Stanford University
Departments of Mathematics and Statistics

Probability Seminar

4pm, Monday, May 20, 2019
Sequoia Hall Room 200

Refreshments served at 3:30pm in the Lounge.

Speaker: Amber L. Puha, *California State University San Marcos*

Title: Asymptotic Behavior of a Critical Fluid Model for a Multiclass Processor Sharing Queue via Relative Entropy

Abstract:

Queueing systems operating under the processor sharing discipline are relevant for studying time-sharing in computer and communication systems. Measure-valued processes, which track the residual service times of all jobs in the system, have been used to describe the dynamics of such systems. However, exact analysis of these infinite-dimensional stochastic processes is rarely possible. As a tool for approximate analysis of such systems, it has been proved that a fluid model arises as a functional law of large numbers limit of a multi-class processor sharing queue. This talk will focus on the asymptotic behavior of such a fluid model in the interesting regime of critical loading, where the average inflow of work to the system is equal to the capacity of the system to process that load.

Using an approach involving a certain relative entropy functional, we show that critical fluid model solutions converge to a set of invariant states as time goes to infinity, uniformly for all initial conditions lying in certain relatively compact sets. This generalizes an earlier single-class result of Puha and Williams to the more complex multiclass setting. In particular, several new challenges are overcome, including formulation of a suitable relative entropy functional and identifying a convenient form of the time derivative of the relative entropy applied to trajectories of critical fluid model solutions.

This is joint work with Justin A. Mulvany (USC) and Ruth J. Williams (UCSD).