

# **COST Action IC1205 on Computational Social Choice: STSM Report**

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The main purpose of this visit was to continue working on an ongoing research regarding problems concerning “Matching under Uncertain Preferences”. Consider a two-sided matching market, such as students/applicants and schools. In the classical problem, agents have full preference ordering over acceptable candidates and these preferences are often assumed to be strict and almost always assumed to be known to the agents. A “good” solution in such markets is a “stable matching”, that is a matching of students to schools such that there exists no (student,school) pair who prefer to leave their assigned partners and instead get matched together—if such a pair exists, then they constitute a blocking pair. In practice it is unlikely that agents have full knowledge of their preferences. Our main goal in this project is to provide different probabilistic uncertainty models that are capable of capturing real-life scenarios, and for each look for “the most stable” matching or a matching with “the least number of blocking pairs”. Various other natural computational problems may arise as well, including computing the stability probability of a given matching, or deciding whether there is a matching that is stable with probability one. We have so far proposed several probabilistic uncertainty models, but have focused on three of them in particular: (1) the lottery model in which each agent is given a probability distribution over possible linear orders, (ii) the pairwise probability model in which each agent is endowed with independent pairwise probabilities for any given two candidates, (iii) the compact indifference model, which is a special case of the previous two models, in which each agent expresses a weak order over the candidates and each linear order extension of this weak order is equally likely. We have studied five different computational problems under these three models and have obtained results in all cases except two.

Peter Biro and I had discussed this problem, and made some early progress on, in the summer of 2014. Prior to my visit, Peter had visited Haris Aziz and colleagues in Australia in January 2016 and explained some of the problems we have worked on or planning to work. They had some good discussions and useful comments which resulted in them providing some additional results and insights into the project. We hence started working as a group on a joint write-up including several open problems and continued working on it actively while I was in Budapest. Our plan is to send our findings to an upcoming conference, and likely to split it up into two papers if appropriate.

During my stay in Budapest, I also gave a talk in the Game Theory seminar organized by Peter’s research group. This provided me with a chance to exchange ideas and knowledge with economists, and in particular correct my understanding of “responsive preferences”. I also had a chance to chat with Tamas Fleiner on our recent collaboration regarding matroids in many-to-many matching markets, as well as discussing a reduction from SAT to one of the open problems in the “Matching under Uncertain Preferences” project.

I sincerely thank the COST Action for their support which made this visit possible, and am grateful to my host for his hospitality.