COST Action IC1205 on Computational Social Choice: STSM Report

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I spent a very fruitful week at the Department of Computer Science at the University of Tübingen, where I was hosted by Britta Dorn and her PhD students Janosch Döcker and Sebastian Schneckenburger. We continued two existing lines of joint work and initiated cooperation on a new topic. All of these topics concern resource allocation and fair division problems and thus fit under the umbrella of WG2.

First, we continued work on a model for combinatorial auctions where the goods to be sold can be arranged along a line and every bundle someone is bidding for corresponds to a discrete interval on that line that may include a gap. This model has practical applications, for instance, in the context of auctioning off offshore oil leases. Our results identify several parameters for which the problem of determining the best allocation of goods to bidders can be solved efficiently, while other results identify cases for which this problem is NP-hard, thereby providing a good understanding of the tractability frontier for this domain.

Second, we continued work on the distributed approach to multiagent resource allocation when the objective is to find an allocation of goods to agents that minimises economic inequality. Cooperation on this topic was initiated after Sebastian Schneckenburger attended my lectures at the Summer School on Fair Division in Grenoble in 2015, where I had presented the basics of the distributed model.

Third, we started a new cooperation on mixed auctions, i.e., auctions where the auctioneer is buying services from the bidders, who each offer to transform a certain set of resources into a different set of resources for a price. The complexity of finding a good set of transformations to buy is highly complex in general and existing results suggest that tractable special cases can only be obtained under very strong restrictions on the number of goods involved in any one transformation. On the other hand, our preliminary results show that this situation can be somewhat improved if we distinguish resources that are "products" (occurring only in the output of a transformation) from resources that are "tools" (occurring in both the input and the output, i.e., they can be reused after a given transformation has been executed).

On Thursday, 7 April 2016, I furthermore delivered a lecture on the *Fair Allocation of Indivisible Goods*, providing a broad overview of the field, to the full Theoretical Computer Science Section at the department, which amongst others also includes researchers in machine learning and algorithmics.