University of Chicago Booth School of Business

Operations Management/Management Science Workshop

Tuesday, May 3, 2016

David Goldberg, Georgia Institute of Technology

Title: Beating the curse of dimensionality in inventory problems with lead times

Abstract:

Many classical inventory models become notoriously challenging to optimize in the presence of positive lead times, since the state-space blows up and dynamic programming techniques become intractable. This includes, for example, lost sales models with positive lead times, and dual-sourcing models with positive lead time gap between the two suppliers. In this talk, we will present a new algorithmic approach to such problems, which shows that as the lead time grows large, simple policies become asymptotically optimal. These results are quite surprising, as this setting had remained an open algorithmic challenge for over forty years. In particular, we will show that a simple constant-order policy is asymptotically optimal for lost sales models with large lead times, and provide explicit bounds on the optimality gap which demonstrate good performance even for small-to-moderate lead times. We will also show that the so-called Tailored-Base Surge heuristic for dual-sourcing problems is asymptotically optimal as the lead time gap between the two sources grows large. In both cases, our results provide a new algorithmic approach to these problems, as well as a solid theoretical foundation for the good performance of these algorithms observed numerically by previous researchers. In the dual-sourcing case, our results also provide further justification for the use of Tailored-Base Surge policies in practice, as several large companies are already implementing such heuristics. Our approach combines ideas from the theory of random walks and queues, convex analysis, Markov decision processes, and inventory control.

Papers relevant to this discussion can be found at the following links:

 "Optimality gap of constant-order policies decays exponentially in the lead time for lost sales models": http://arxiv.org/abs/1409.1499v2

 "Asymptotic optimality of Tailored Base-Surge policies in dual-sourcing inventory systems": http://arxiv.org/abs/1503.01071v2

Biography:

David A. Goldberg (http://www2.isye.gatech.edu/~dgoldberg9/) is the A. Russell Chandler III Assistant Professor at the Industrial and Systems Engineering Department of the Georgia Institute of Technology. His research is in applied probability and stochastic processes, on topics including inventory models, queueing theory, combinatorial optimization, and distributionally robust optimization. David graduated with a B.S. in Computer Science and minors in Applied Math and Industrial Engineering Operations Research from Columbia University's School of Engineering and Applied Science in 2006, and a Ph.D. in Operations Research from the Massachusetts Institute of Technology's Operations Research Center in 2011, and has been at Georgia Tech since 2011. His work has been recognized with several accolades, including an NSF CAREER award, first place in the 2015 George Nicholson Student Paper Competition, second place in the 2015 JFIG Paper Competition, as well as finalist in the 2014 MSOM Student Paper Competition and 2010 George Nicholson Student Paper Competition.