Asymptotically Optimal Allocation Policies for Transplant Queueing Systems

Xin Liu
Assistant Professor
School of Mathematical and Statistical Sciences
Clemson University

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Abstract: We consider the problem of dynamic allocation of organs to patients in a transplant system. The system is modeled as a multi-class bipartite matching system, in which patients may die/delist or move between classes due to changes of their health status. We study a stochastic queueing control problem (QCP) with the control process governing the allocation of each arriving organ, and the objective of maximizing the expected total life years, which consists of both pre- and post-transplant years, of all population in the system during a finite time horizon. We first construct a deterministic control problem, referred to as the fluid control problem (FCP), and show that it serves as a performance upper bound for the QCP. We next develop an asymptotic framework, in which large scaled overloaded transplant systems are considered, and show that the fluid scaled QCP attains the FCP upper bound asymptotically. We then propose a simple priority type policy for the QCP based on the optimal solution of the FCP, and establish its asymptotic optimality through a scaling limit theorem. At last we conduct sensitivity analysis of the FCP with respect to the input parameters and functions to demonstrate the robustness of the proposed policy.

Talk will take place from 1:00PM - 2:00PM through Zoom (invitation will be emailed to everyone soon).