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Are Hospitals Building Too Many Private Rooms?

There is a trend toward greater use of private rooms in hospitals motivated by concerns about privacy, comfort, and infection control. Although semiprivate rooms have more space and are more cost efficient in terms of beds per square foot or dollar spent, these benefits are eroded by the need to isolate some patients. In "Determining the Optimal Configuration of Hospital Inpatient Rooms in the Presence of Isolation Patients," E. Pinker and T. Tezcan use a queueing model to investigate the impact of hospital bed configuration on access to care. They find evidence that hospitals that are building units with 100% private rooms may be creating a situation in which access to care is diminished. These results suggest that it may be beneficial for hospitals to explore other mechanisms for achieving the benefits that are claimed for private rooms rather than by increasing the cost of bed construction.

Managing Visit Intervals to Improve Patient Care

A key prerequisite for successful management of chronic conditions is that patients visit their provider at regular intervals. Visit intervals prescribed in clinical guidelines are often based on the individual's health status and do not explicitly account for capacity constraints that might render them infeasible. In "Improving Health Outcomes Through Better Capacity Allocation in a Community-Based Chronic Care Model," S. Deo, S. Iravani, T. Jiang, K. Smilowitz, and S. Samuelson overcome this challenge by analyzing a capacity allocation model combined with a model of disease progression. They derive policies that dynamically modify the visit intervals based on the current health state of the entire patient population under care. Using clinical and operational data from a community-based provider of care for childhood asthma, the authors show that implementing proposed polices could significantly improve health outcomes over the current policy of fixed visit intervals without any other medical intervention.

Role of Tiered Penalties in Repair Services

In the after-sales service supply chain, performance-based contracts (PBCs) have become popular in practice. Although practitioners recognize the potential merits of PBCs in aligning incentives, they have also expressed concerns about the detrimental role of PBCs in the service provider's financial health. However, there is limited literature on the impact of this detrimental role of PBCs on the service provider's decision making. In addition, the extant literature lacks in understanding of efficacy of PBCs in an important class of repair outsourcing settings, wherein the equipment's performance is determined jointly by efforts of the client and the service provider. Such settings may entail agency issue of double-sided moral hazard. In "Optimal Contracts for Outsourcing of Repair and Restoration Services," N. Jain, S. Hasija, and D. G. Popescu analyze the efficacy of commonly observed/studied contracts in repair outsourcing settings that entail double-sided moral hazard and contract-induced financial distress to the service provider.

Re-Solving Booking Limit and Bid Price Do Not Matter

In "Analysis of Deterministic LP-Based Booking Limit and Bid Price Controls for Revenue Management," S. Jasin and S. Kumar study the impact of frequent re-solvings of two popular LP-based heuristics known as the booking limit and bid price controls. In contrast to other known results in the literature, where re-solving has been shown to effectively reduce revenue loss, they show that re-solving either booking limit or bid price does not have a significant impact on revenue performance, at least not asymptotically. They also show that further variations within the policy classes such as using nested booking limit instead of partition booking limit does not help: re-solving does not improve the performance of nested booking limit either. Their results highlight a limitation of re-solving an LP when the solution of the LP is interpreted as either a booking limit or a bid price.

Managing Capacity When Asking for Service Is Costly

Asking for service is often costly. Walking into a restaurant or a barbershop takes time and effort but may only result in being turned away without being served. In "Saving Seats for Strategic Customers," E. B. Çil and M. A. Lariviere examine how such "travel" costs affect how a service provider should divide capacity between customers who ask for service in advance (i.e., request a reservation) and those who walk in at the time of service. Intuitively, one might expect that the firm should restrict the number

of reservations it gives out in order to increase availability for walk-in customers. A greater chance of being served encourages more customers to walk in. Although this is often the correct policy, when walk-in customers are worth more to the firm, the firm may be better off giving out additional reservations. Indeed, high travel costs may make a reservations-only policy optimal.

Computationally Efficient Optimization of Complex and Inefficient Stochastic Network Simulators

Urban congestion in the United States cost an estimated $121 billion in 2011. Federal, state, regional, and local transportation agencies, as well as transportation consultants, rely on traffic simulation models to inform the planning and operations of congested urban road networks. The use of the most detailed stochastic network models is mostly limited to what-if analysis. There is a lack of efficient simulation-based optimization methods for such complex simulators. In "A Simulation-Based Optimization Framework for Urban Transportation Problems," C. Osorio and M. Bierlaire propose a simulation-based optimization method that enables complex stochastic network simulators to identify points with improved performance under tight computational budgets. They use the method to address an urban traffic signal control problem. It outperforms a traditional simulation-based optimization approach. The main idea is to combine information from the simulator with information from an analytical network model, which provides structural and tractable problem information.

Design and Management of Public Bicycle-Sharing Systems

In "Models for Effective Deployment and Redistribution of Bicycles Within Public Bicycle-Sharing Systems," J. Shu, M. C. Chou, Q. Liu, C.-P. Teo, and I.-L. Wang develop network flow models with proportionality constraints to support decision making in the design and management of public bicycle-sharing systems. The models help estimate the flow of bicycles within the network and the number of trips supported, given an initial allocation of bicycles at each station. The authors also examine the effectiveness of periodic redistribution of bicycles in the network to support greater flow, and the impact on the number of docks needed. The models are validated by numerical analysis using transit data from train operators in Singapore. The authors conclude that for a bicycle-sharing system to be most effective, the system must deploy the right number of bicycles at the right places, as this affects the utilization rate of the bicycles and how bicycles circulate within the system.

Location, Location, Location

Hub-and-spoke distribution models, a fundamental paradigm in geographic location analysis, allow one to exploit economies of scale on transportation costs and economies of scope in the use of shared transshipment facilities. In determining the optimal solution to a hub-and-spoke location problem, one must consider many factors, such as the number of hub nodes to use, their placement, and the optimal backbone network topology employed to connect nodes. In "Euclidean Hub-and-Spoke Networks," J. G. Carlsson and F. Jia take a geometric approach to hub-and-spoke location and network design. They consider various hub-and-spoke problems in the Euclidean plane, where demand is distributed uniformly within a bounded region, and give asymptotic and algorithmic analyses for various natural location problems. The optimal solutions to these problems often exhibit surprising and counterintuitive structures, such as placing all hub nodes in an Archimedean spiral or a "contracted honeycomb" tiling.

When Forecasters Compete, You Win

In "The Wisdom of Competitive Crowds," K. C. Lichtendahl Jr., Y. Grushka-Cockayne, and P. E. Pfeifer show how a decision maker can benefit when forecasters compete. To capture these gains, the decision maker organizes a winner-take-all contest. A prize goes to the contestant whose forecast is closest to the outcome of an uncertain quantity, such as GDP growth or sales revenue. In a typical crowd, forecasters have some information in common, and each forecaster has his or her own private information. To win, forecasters do not place proper weights on their private and the common information in their entries. Rather than encourage truthful forecasts, the competition provides incentives for forecasters to exaggerate or overweight their private information. To find the competitive crowd's forecast, the decision maker averages the forecasters' entries. Because of the competition, the crowd is wiser: the average exploits the forecasters' private information more fully.

Preference Conditions for Satiation and Habit Formation in Intertemporal Choice

When making intertemporal choices, the past consumption experience of a decision maker may influence his or her preference in the current period through satiation and habit formation. In "On the Axiomatization of Satiation and Habit Formation Utility Models," Y. He, J. S. Dyer, and J. C. Butler study the preference conditions that justify a family of utility models that incorporate either the satiation effect or the habit formation effect, or both, when a decision maker evaluates different intertemporal consumption streams. They propose "shifted difference independence"—that is, under different levels of past consumption, the utility function used by the decision maker to evaluate the consumption streams will shift according to the satiation and habit formation. By generalizing this condition, the authors show that the satiation and habit formation functions in the utility models could be linear functions of the past consumption levels, which is consistent with the functional forms usually assumed in the literature.

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Pushing the Envelope for Sequential Scheduling

Sequential scheduling refers to determining the best order for performing a set of tasks, for example in the context of routing or manufacturing applications. This broad class includes sequencing problems with precedence constraints, time windows, and various objective functions such as minimize makespan, sum of setup times, and tardiness. Despite decades of progress, many practical sequential scheduling problems are still computationally intractable to solve optimally, even when only 50 tasks need to be sequenced. In "Multivalued Decision Diagrams for Sequencing Problems," A. A. Cire and W.-J. van Hoeve introduce a generic solving methodology for sequencing problems, utilizing multivalued decision diagrams. Multivalued decision diagrams (MDDs) provide a graphical model that can, in principle, compactly represent all possible orderings. To avoid exponential-sized MDDs, the authors study relaxed MDDs by imposing a maximum size. The authors incorporate relaxed MDDs within a generic constraint-based scheduler and obtain orders of magnitude improvement over the state of the art.

Sharing Traveling Salesman Costs

Cost sharing in joint transportation ventures is difficult, usually involving trade-offs between allocation stability and efficiency. In "On Traveling Salesman Games with Asymmetric Costs," A. Toriello and N. A. Uhan study the traveling salesman game in the presence of nonnegative asymmetric arc costs satisfying the triangle inequality. They show how to efficiently construct a stable cost allocation that recovers a fraction of the cost equal to the well-known Held-Karp integrality gap. The construction exploits the traveling salesman problem's parsimonious property and a previously unknown connection to Owen's linear production games. This connection also allows the authors to show how similar allocations exist for other network design and connectivity games. But is this the best we can hope for? The authors conclude by showing that even in surprisingly simple cases, there are allocations that can recover more of the cost, although the computational efficiency of such allocations is not clear.

Accounting for Uncertainty in a Power Distribution System

The planning operation for the Brazilian power system is formulated as a stochastic programming problem that considers only the uncertainties associated with inflows, modeled as random variables with specified probability distribution. On the other hand, there are uncertainties related to economic factors that could be difficult to predict based on the previous history. For instance, the effects of the 2008 international economic crisis on the demand values used for 2008–2013 Brazilian operation planning were not foreseen, and the operation plan had to be revised. In "Worst-Case-Expectation Approach to Optimization Under Uncertainty," A. Shapiro, W. Tekaya, M. Pereira Soares, and J. Paulo da Costa account for both uncertainties: the inflows are taken as a random process with a specified probability distribution, and the demand is dealt from a robust (worst-case) point of view. In this way, the resulting operation plan complies with both uncertainties in the data process.

Optimal Rate Scheduling in Wireless Systems

In "Optimal Rate Scheduling via Utility-Maximization for J-User MIMO Markov Fading Wireless Channels with Cooperation," W. Dai designs a dynamic rate scheduling policy of Markov type using the solution to a utility-maximization problem over a randomly evolving capacity set for a stochastic system of generalized processor-sharing queues in a random environment, whose job arrivals to each queue follow a doubly stochastic renewal process (DSRP). Both the random environment and the random arrival rate of each DSRP are driven by a finite state continuous time Markov chain. The scheduling policy optimizes in a greedy fashion with respect to each queue and environmental state. The author establishes a reflecting diffusion with regime-switching model for measuring performance and identifies a cost function related to the utility function, which is minimized by minimizing the workload process in the diffusion limit. More importantly, the queueing model includes typical systems in MIMO wireless networks as special cases.