SPECIAL SEMINAR

Title: From Distributed Search to Matching Markets: The Advantage of Social Network Structure

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Abstract: In this talk, we examine two distinct problems, distributed search and matching markets with externalities, through the lens of social networks. In the first, we focus on the problem of distributed search in social networks - forwarding a message using only local contact information. In order to model networks that are "searchable" by such an algorithm, we construct a generalization of stochastic Kronecker graphs for generating random social networks, introducing a Kronecker-like operator and defining a family of generator matrices dependent on distances between nodes in a specific graph embedding. Using this model, we highlight a few of our results on the performance of greedy message forwarding algorithms and demonstrate that "distance-dependent Kronecker graphs" can generate searchable networks.

In the second problem, we focus on matching markets, such as those used to match medical interns to hospital residencies and assign housing to college students. Externalities such as complementarities and peer effects can severely complicate the preference ordering of each agent and lead to serious problems for market stability. We note that peer effects are often the result of underlying social connections, and so we explore a formulation of the market where peer effects are derived from an underlying social network. The key feature of our model is that it captures peer effects and complementarities using utility functions, rather than traditional preference ordering. With this model and considering a slightly different notion of stability, we prove that stable matchings always exist and characterize the set of stable matchings in terms of social welfare. To characterize the efficiency of matching markets with externalities, we provide "price of stability" and "price of anarchy" bounds and find that the structure of the social network (e.g. how well clustered the network is) plays a large role. Finally, we demonstrate the performance of two matching algorithms on a real-world matching problem: assigning students to housing at Caltech while incorporating their social network structure.

Biography: Elizabeth Bodine-Baron is a Ph.D. student at the California Institute of Technology in Pasadena, CA, advised by Dr. Babak Hassibi in the Electrical Engineering department as well as Dr. Adam Wierman from the Computer Science department. She received the B.S. degree in Electrical Engineering and the B.A. degree in Plan II Honors (a liberal arts program) from the University of Texas at Austin in 2006. She moved to Los Angeles in 2007 to work for the Jet Propulsion Laboratory and began her graduate career at Caltech in the fall of that year, earning the M.S. degree in Electrical Engineering in 2009. Her research interests include social networks, distributed algorithms, and game theory. Ms. Bodine-Baron is a recipient of the NDSEG Fellowship and the Atwood Fellowship, and expects to graduate in June 2012.