



## Operations Research

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

### In This Issue

To cite this article:

(2014) In This Issue. Operations Research 62(5):ii-iv. <https://doi.org/10.1287/opre.2014.1320>

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](mailto: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 © 2014, 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

### Balance Relevancy and Diversity in Recommendation

Recommender systems have been widely used by online stores to suggest items of interest to users. These systems often identify a list of items from a much larger set that best matches the user's interest. A key concern with existing approaches is over-specialization, which results in returning items that are too similar to each other. In "Choice-Based Recommender Systems: A Unified Approach to Achieving Relevancy and Diversity," H. Jiang, X. Qi, and H. Sun propose to use choice probability to measure the overall quality of a recommendation list, which unifies the desire to achieve both relevancy and diversity in recommendation. The authors model the recommendation problem under the multi-level nested logit model and formulate it as a nonlinear binary integer programming problem. They develop an efficient dynamic programming algorithm that solves the problem to optimum in polynomial time.

### Managing the Introduction of a New Product or Service

When a new product or service is introduced, sales over time are typically dynamically influenced by word-of-mouth as well as by the firm's decisions on marketing and distribution. Appropriate marketing support strategies must be specified to induce the best sales pattern over a limited introduction time. However, the success of these strategies is heavily tied to the accessibility of the retail facilities where the product will be distributed, whether physical stores or virtual ones such as internet or phone. In "Supporting New Product or Service Introductions: Location, Marketing, and Word of Mouth," V. S. Abedi, O. Berman, and D. Krass present and analyze a framework for the joint design of the network of retail facilities and marketing strategies in the presence of word-of-mouth effects and limited time horizon. They demonstrate that significant profit improvement can be achieved by jointly optimizing the design of the network of retail facilities with the choice of marketing strategies.

### Bounding Ambulance Performance

Ambulance organizations strive to minimize response times to calls by making efficient use of their resources. This increasingly involves redeploying available ambulances in anticipation of future demand. Finding the truly best way to redeploy ambulances appears to be intractable. In "A Bound on the Performance of an Optimal Ambulance Redeployment Policy," Maxwell et al. develop a bound on the performance of an optimal redeployment policy without explicitly constructing such a policy. The bound can be used, for example, to establish beyond a doubt that a proposed set of ambulance shifts cannot attain a desired level of performance, or to determine bounds on optimality gaps for specific redeployment policies.

### Blocking Rocket Attacks

The role in which ballistic missile defense systems have seen the most combat is tactical defense against short-range weapons. In particular, since 2011 Israel has been using its Iron Dome systems to try to intercept incoming artillery rockets. In "Modeling short-range ballistic missile defense and Israel's Iron Dome system," M. J. Armstrong develops a simple model of such systems. He then uses it to analyze the performance of Israel's systems during the November 2012 conflict. If the Iron Dome units performed as well as claimed, their interceptions saved Israel an estimated 1,778 casualties and \$80 million in property damage. They thereby made a potential invasion of Gaza 8 times less valuable to Israel. However, such performance depends heavily on the missile salvo size. Ironically, systems with higher interception rates are more "fragile" when overloaded by larger salvos.

### Inventory Management for Business-to-Consumer Supply Chains

Most of the theory of inventory optimization in supply chains assumes that demand that a firm is unable to meet immediately from stock is backordered. While this assumption reflects business-to-business interactions well, it does not provide a good model for managing business-to-consumer retail supply chain inventories. The authors of this paper consider the alternate assumption that unmet demand leads to lost sales, which depicts such retail situations better. They analyze this inventory model and propose easy-to-implement inventory management policies/strategies for such situations and demonstrate the cost effectiveness of these strategies.

### Optimal Replenishment Rate for Production-Inventory Systems with Lost-Sales

Production-inventory systems with constant production rate are often deployed, even in the presence of random demand, when frequent production rate changes are financially or operationally prohibitive. In addition, manufacturers often employ "full capacity" production policies. For example, the refinery industry has operable capacity utilization rate of 92% or even higher. The production capacity level corresponding to a constant production rate has a critical impact on the firm's cost structure, its inventory policies and its service levels, as well as its management and staff support requirements. This study investigates the optimal production rate, and hence production capacity, of a firm from a long-term cost minimization perspective. In this paper, optimal replenishment rates are derived so as to minimize two metrics of operational costs over an infinite time horizon: the total expected discounted costs of inventory holding and lost-sales, and the long-run time average of the same costs.

## Effects of the Observability of Demand Distribution and Lost Demand in Service-Dependent Demand

A customer may leave a seller's market after experiencing an inventory stockout. Traditionally, researchers and practitioners assume a single penalty cost to model this customer behavior of stockout aversion. Recently, a stream of researchers explicitly model this customer behavior and support the traditional "penalty cost" approach. In "Statistical Learning of Service-Dependent Demand in a Multiperiod Newsvendor Setting," T. Deng, Z. J. M. Shen, and J. G. Shanthikumar study the statistical learning of service-dependent demand by building and investigating four models: the state of demand distribution may or may not be observed and the demand in excess of available inventory may or may not be observed. The authors find that all four models support the traditional "penalty cost" approach. This result confirms the use of a state-independent stockout penalty cost in the presence of demand learning.

## Dynamic Pricing and Inventory Management under the Scarcity Effect of Inventory

The negative correlations between demand and inventory (i.e., the scarcity effect of inventory) have been observed in a wide range of industries (e.g., automobile, electronics, etc.) and well-studied in psychological and economic theories. Firms can deal with the scarcity effect of inventory by pricing, withholding, or disposing inventory. In "Dynamic Pricing and Inventory Management under Inventory-Dependent Demand," N. Yang and R. Zhang characterize the optimal joint dynamic pricing/inventory withholding/inventory disposal policy under the scarcity effect of inventory. They show that the scarcity effect of inventory leads to higher overage risk, and hence, lowers the optimal sales price and inventory level. They study how the operational flexibility (i.e., inventory disposal and inventory withholding) helps mitigate the increased overage risk and how a firm should take advantage of strong scarcity effect.

## Using Reduced Costs for Finding Heuristic Solutions of the Transportation Problem with Fixed Costs

The fixed-charge transportation problem (FCTP) generalizes the well-known transportation problem by considering additional fixed costs for sending flows from origins to destinations. The paper "A Reduced-Cost Iterated Local Search for the Fixed-Charge Transportation Problem," E. Buson, R. Roberti, and P. Toth proposes a two-phase heuristic algorithm for the FCTP based on an Iterated Local Search (ILS) metaheuristic enhanced by the utilization of reduced costs for guiding the restart phase. First, the algorithm computes a sequence of lower bounds and the corresponding dual solutions, by solving the linear relaxation of a three-index formulation strengthened with valid inequalities. Then, the heuristic search is performed through an ILS where the perturbation of the local minima is guided by the reduced costs associated with the lower bounds computed in the first phase. The resulting Reduced-Cost Iterated Local Search heuristic improved the best-known upper bounds of all open instances of a classical testbed from the literature.

## Dynamically Routing a Traveling Salesman

The problem of routing a vehicle to visit a set of destinations becomes even more challenging when the cost of traveling between

locations is uncertain. In "A Dynamic Traveling Salesman Problem with Stochastic Arc Costs," A. Toriello, W. B. Haskell, and M. Poremba study one of the most fundamental routing problems under the assumption that outgoing travel costs are only revealed upon arrival at a location; such a setting mimics real-time traffic routing and similar applications. The authors show that dynamically reacting to new cost information can produce far better routes than any static plan, and use various approximate techniques to bound the problem and produce high-quality heuristic policies.

## Two-Dimensional Packing for the Delivery of Large and Heavy Items

In a number of applications, commercial delivery vehicles must carry large and heavy items. In this context, the item(s) delivered to the current customer should be directly accessible in the loading area of the vehicle, that is, without moving any item intended for other customers. This situation gives rise to packing problems with unloading constraints. In "An Exact Algorithm for the Two-Dimensional Orthogonal Packing Problem with Unloading Constraints," by J.-F. Côté, M. Gendreau, and J.-Y. Potvin, an exact branch-and-cut algorithm is proposed to solve the two-dimensional case. Several preprocessing techniques aimed at reducing the size of the solution space and uncover infeasibility are also described. The paper concludes with a comparison with the best known exact method on a set of benchmark instances.

## Dynamic Pricing with Demand Learning

Pricing of products and services involves a fundamental trade-off between learning and earning: (i) learning about consumer demand to increase future revenues; and (ii) earning immediate revenues. Different forms of price experimentation are typically employed, often in a very ad hoc manner, to resolve this trade-off. In "Dynamic Pricing with an Unknown Demand Model: Asymptotically Optimal Semi-Myopic Policies," N. B. Keskin and A. Zeevi study a dynamic pricing model with demand model uncertainty, and offer practical guidelines for successful price experimentation. In particular, they develop a unified theme to analyze dynamic pricing problems with demand learning, and derive general conditions that ensure near-optimal revenue performance via careful balancing of the aforementioned trade-off between learning and earning.

## Dynamic Pricing on the Fly

There is little doubt that dynamic pricing has become very prevalent in many industries. But, how should the firm dynamically adjust its price? Is there an easy-to-implement update rule that does not require frequent (and potentially time-consuming) reoptimizations? In "Reoptimization and Self-Adjusting Price Control for Network Revenue Management," S. Jasin proposes a simple improvement of the popular static price introduced in Gallego and van Ryzin (1994, 1997) and analyzes its performance. The proposed heuristic only requires a single optimization at the beginning of the selling horizon and does not require any reoptimization at all. This takes away the burden of reoptimization and allows firms to implement dynamic pricing on the fly. From practical point of view, it is also possible to combine the proposed heuristic with a few reoptimizations. Thus, creating a hybrid price control which allows the firm to still enjoy the benefit of reoptimizations without overdoing it.

## **A Queuing Model for Financial Markets with Nonvisible Order Books**

Crossing networks or dark pools are alternative financial trading venues. They differ from more familiar markets such as NYSE and NASDAQ in that their order book is not visible to market participants and price is established exogenously, for example by the NBBO bid/ask spread midpoint. In 2010 over 13% of U.S. market volume traded in these markets, increasing at a 30% rate. Because of this, market participants and regulators are

greatly interested in understanding their behavior. In “Double-Sided Batch Queues with Abandonment: Modeling Crossing Networks,” P. Afèche, A. Diamant, and J. Milner present the first queueing model of these markets, characterizing their steady-state behavior and determining the average system- and customer-level fill rates and flow times. They show a close correspondence between their model and simulated customer behavior representative of traders. Significantly, they demonstrate that abandonment is best modeled as a constant rather than linear function of the queue length.