Optimal Scheduling of Proactive Service with Customer Deterioration

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Abstract

Service systems, especially healthcare systems, are limited resource environment where scarce capacity is often reserved for the most critical/urgent customers. However, there has been a growing interest in the use of proactive service when a less urgent customer may become urgent while waiting. On one hand, providing service for customers when they are less urgent could mean that fewer resources are needed to fulfill their service requirement. On the other hand, utilizing limited capacity for customers who may never need the service in the future takes the capacity away from the other more urgent customers who need it now. To understand this tension, we propose a queueing model with two customer classes: moderate and urgent, and customers to transition classes while waiting. We characterize how moderate and urgent customers should be prioritized for service when proactive service for moderate customers is an option. Our focus is on the transient setting, where demand surge brings the system away from its normal state of operation. The goal is to cope with the surge in a cost-effective way. In this context, we demonstrate how Pontryagin's Minimum Principle can be applied to derive structural insights into the optimal scheduling policy. The talk is based on joint work with Yue Hu and Carri Chan.