COST Action IC1205 on Computational Social Choice: STSM Report

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I was hosted for a little more than a week by Carsten Schürmann at the IT University of Copenhagen in the Programming, Logic and Semantics (PLS) Research Group. During this time, I had fruitful discussions with Carsten as well as the partners of the DemTech project Peter Ryan and David Basin. For the first few days, work was joined with my supervisor Bernhard Beckert.

The topic was "Synthesizing the Computation of Margins from Social Choice Functions". Margin computation is an important task, as arguments about the correctness of an election outcome usually rely on the size of the electoral margin. One such method which became popular recently among countries using electronic voting machines are risk-limiting audits. They require a knowledge of the margin of victory in order to determine how much auditing is necessary. In general, this is a challenging task and current techniques rely on argumentations based on fundamental probabilistic theory. These are easy to get wrong, especially for complex voting systems.

As a means to overcome this difficulty, we worked on methods for synthesizing the margin computation using symbolic execution and software verification techniques based on bounded model-checking towards an automatic technique. We examined the d'Hondt method and STV, as well as the current parliamentary election system used for national elections in Denmark. Based on these examinations, we developed an automated technique for the computation of election margins and worked on improvements regarding scalability. A publication of our findings in a major conference on the field is planned.

Furthermore, I learned about other interesting voting-related research at ITU. E.g., I learned about the Norwegian election system and its formalisation in linear logic and CELF, as well as various technical details of actual electronic voting machines. In the group, we discussed various challenges in the design of electronic voting systems, from different perspectives.

I am grateful to the COST Action IC1205 on Computation Social Choice for giving me this opportunity. Furthermore, I want to thank Carsten Schürmann and his (current and former) group members – especially Peter Brottveit Bock, Alessandro Bruni, Agata Murawska and Alec Faithful – for the warm welcome and the hospitality.