Speaker: Professor David Gamarnik, MIT

Date: Friday, February 28, 2014

Time: 10:30 am - 11:30 am

Location: Room 4568

Title: A Dynamic Model of Kidney Exchange

Abstract: Kidney exchange programs enable patients with living but incompatible donors to exchange kidneys in chains initiated by altruistic donors and short cycles. The problem of maximizing the number of transplants in a fixed pool of patients has been well studied. In practice, exchange programs perform this optimization periodically and the long run implications of this policy for average patient waiting time are not well understood.

To address this issue, we propose a dynamic random graph model of a kidney exchange program. In each time period, a single node (a donor-patient pair) arrives, and for each pre-existing node in the graph, directed edges (feasible transplants) are added to and from the new node with probability $p$, i.i.d. We consider two policies for deleting nodes (selecting transplants): either we remove short cycles, or we maintain and advance a single chain. In both cases, we show that the "greedy policy," where we maximize the number of transplants in every time period, results in a long run average patient waiting time that is as good as any other policy, up to constant factors as the compatibility probability $p$ approaches zero. Additionally, we find that as $p$ approaches zero, the steady state average patient waiting time using the chains policy is an order of magnitude smaller in $p$ than under the cycles policy, which explains why modern kidney exchanges in the U.S. tend to do most transplants through chains.

Joint work with Ross Anderson, Itai Ashlagi, Yashodan Kanoria and Alvin Roth.

Bio: David Gamarnik is a Nanyang Technological University Professor of Operations Research at the Sloan School of Management of Massachusetts Institute of Technology. He received B.A. in mathematics from New York University in 1993 and Ph.D. in Operations Research from MIT in 1998. Since then he was a research staff member of IBM T.J. Watson Research Center, before joining MIT in 2005.

His research interests include applied probability and stochastic processes, theory of random graphs, algorithms and combinatorial optimization. He works on applications in health care management,
management of call centers and business processes. He is a recipient of the Erlang Prize and the Best Publication Award from the INFORMS Applied Probability Society, IBM Faculty Partnership Award and several NSF sponsored grants. He is currently an area editor of Operations Research journal, associate editor of Mathematics of Operations Research, Stochastic Systems, and Queueing Systems journals, and he has been an associate editor of Annals of Applied Probability in the past.