Paths to stability in matching markets with and without payments

Péter Biró*

This talk will be on two recent works I have been involved in. The first one [3] is on the stable marriage and roommates problems, so matching markets without payments. The second one [2] is on the assignment and matching games, so matching markets with payments. We investigate the stochastic behaviour of the markets in both papers. I copy their abstracts below.

1. Suppose that the agents of a matching market contact each other randomly and form new pairs if is in their interest. Does such a process always converge to a stable matching if one exists? If so, how quickly? Are some stable matchings more likely to be obtained by this process than others? In this paper we are going to provide answers to these and similar questions, posed by economists and computer scientists. In the first part of the paper we give an alternative proof for the theorems by Diamantoudi et al. and Inarra et al. which implies that the corresponding stochastic processes are absorbing Markov chains. Our proof is not only shorter, but also provides upper bounds for the number of steps needed to stabilise the system. The second part of the paper proposes new techniques to analyse the behaviour of matching markets. We introduce the Stable Marriage and Stable Roommates Automaton and show how the probabilistic model checking tool PRISM may be used to predict the outcomes of stochastic interactions between myopic agents. In particular, we demonstrate how one can calculate the probabilities of reaching different matchings in a decentralised market and determine the expected convergence time of the stochastic process concerned. We illustrate the usage of this technique by studying some well-known marriage and roommates instances and randomly generated instances.

2. We show that a variant of an algorithm described in [1] can be used to prove the existence of a path to stability in assignment games, a result recently published in [4]. This alternative proof is not just simpler, but also gives a small upper bound for the number of steps needed to reach a stable solution. Furthermore, the same technique can be used for the more general nonbipartite case, the so-called *matching games*.

References

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[4] Chen, B., S. Fujishige and Z. Yang. Decentralized Market Processes to Stable Job Matchings with Competitive Salaries. *Working paper, Kyoto University, RIMS-1715*, 2011.

*Institute of Economics, Hungarian Academy of Sciences; H-1112, Budarsi út 45, Budapest, Hungary birop@econ.core.hu