COST Action IC1205 on Computational Social Choice: STSM Report
Applicant: Jannik Matuschke
Home institution: Technische Universität München
Home country: Germany
Host: Ágnes Cseh
Host institution: Centre of Economic and Regional Studies of the Hungarian Academy of Sciences
Host country: Hungary
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From Nov 7 to Nov 11, 2016, I visited the Centre of Economic and Regional Studies of the Hungarian Academy of Sciences to collaborate with Ágnes Cseh. As outlined in the proposal, we studied new and simplified algorithms for various stable flow problems. We were successful in obtaining

1. a polynomial-time augmenting path algorithm for computing a stable flow,
2. a simple algorithm for stable flows with restricted edges, which either computes a stable flow avoiding a set of forbidden edges or determines that no such flow exists,
3. a reduction that shows that in the stable multicommodity flow model by Kiraly and Pap [2] it is without loss of generality to assume that no commodity-specific preference lists at the vertices and no commodity-specific capacities on the edges exist.

The algorithm in result 1) is based on a special helper graph, whose properties ensure that at any step of the algorithm there is a unique augmenting path to push flow along while maintaining certain invariants guaranteeing stability of the final flow. The results 2) and 3) use carefully designed graph-theoretic gadgets to reduce the general problem under consideration to an easier case. For the correctness of the algorithm in 2), we also make use of an implication of the analysis of the augmenting path algorithm from 1) that ensures that the reduction can be applied simultaneously for multiple forbidden edges. Result 3), in particular, strengthens the previous complexity result from [1] for deciding on the existence of an integral stable multicommodity flow

The corresponding paper "New and simple algorithms for stable flow problems" (by Á. Cseh and J. Matuschke) reporting on these results is in preparation and will be submitted to MATCH-UP 2017.

In addition, I presented some recent results on the complexity of the Maximum Robust Flow problem and a related open question at the Game Theory Seminar at Corvinus University. The talk inspired an interested discussion with the audience. I was made aware of several articles on related subjects in other fields of research.

References

[1] Á. Cseh: Complexity and algorithms in matching problems under preferences. PhD thesis, TU Berlin, 2016.

[2] T. Király and J. Pap. Stable multicommodity flows. *Algorithms* 6:161–168, 2013.