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The journal is pleased to publish the abstracts of the six finalists of the 2018 Manufacturing and Service Operations Management Society's student paper competition.

The 2018 prize committee was chaired by Saravanan Kesavan (University of North Carolina at Chapel Hill), Tunay I. Tunca (University of Maryland), and Yi Xu (University of Maryland). The other committee members were Jason Acimovic, Elodie Adida, Vishal Agrawal, Mazhar Arikan, Jiaru Bai, Nitin Bakshi, Gah-Yi Ban, Saurabh Bansal, Bob Batt, Elena Belavina, Kostas Bimpikis, Onur Boyabatli, Fernanda Bravo, Robert Bray, Ying-Ju Chen, Soo-Haeng Cho, So Yeon Chun, Florin Ciocan, Pascale Crama, Ruomeng Cui, Kaitlin Daniels, Seyed Emadi, Liu Fang, Kris Johnson Ferreira, Michael Freeman, Santiago Gallino, Chloe Kim Glaeser, Xiting Gong, Jose Guarjado, Dan Iancu, Nitish Jain, Stefanus Jasin, Ashish Kabra, Bharadwaj Kadiyala, Diwas KC, Bora Keskin, Song-Hee Kim, Guoming Lai, Cuihong Li, Daniel Lin, Wei Luo, Vidya Mani, Mili Mehrotra, Liu Ming, Ken Moon, Toni Moreno, Rahmani Morvarid, Suresh Muthulingam, Karthik Natarajan, Jie Ning, Adem Orsdemir, Yiangos Papanastasiou, Chris Parker, Olga Perdikaki, Heikki Peura, Anyan Qi, Soroush Saghafian, Ozge Sahin, Bill Schmidt, Stephen Shechter, Pengyi Shi, Hummy Song, Nur Sunar, Nicos Trichakis, Mistic Velibor, Jingqi Wang, Ruxian Wang, Shouqiang Wang, Yehua Wei, Joel Wooten, Wenqiang Xiao, Linwei Xin, Alex Yang, Safak Yucler, Dennis Zhang, Renyue Zhang, Yao Zhao, and Weiming Zhu.

The 2018 prize winners are as follows:

First Prize

A Dynamic Clustering Approach to Data-Driven Assortment Personalization
Sajad Modaresi, Duke University

Second Prize

Inconvenience, Liquidity Constraints, and the Adoption of Off-Grid Lighting Solutions
Bhavani Shanker Uppari, INSEAD

Finalists (in alphabetical order according to the author's last name):

A Re-solving Heuristic with Uniformly Bounded Loss for Network Revenue Management
Pornpawee Bumpensanti, Georgia Institute of Technology

Flexible FDA Approval Policies
Taylor Courtney Corcoran, University of California, Los Angeles

Frustration-Based Promotions: Field Experiments in Ride Sharing
Baek Jung Kim, New York University

Shipping Consolidation Across Two Warehouses with Delivery Deadline and Expedited Options for E-Commerce and Omnichannel Retailers
Lai Wei, University of Michigan

A Dynamic Clustering Approach to Data-Driven Assortment Personalization

Sajad Modaresi

Duke University

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Advisors: Fernando Bernstein, Duke University; Denis Sauré, University of Chile

We consider an online retailer facing heterogeneous customers with initially unknown product preferences. Customers are characterized by a diverse set of demographic and transactional attributes. The retailer can personalize the customers' assortment offerings based on available profile information to maximize cumulative revenue. To that end, the retailer must estimate customer preferences by observing transaction data. This, however, may require a considerable amount of data and time given the broad range of customer profiles and large number of products available. At the same time, the retailer can aggregate (pool) purchasing information among customers with similar product preferences to expedite the learning process. We propose a *dynamic clustering* policy that estimates customer preferences by adaptively adjusting customer segments (clusters of customers with similar preferences) as more transaction information becomes available. We test the proposed approach with a case study based on a data set from a large Chilean retailer. The case study suggests that the benefits of the dynamic clustering policy under the MNL model can be substantial and result (on average) in more than 37% additional transactions compared with a *data-intensive* policy that treats customers independently and more than 27% additional transactions compared with a *linear utility* policy that assumes that product mean utilities are linear functions of available customer attributes. We support the insights derived from the numerical experiments by analytically characterizing settings in which pooling transaction information is beneficial for the retailer in a simplified version of the problem. We also show that there are diminishing marginal returns to pooling information from an increasing number of customers.

Inconvenience, Liquidity Constraints, and the Adoption of Off-Grid Lighting Solutions

Bhavani Shanker Uppari

INSEAD

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Advisors: Serguei Netessine, University of Pennsylvania; Ioana Popescu, INSEAD

A significant proportion of world's population does not have access to grid-based electricity and therefore, relies on off-grid lighting solutions. Rechargeable bulb technology is becoming prominent as an alternative off-grid lighting model in developing countries. In this paper, we explore the consumer behavior and the operational inefficiencies that result under this model. Specifically, we are interested in measuring the impact of inconvenience (of travel to recharge the bulb)—which is a peculiar feature of this model—along with the impact of liquidity constraints on bulb usage. We also discuss the efficacy of strategies that address these factors. We use multiple methodologies: we first build a model of recharge decisions and theoretically explore its properties. To test (both ordinal and cardinal) predictions of this model and examine the performance of counterfactual strategies, we conduct field experiments in Rwanda in collaboration with a company that operates a rechargeable bulbs business. Using our model as the data-generating process, we then estimate its parameters by fitting it to the experimental data. We show that the fitted model predicts the data reasonably well. Using the estimated model, we find that inconvenience-based strategies—which are usually ignored by the firms and the policy makers—tend to perform as well as and sometimes better than price-based strategies in terms of improving the bulb usage. We also discuss the implications of our results for the off-grid firms and the policy makers.

A Re-solving Heuristic with Uniformly Bounded Loss for Network Revenue Management

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Advisor: He Wang, Georgia Institute of Technology

We consider the canonical (*quantity-based*) *network revenue management* problem, where a firm accepts or rejects incoming customer requests irrevocably in order to maximize expected revenue given limited resources. Because of the curse of dimensionality, the exact solution to this problem by dynamic programming is intractable when the number of resources is large. We study a family of re-solving heuristics that periodically reoptimize an approximation to the original problem known as the deterministic linear program (DLP), where random customer arrivals are replaced by their expectations. We find that, in general, frequently re-solving the DLP produces the same order of revenue loss as one would get without re-solving, which scales as the square root of the time horizon length and resource

capacities. By re-solving the DLP at a few selected points in time and applying thresholds to the customer acceptance probabilities, we design a new re-solving heuristic in which revenue loss is uniformly bounded by a constant that is independent of the time horizon and resource capacities.

Flexible FDA Approval Policies

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Advisors: Fernanda Bravo, University of California, Los Angeles; Elisa Long, University of California, Los Angeles

To approve a novel drug therapy, the U.S. Food and Drug Administration (FDA) requires clinical trial evidence demonstrating efficacy with 2.5% statistical significance, although the agency often uses regulatory discretion when interpreting these standards. Factors, such as target disease severity, prevalence, and availability of existing therapies, are qualitatively considered, yet no quantitative guidelines exist to incorporate such characteristics into approval decisions. We propose a novel queueing network modeling framework to analyze the FDA's drug approval decision-making process that explicitly incorporates these factors as well as obsolescence—when newer drugs replace older formulas—through the use of preemptive M/M/1/1 queues. Given an objective of maximizing net societal benefits, including health benefits and the monetary value of drug approval/rejection, we show that the optimal policy relaxes approval standards for drugs targeting diseases with long clinical trials, high attrition during development, or low initiation of new candidate drugs. Using publicly available data sets encompassing all registered U.S. clinical trials and FDA-approved drugs, we estimate model parameters for drugs targeting three high-burden diseases: breast cancer, human immunodeficiency virus, and hypertension. Our results indicate that the current standard of a 2.5% significance level is too stringent for some diseases but too lenient for others. A counterfactual analysis of the FDA's Fast Track program—offering expedited review of therapies for life-threatening diseases—demonstrates that this program achieves a level of societal benefit that cannot be attained by solely changing approval standards.

Frustration-Based Promotions: Field Experiments in Ride Sharing

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Advisor: Maxime C. Cohen, New York University

The service industry has become increasingly competitive. One of the main drivers for increasing profits and market share is quality of service. When a consumer encounters a bad experience or a *frustration*, he or she may be tempted to stop using the service (or at least decrease its usage) and switch to the competitor(s). In collaboration with one of the leading ride-sharing platforms, Via, our goal is to understand the benefits of proactively compensating customers who have experienced a frustration. Motivated by historical data, we considered two types of frustrations: long waiting times and long travel times. In this paper, we examine whether a firm should proactively send compensation to users who have experienced a frustration. To this end, we designed and ran field experiments to investigate how different types of compensation affect the engagement behavior of riders who experienced a frustration. We conducted analysis of variance tests and regression analyses and used a difference-in-differences approach to support our findings. We observed that sending compensation to frustrated riders (i) is profitable and boosts their engagement behavior (relative to not sending a compensation), (ii) works well for long waiting times but does not work well for long travel times, and (iii) has an impact that is moderated by past usage frequency. We also observed that the best strategy is to send credit for future usage (as opposed to waiving the charge or sending an apologetic message). We performed several robustness checks to showcase the consistency of our results.

Shipping Consolidation Across Two Warehouses with Delivery Deadline and Expedited Options for E-Commerce and Omnichannel Retailers

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Shipment consolidation is commonly used to avoid some of the shipping costs. However, when delivery of current orders is delayed to consolidate them with future orders, a more expensive expedited shipment may be needed to meet shorter deadlines. In this paper, we study the optimal consolidation policy focusing on the tradeoff between economies of scale owing to combining orders and expedited shipping costs in the setting of two warehouses. Our work is motivated by the application in e-commerce and omnichannel retail, especially with the rise of so-called on-demand logistics services. In such situations, sellers have the flexibility to take advantage of consolidation by deciding when to ship the orders and from which warehouse

to fulfill the orders as long as the orders' deadlines are met. We use dynamic programming to characterize the optimal policy and its structure. Using the insights of these structural properties, we propose two easily implementable heuristics that perform within 1%–2% of the optimal solution and outperform other benchmark

consolidation methods in extensive numerical tests. In all, consolidation is shown to significantly reduce the outbound shipping costs. Retailers can take advantage of it to effectively improve the standard policies by simply applying the threshold-form heuristics that we propose.