



Operations Research

Publication details, including instructions for authors and subscription information:
<http://pubsonline.informs.org>

In This Issue

To cite this article:

(2017) In This Issue. Operations Research 65(5):ii-v. <https://doi.org/10.1287/opre.2017.1686>

Full terms and conditions of use: <https://pubsonline.informs.org/Publications/Librarians-Portal/PubsOnLine-Terms-and-Conditions>

This article may be used only for the purposes of research, teaching, and/or private study. Commercial use or systematic downloading (by robots or other automatic processes) is prohibited without explicit Publisher approval, unless otherwise noted. For more information, contact permissions@informs.org.

The Publisher does not warrant or guarantee the article's accuracy, completeness, merchantability, fitness for a particular purpose, or non-infringement. Descriptions of, or references to, products or publications, or inclusion of an advertisement in this article, neither constitutes nor implies a guarantee, endorsement, or support of claims made of that product, publication, or service.

Copyright © 2017, INFORMS

Please scroll down for article—it is on subsequent pages



With 12,500 members from nearly 90 countries, INFORMS is the largest international association of operations research (O.R.) and analytics professionals and students. INFORMS provides unique networking and learning opportunities for individual professionals, and organizations of all types and sizes, to better understand and use O.R. and analytics tools and methods to transform strategic visions and achieve better outcomes. For more information on INFORMS, its publications, membership, or meetings visit <http://www.informs.org>

In This Issue

<https://doi.org/10.1287/opre.2017.1686>

Copyright: © 2017 INFORMS

Translating Experts' Intuition and Judgments into Probability Distributions

When historical data are not relevant to future, how can firms harness available in-house expertise to quantify uncertainties for new products? In "Using Experts' Noisy Quantile Judgments to Quantify Risks: Theory and Applications to Agribusiness," S. Bansal, G. Gutierrez and J. Keiser develop new theory to estimate the mean and standard deviation of probability distributions as weighted averages of quantile noisy judgments provided by domain experts. The theoretical development explicitly models and incorporates judgmental errors present in the quantile judgments into the estimation process. The approach provides a statistical basis to a number of numerical observations made in the prior decision analysis literature for the weights used on quantile judgments. The results were implemented for a high stakes annual decision in the agribusiness domain, at Dow AgroSciences, with substantial monetary and non-monetary benefits. The article also describes steps of implementing the approach at Dow, including a simple way to calibrate experts' quantile judgments. The implementation details also constitute a useful roadmap for other academicians and industry managers to use.

Screening Strategies for Patients on the Kidney Transplant Waiting List

Transplant centers screen patients on the kidney transplant waiting list to identify patients with severe conditions such as cardiovascular disease (CVD), which makes them ineligible for a transplant. In "Screening Strategies for Patients on the Kidney Transplant Waiting List," A. Sabouri, W. T. Huh and S. M. Shechter develop a framework to optimize the decision of when to screen patients based on their characteristics and position on the waiting list. The authors show that current screening guidelines, which are based only on patients' risk for developing CVD, are significantly dominated by their proposed model-based policy, which also considers factors predictive of patients' remaining waiting time. The authors also propose an intuitive regression model that simplifies the implementation of their policy.

Will Stochastic Programming Stand Up Under Exercise of Market Power?

With increasing penetration of renewable energy in the electricity generation mix, volatility has reached unprecedented levels. A number of stochastic market clearing mechanisms have been introduced to facilitate seamless integration of renewables into electricity markets. These stochastic auctions however uniformly assume that electricity markets

are perfectly competitive. In "Single and Multi-settlement Approaches to Market Clearing under Demand Uncertainty," J. Khazaei, G. Zakeri, and S. Oren relax the assumption of perfect competition and for the first time take a close look at stochastic market clearing under exercise of market power. We find that even in imperfectly competitive markets, the net benefit increases under stochastic mechanisms.

The Gamblers' Challenge

Two gamblers are competing to see who can do better in a visit to a casino offering fair odds. They visit the casino separately, each with a starting capital of \$100. A gambler who loses all his money must leave, but while solvent he can continue as long as he wants, or quit at any time. Afterwards, they compare their results. What gambling strategies should they use? This is an example of a "winner-take-all" game, where results are obtained by risk rather than effort. In "Winner-Take-All Games: Strategic Optimisation of Rank," S. Alpern and J. V. Howard analyse such games. They model the general case, where each player is given a convex set of non-negative distributions as pure strategies. Each picks a distribution from his set, the distributions are sampled independently, and the player with the highest sampled number wins the game.

Three-Part Pricing when Consumers are Heterogeneous & Forward-Looking

The popularity of three part-tariff plans has increased during the last decade. A typical plan includes three instruments: a fixed fee, number of free units (e.g., GB of data) and overage price above the limit. Tailoring such plan is a tough managerial task as the underlying mathematical problem is complex. In "Optimal Three-Part Tariff Plans," G. Fibich, R. Klein, O. Koenigsberg, and E. Muller characterize the optimal plans for variety of cases. For example, with homogeneous consumers, the optimal plan is to let consumers use as many units as they want, and extract all their utility through the fixed fee. With heavy and light users, an intuitive contract is a plan that maximizes profits from light consumers through the fixed fee, and optimizes profits from the heavy consumers by a choice of the overage price. However, we find that the optimal policy is to reduce the allotted free units, and to increase the overage price. Under such plan, the light users consume less than the total amount that they can consume for free and the firm compensates for this by extracting profits from the overage use of the heavy users.

Simulating Prices Exactly with Affinely Diffusing Wishart Stochastic Volatility Matrix

Heston's stochastic volatility model has been the most popular volatility model to capture the skews in option markets. However, empirical researches found some limitation

of Heston model: it cannot generate realistic term structures of volatility smiles. As a generalization of the Heston model, the Wishart multidimensional stochastic volatility model can fit both the long-term volatility level and the short-term skew as well as stochastic leverage effects. In “Exact Simulation of the Wishart Multidimensional Stochastic Volatility Model,” C. Kang, W. Kang, and J. M. Lee propose an exact simulation scheme, which is free from discretization errors, for a single asset price under a multidimensional Wishart variance process. Motivated by the Broadie and Kaya’s method, theirs is based on analysis of the conditional characteristic function of the log-price given a terminal volatility level. They take a more direct approach and the new scheme provide an explicit formula of the conditional characteristic function for the Heston model.

Playing Hide-and-Seek for High Stakes

While most of us can remember playing hide-and-seek for fun as children, or with our children, it is often played out for high stakes by terrorists and others who don’t want to be found by the ‘authorities’ who are searching for them. Recent examples are the cross border escapes, and eventual capture, from attacks in Paris and Berlin. A new and simplified version of hide-and-seek is proposed by S. Alpern, in his article “Hide-and-Seek Games on a Network, Using Combinatorial Search Paths.” This model assumes the search region is a network and that the searcher must choose a sequence of arcs in constructing a ‘combinatorial’ path to follow. The earlier search paradigm allowed more complex path structure (including turning around inside an arc) which has slowed down recent progress in the field. It is hoped that the simplified model will allow continued progress to solve the search game on many more classes of networks.

Modeling Demand and Setting Prices for a Line of Products with Feature Overlap

A product within a line of products offered by a firm will often share some of the features of other products in the line, a characteristic that can result in correlation among choice alternatives under random utility maximization. The well-known nested logit model allows for correlation under a strict regime and, for model estimation, requires that a hierarchical decision structure be specified in advance. In “Optimal Pricing of Correlated Product Options under the Paired Combinatorial Logit Model,” H. Li and S. Webster consider a different approach that allows for correlation between each pair of choices. They show that the cross-nesting flexibility greatly increases the complexity of the pricing problem. To overcome this difficulty, they apply the theory of P-matrix to identify conditions for tractability, develop an efficient procedure for finding optimal prices, and characterize how optimal revenue and prices change with respect to correlation between products.

Managing Multi-Echelon Supply Chains in a Dynamic Demand Environment

As supply chains have been stretched long and thin due to globalization, companies also increasingly face more dynamic demand when serving new markets. In “Serial Inventory Systems with Markov-Modulated Demand: Derivative Bounds, Asymptotic Analysis, and Insights,”

L. Chen, J.-S. Song, and Y. Zhang bring new insights to optimal inventory control of multi-echelon supply chains with demand uncertainties driven by dynamic environmental factors. By leveraging an innovative derivative analysis approach, the authors obtain analytical bounds for the optimal solution and prescribe a simple-to-compute, near-optimal derivative-based heuristic. They further characterize the proposed heuristic’s asymptotic performance under long lead time, and show that its computational complexity is superior to existing methods. Numerical experiments reveal that the dynamic demand environment can induce drastically different system behaviors compared to the stationary demand case.

Shipping Seasonal Products with a Carrier Portfolio

For shipping seasonal products, the shipments arriving earlier in the destination market may sell at higher prices but faster shipping services can be costly. In “Carrier Portfolio Management for Shipping Seasonal Products,” T. Lu, J. Fransoo and C.-Y. Lee study a newsvendor-type shipper who transports and sells products to an overseas market where the selling price declines over time. A set of vessels with different schedules and freight rates are available to choose from. Their analysis demonstrates that a portfolio of carriers has two distinct effects on mitigating uncertainties in both demand and vessels’ arrival schedules, while these two portfolio effects have been previously understood as separate issues in the literature. Through analyzing several special cases, a general solution approach is proposed to determine the optimal portfolio. They also present a numerical study based on a real-world case.

The Impact of Inbound Transportation on Inventory Optimization

In “Stochastic dynamic inventory problem under explicit inbound transportation cost and capacity,” L. Zhang and S. Cetinkaya consider a generalization of the classical, finite horizon, stochastic dynamic inventory problem where a private-fleet with capacitated trucks is used for inbound transportation. The authors generalize the concept of non-K-decreasing and offer a complete characterization of the optimal policies, solving a fundamental stochastic control problem that has remained open in the literature for over four decades.

Optimal Supply Chain Contracts for Dynamic Environments

Traditional supply chain contract theory says that optimal contracts take the form of quantity discount contracts. This statement, however, is based on a single-period model. What happens in a dynamic environment where the seller is allowed to offer a long-term contract? In “Optimal Long-Term Supply Contracts with Asymmetric Demand Information,” I. Lobel and W. Xiao study what happens in a dynamic model where the retailer has private information that arrives over time. They consider two cases: backlogging and lost sales. Under backlogging, they show that optimal contracts are quite simple, involving only upfront fees and wholesale prices. Under a lost sales model, the optimal contract must also include an option to reduce the retailer’s wholesale price in exchange for an immediate payment to the manufacturer.

How to Optimally Manage Inventory under Total Minimum Order Commitments and Two Supply Options?

Total minimum order commitment (TMC) contracts, under which the purchasing firm commits to buying a minimum quantity of products from its supplier during a contract period, are widely used in practice. Meanwhile, many firms have two supply options with different costs and lead times to balance responsiveness and efficiency. In “Dynamic Inventory Management with Total Minimum Order Commitments and Two Supply Options,” T. Wang, X. Gong and S. X. Zhou show that when TMC is on the total orders from both supplies, the optimal policy is determined by three critical numbers in each period whereas when TMC is on the order from each supply, the optimal policy depends on the inventory and remaining commitments. For the latter case, a simple and effective heuristic is developed. The importance of properly managing inventory under TMC contracts and some related issues on the firm’s contract selection are discussed.

A Dynamic Discretization Discovery Algorithm for Service Network Design Problems

Carriers that transport shipments that are small relative to container capacity must consolidate shipments to achieve high container utilization and low transportation costs. Consolidation is achieved by coordinating the routes for shipments through the network of terminals and the schedules of the vehicles transporting the shipments. Traditionally, the temporal component in consolidation planning models has been approached by an a priori discretization of time, resulting in time-expanded network models. In “The Continuous Time Service Network Design Problem,” N. Boland, M. Hewitt, L. Marshall, and M. Savelsbergh present an alternative approach: an iterative refinement algorithm that repeatedly solves a service network design problem defined on a partially time-expanded network, and refines that partially time-expanded network based on an analysis of the most recent solution: the time discretization is discovered dynamically. The authors show that the algorithm not only has desirable theoretical properties, but that it also performs well in practice.

Modeling the Customer Choice Process Through Transitions Among the Products

Assortment optimization involves finding the revenue-maximizing set of products to offer given that customers choose among the offered products according to a certain choice model. One tradeoff in assortment optimization is that a sophisticated choice model may capture complicated choice behavior, but it may render the problem of finding the revenue-maximizing set of products intractable. In “Revenue Management under the Markov Chain Choice Model,” J. B. Feldman and H. Topaloglu consider assortment optimization models when the choice process is modeled through transitions of a Markov chain from one product to another. Under this choice model, one can efficiently find the revenue-maximizing set of products to offer. For revenue management with a single resource, the authors characterize how the optimal set of products to offer changes as a function of the remaining resource inventory. For revenue management over a resource network, the authors show how to tractably solve a fluid approximation.

Winning National Football League Survivor Pools

In “Surviving an NFL Survivor Pool,” D. Bergman and J. Imbrogno examine strategies for National Football League (NFL) survivor pools. These increasingly popular betting pools require participants controlling a limited number of entries to pick, for each entry, a team to win at the start of each week of the NFL season, where no entry can pick a given team more than one. The goal of a participant is to select for one of his/her entries a longer sequence of winning teams, starting in the first week, than any other participants’ entries. The authors discuss connections between this problem and sequential stochastic assignment problems, and develop an optimization model based on the Principle of Inclusion-Exclusion that encodes the complex dependencies between the choices among the entries. Experimental results indicate that the model developed identifies strategies that are far superior to millions of simulated strategies.

Computing Performance Bounds for Infinite Horizon Dynamic Programs

Stochastic dynamic programs are often very difficult to solve to optimality. Consequently, we often rely on heuristic policies that may not be optimal. Although we can evaluate the performance of a heuristic policy using Monte Carlo simulation, it is also useful to know how much better we could do with an optimal policy. In “Information Relaxation Bounds for Infinite Horizon Markov Decision Processes,” D. Brown and M. Haugh study the information relaxation approach for calculating lower bounds on the expected cost given by an optimal policy. This approach relaxes the non-anticipativity constraints that require decisions to depend only on the information available and imposes penalties that punish violations of these non-anticipativity constraints. The authors extend the information relaxation approach to infinite horizon problems and develop problem reformulations that can greatly simplify the solution of the relaxed problems by reducing the number of states that need to be considered. Among other results, they show that weak and strong duality continue to hold under these reformulations. They demonstrate the use of these techniques in applications involving inventory management with an autoregressive demand process and dynamic service allocation for a multiclass queue.

Refined Queueing Models to Manage Delay Announcement

Delay announcements affect customers’ behavior in service systems and hence also operational performance, which one could use for the mutual benefits of customers and service systems. In “Refined Models for Efficiency-Driven Queues with Applications to Delay Announcements and Staffing,” J. Huang, A. Mandelbaum, H. Zhang, J. Zhang analyze these benefits in the context of telephone call center and consider the central operational problem of staffing a call center that offers delay announcements. The call center is modeled as a many-server queueing system in the ED+QED regime. The authors analyze two types of delay announcement: announce upon arrival or during waiting. For both types, one must incorporate the instantaneous impact of an announcement on customers, which formally translates into distribution discontinuity of customer-patience. The latter requires one to go beyond existing theory of many-server queues, which gives

rise to their theoretical contribution. Practically, their analysis shows that, through exercising delay announcements, one can reduce staffing levels by significant amounts and hence significantly save on operating costs.

Flexible Queueing Architecture

In “Flexible Queueing Architectures,” J. Tsitsiklis and K. Xu study a multi-server model with n flexible servers and n queues, connected through a bipartite graph, where the level of flexibility is captured by an upper bound on the graph’s average degree, d_n . Applications in content replication in data centers, skill-based routing in call centers, and flexible supply chains are among their main motivations. The authors focus on the scaling regime where the system size n tends to infinity, while the overall traffic intensity stays fixed. They show that a large capacity region and an asymptotically vanishing queueing delay are simultaneously achievable even under limited flexibility ($d_n \ll n$). Their main results demonstrate that, when $d_n \gg \ln(n)$ a family of expander-graph-based flexibility architectures has a capacity region that is within a constant factor of the maximum possible, while simultaneously ensuring a diminishing queueing delay for all arrival rate vectors in the capacity region. Their analysis is centered around a new class of virtual-queue-based scheduling policies that rely

on dynamically constructed job-to-server assignments on the connectivity graph. For comparison, they also analyze a natural family of modular architectures, which is simpler but has provably weaker performance.

A Cube-Root Formula for Optimal (r, q) Policies under Independent Stochastic Leadtimes

The reorder-point, order quantity (r, q) policy is widely used in practice and is well understood when leadtimes are sequential so orders do not crossover. One key insight is that the optimal order quantity can be reasonably approximated by the celebrated EOQ formula, which has a square-root relationship with the demand rate. However, it is not known whether this is still true when the orders are processed in a parallel environment (with multiple supply sources) so they may crossover. In “Closed-Form Approximations for Optimal (r, q) and (S, T) Policies in a Parallel Processing Environment,” M. Ang, K. Sigman, J.-S. Song, and H. Zhang consider an inventory system with a renewal demand process and i.i.d. stochastic leadtimes. Using techniques from stationary marked point process and heavy traffic limit, they establish closed-form expressions for the optimal policy. They demonstrate that in this setting the well-known square-root relationship is replaced by the cube root.