer at different ages.

■ SD58

H-Room 309, Third Floor

New Developments in Scheduling Studies

Cluster: Scheduling
Invited Session

Chair: Xiaoqiang Cai, Professor, The Chinese University of Hong Kong, Dept of Systems Eng & Eng Management, Hong Kong, Hong Kong - PRC, xqcai@se.cuhk.edu.hk

1 - Scheduling with Time-Dependent Machining Costs

Xiangtong Qi, Professor, HKUST, HKUST Academic Building 5540, Kowloon, Hong Kong, Hong Kong - PRC, ieemqi@ust.hk, Guohua Wan

We study a class of new scheduling models where a job scheduled within certain time slots will incur a machining cost which is determined by the length and position of the occupied time slots. Such problems exist when the production cost varies over time. The scheduling objective is to minimize the total machining cost plus a traditional scheduling performance measure. The work is partially supported by Hong Kong RGC under project No. 618807.

2 - Stochastic Scheduling Subject to Multiple-type Machine Breakdowns

Xian Zhou, Professor, Macquarie University, North Ryde, NSW, Sydney, 2109, Australia, xzhou@efs.mq.edu.au

We examine a stochastic scheduling model to schedule n jobs with random processing times on a single machine subject to multiple types of stochastic breakdowns. The aim is to maximize the expected weighted discounted rewards. The optimal policy is tackled by using the multi-armed bandit process in terms of Gittins indices. The optimal policies of some extensively studied models are derived as the applications of the theory developed.

3 - Dynamic Scheduling in a Make-to-Stock System Subject to Machine Breakdowns

Houcai Shen, Professor, Nanjing University, No 22, Hankou Road, Nanjing, China, hcshen@nju.edu.cn

We consider dynamic scheduling in a make-to-stock production system with a single failure-prone machine. The demand with Poisson arrival should be satisfied from on-hand inventory, otherwise it is backlogged with a backlog cost. A scheduling rule specifies when and which item to produce, under the objective of minimizing the expected discounted inventory related cost over an infinite planning horizon.

■ SD59

H-Room 310, Third Floor

Tutorial: 25 Years of Interior Points Methods

Cluster: Tutorials
Invited Session

Chair: Tamas Terlaky, Professor, Chair, Lehigh University, Department ISE, H. Mohler Lab, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, terlaky@lehigh.edu

1 - 25 Years of Interior Points Methods

Tamas Terlaky, Professor, Chair, Lehigh University, Department ISE, H. Mohler Lab, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, terlaky@lehigh.edu

Karmarkar launched the age of IPMs in 1984. Hundreds of polynomial IPMs are designed. IPM software challenged simplex software. Duality theory, strict complementarity, novel sensitivity analysis are explored. New problem classes, e.g. SOCO/SDO are solved. Novel applications, e.g. robust IMRT are solved. Theory and practice of optimization has changed forever. By now, the limits of IPMs are understood. Klee-Minty examples were constructed for IPMs and complexity bound is proved be tight.

■ SD60

H-Room 311, Third Floor

New Advances in Nonlinear Interior Point Methods

Cluster: 25th Anniversary of Interior-Point Methods
Invited Session

Chair: Richard Waltz, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, rwaltz@usc.edu

1 - Penalty Techniques in SQP and Interior-Point Algorithms

Frank Curtis, Lehigh University, Bethlehem, PA, fecurt@gmail.com, Richard Waltz

SQP and interior-point methods form the backbone of contemporary algorithms for NLP. In this talk, we present variants of these approaches that share a common strategy for regularizing the constraints via an exact penalty. We illustrate that penalties — with appropriate updates for the penalty parameter — can be employed to both maintain the convergence properties of an algorithm and improve its practical performance. Our discussion focuses primarily on infeasibility detection and MINLP.

2 - IPM Warmstarts for Single Coefficient Perturbation on the Right Hand Side

Fernando Ordonez, Associate Professor, Daniel J. Epstein Department of Industrial and Systems Engineering, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089-0193, United States of America, fordon@usc.edu, Richard Waltz

A classic branch and bound method requires the solution of a series of problems which differ only in the bound constraint of a variable from a previously solved problem. We formulate this as single perturbations to the righthand side vector and propose a penalty approach. We study theoretical and efficient heuristic methods to reduce the number of IPM iterations of solving the modified problem.

3 - Numerical Experience Using Interior-Point Methods for Mixed Integer Nonlinear Programming

Richard Waltz, University of Southern California, 3715 McClintock Ave, GER 240, Los Angeles, CA, 90089, United States of America, rwaltz@usc.edu

Interior-point methods are likely to play a more important role in mixed integer nonlinear programming (MINLP) compared to mixed integer linear programming. In this talk, we present some comparative results using interior-point methods in MINLP and discuss current issues related to this.

■ SD61

H-Room 312, Third Floor

Joint Session Location Analysis/ TSL: Discrete Location Analysis

Sponsor: Location Analysis & Transportation Science and Logistics
Sponsored Session

Chair: Zvi Drezner, Professor, California State University, Fullerton, Department of ISDS, Fullerton, CA, 92834, United States of America, zdrezner@Fullerton.edu

1 - An Efficient Approach for Service System Design Problem

Robert Aboolian, Associate Professor, California State University San Marcos, raboolia@csusm.edu, Samir Elhedhli

We consider the service system design problem in a congested network. The problem is set up as a network of M/M/1 queuing systems and modeled as NLIP. Efficient solution approaches under a policy which allocates customers to the facility with minimum access cost are developed. We also examine the efficiency of the solution to this policy compared to the optimal allocation policy.

2 - Empirical Analysis of Ambulance Travel Times: The Case of Calgary Emergency Medical Services

Dawit Zerom, Associate Professor, California State University-Fullerton, Fullerton, CA, 92834, United States of America, dzerom@fullerton.edu, Armann Ingolfsson, Susan Budge

Reducing response times to emergency calls is an important focus of much strategic and operational planning for emergency medical service systems. We estimate how ambulance travel travel times depend on distance using administrative data for one year of high-priority calls in Calgary, Alberta. We illustrate how the travel time distribution model can be used to create probability-of-coverage maps for diagnosis and improvement of system performance.

3 - Error Bound for P-median, P-center or Covering Location Models with Continuous and Discrete Demands

Richard Francis, University of Florida, francis@ise.ufl.edu, Timothy Lowe

We develop an error bound theory to compare a given p-median, p-center or covering location model with continuously distributed demand points to a corresponding given model of the same type having a finite demand point collection. In a precise sense involving only the error bounds, our approach can be viewed as demand point disaggregation.

4 - Single Facility Location Problem with Optimal Construction Timing under Uncertainty

Kyoko Yagi, Dr., The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-0033, Japan, yagi@e.u-tokyo.ac.jp, Ken-ichi Tanaka, Ryuta Takashima

In this paper we present a problem to decide both the location and the construction timing of a single facility under uncertainty in future population growth and the cost of locating the facility. The problem seeks to maximize the expected present value of future return that is determined by the number of customers using the facility. We investigate how the uncertainty affects the optimal location and construction timing of the facility under various assumptions.

■ SD62

H-Room 313, Third Floor

Behavioral Experiments in OM

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Yaozhong Wu, NUS Business School, 1 Business Link, Singapore, Singapore, bizwyz@nus.edu.sg

1 - Temporal Correlation of Lottery Choices and fMRI Imaging

Kay-Yut Chen, Hewlett Packard Laboratories, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, kay-yut.chen@hp.com, Tad Hogg, Brian Knutson

Decision theories consider evaluations of utilities to be independent across time. Experiments were conducted where subjects making lottery choices while their brains were scanned with fMRI techniques. We observe a non-trivial correlation of choices over time. fMRI data reveal temporal patterns of neural activations that suggests processes of utility evaluations. We developed a modified version of the quantal response model, with a specific correlation structure across time, to explain the data.

2 - Mental Balancing of Tradeoffs

Sanjiv Erat, University of California San Diego, 9500 Gilman Drive, La Jolla, CA, 92093, United States of America, serat@ucsd.edu

The concept of tradeoffs is central to much of our thinking of optimal operational decision making. In this presentation, I shall propose and give evidence for a mental heuristic that people employ in managing trade-offs. As an application, I shall also explore the implications of such a heuristic to biases in decision making in the classic newsvendor problem.

3 - Social Preferences, Culture and Performance in Teams

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, Christoph.LOCH@insead.edu, Kishore Sengupta, Ghufran Ahmad

An experimental study shows how problem solving routines (blocks of culture) develop at the micro-level, and how this type of cultural learning is influenced by the social interactions in the team.

4 - Consequences and Control of Present-Bias and Effort Distortion: An Experiment

Karthik Ramachandran, SMU Cox School of Business, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, karthik@cox.smu.edu, Yaozhong Wu, Vish Krishnan

We report findings from an experiment on the effects of present-bias of individuals on the quality of their performance. The experiment also measures the efficacy of deadlines in managing effort distortion by present-biased individuals, and their contribution to overall welfare of the participants.

■ SD63

H-Room 314, Third Floor

Joint Session OR Bio/HAS: Global Health and Medical Decision Making

Cluster: OR in Biomedicine and Global Health & Health Applications
Invited Session

Chair: Eva Lee, Associate Professor and Director, Georgia Institute of Technology, School of Ind & Sys Engineering, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

1 - Resource Allocation for Infectious Diseases
Benjamin Armbruster, Northwestern University, 2145 Sheridan Rd., IEMS C210, Evanston, IL, United States of America, armbruster@northwestern.edu

For an infectious disease, we model the optimal mix of interventions targeting different population groups under a budget constraint. With a short time horizon, the optimal strategy is to focus on the single intervention averting the great number of infections per dollar. With a longer time horizon, the nonlinear dynamics of disease spread become important and interventions previously considered less efficient become part of the optimal strategy. I apply these models to a numerical example.

2 - Disease Propagation Analysis and Mitigation Strategies for Effective Mass Dispensing
Chien-Hung Chen, Graduate Research Assistant, Georgia Tech, Industrial & Systems Engineering Department, Atlanta, GA, 30332, cchen@isye.gatech.edu, Eva Lee

Effective mass dispensing of medical countermeasures is an effective way to contain the outbreak of highly infectious disease. The large influx of individuals brought into the dispensing centers, however, raises the risk of intra-facility cross-infections. For understanding the intra-facility infection, we employ a real-time simulator to analyze the disease propagation within dispensing sites, and show how the results can help mounting an effective monitoring and response against such an event.

3 - Inventory Stockpiling and Sharing for Disaster Preparedness
Elodie Adida, University of Illinois at Chicago, 842 W. Taylor St., Chicago, United States of America, elodie@uic.edu, Po-Ching DeLaurentis, Mark Lawley

We address the problem of stockpiling a medical item in preparation for a disaster such as influenza pandemic. Taking into account the uncertain demand surge under various scenarios, we consider a game theoretical framework that captures the sharing of supplies during a disaster and the community-wide impact of a shortage.

4 - Optimization Strategies for Cancer Treatment Planning
Kyungduck Cha, Postdoc, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, chacha2000@isye.gatech.edu, Eva Lee

Cancer is one of the most common cause of death. In United States, the rate is nearly 1 in every 4. Universally, many patients receive radiation therapy as part of their cancer treatment. In this talk, we will describe various optimization issues and complexity related to cancer treatment. This includes management of competing/conflicting multiple objectives, and changes in tumor shape/position due to organ motion. Computational experience will be discussed.

■ SD64

H-Room 202A, Second Floor

2009 INFORM-ED Case Competition II

Sponsor: INFORM-ED (Education Forum)
Sponsored Session

Chair: Mike Racer, Associate Professor, University of Memphis, 302 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

1 - 2009 INFORM-ED Case Competition
Mike Racer, Associate Professor, University of Memphis, 302 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

This session will host the presentations of the finalists for this annual competition. A panel of judges from INFORM-ED will select the winners.

■ SD75

C-Room 32A, Upper Level

Next Generation Car Scheduling System II

Sponsor: Railroad Applications
Sponsored Session

Chair: Dharma Acharya, AVP - Operations Research, CSX Transportation, 500 Water St. J315, Jacksonville, FL, 32082, United States of America, Dharma_Acharya@CSX.com

1 - Design of Next Generation Car Scheduling Systems - Lessons Learned From Prior Systems
Carl Van Dyke, Partner, Oliver Wyman, 212 Carnegie Center, 3rd Floor, Princeton, NJ, 08540, United States of America, carl.vandyke@oliverwyman.com

The very first car scheduling systems were created almost 40 years ago. The fundamental capabilities of these systems has not changed significantly over this time period. At the same time, the industry has changed dramatically, with the rise of unit train and intermodal services, which are unsupported by these existing systems. As railways create the next generation of such systems, it is time to look at the lessons of the past 40 years, and factor them into the design of the new systems.

2 - Current and Future Car Scheduling System at BNSF
John Orrison, AVP Service Design and Performance, BNSF Railway Company, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United States of America, john.orrison@bnsf.com

In this presentation, we will describe the features of the existing car scheduling system at BNSF. We will also discuss the desired features/functionalities of a future-state car scheduling system.

3 - Computational Results of Several Dynamic Trip Planning Approaches
Ravindra Ahuja, President, Innovative Scheduling, GTEC, 2153 SE Hawthorne Road, Suite 206, Gainesville, FL, 32641, United States of America, ravi@innovativescheduling.com

We believe that dynamic trip planning for railcars can increase a railroad's network capacity significantly without much capital investments. In this presentation, we will present comparative computational results of several dynamic trip planning algorithms on real-life railroad data: (i) a railcar has single/multiple car-block sequences; (ii) a block has single/multiple block-train assignments; and (iii) a railcar's route remains static after arrival or it dynamically changes in route.