Dynamic Matching in Overloaded Systems

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October 2012

ABSTRACT

In many assignment problems items arrive stochastically over time. When items are scarce, agents form an overloaded waiting list and items are dynamically allocated as they arrive; two examples are public housing and organs for transplant. Even when all the scarce items are allocated, there is the efficiency question of how to assign the right items to the right agents. I develop a model in which impatient agents with heterogeneous preferences wait to be assigned scarce heterogeneous items that arrive stochastically over time. Social welfare is maximized when agents are appropriately matched to items, but an individual impatient agent may misreport her preferences to receive an earlier mismatched item. I first consider a standard queue-based allocation policy and derive its welfare properties. To determine the optimal policy, I formulate the dynamic assignment problem as a dynamic mechanism design problem without transfers. The resulting optimal incentive compatible policy uses a buffer-queue of a new queueing policy, the uniform wait queue, to minimize the probability of mismatching agents. Finally, I derive a policy which uses a simple rule: giving equal priority to every agent who declines a mismatched item (a SIRO buffer-queue). This policy is optimal in a class of robust mechanisms and has several good properties that make it a compelling market design policy recommendation.