Supervisor's report on the PhD thesis

Kristina Asimi: Promises in Satisfaction Problems

The thesis consists of an introduction and three independent chapters. The common theme is the Promise Constraint Satisfaction Problem (CSP), a recent framework that enables us to systematically study certain approximation variants of the standard constraint satisfaction problems (CSPs).

The first chapter is an extended version of the conference paper *K. Asimi, L. Barto, Finitely Tractable Promise Constraint Satisfaction Problems, MFCS 2021*. It concentrates on a class of PCSPs and characterizes those PCSPs in the class which can be efficiently solved by a reduction to a finite domain CSP. This result is technically the most challenging one. In fact, work on this result took a good part of Kristina's PhD studies. The presented proof is technical but quite short. It took a significant effort to improve the original arguments to the presented version.

The second chapter is an extended version of the conference paper *K. Asimi, L. Barto, S. Butti, Fixed-Template Promise Model Checking Problems, CP 2022*. It explores versions of the PCSP with different choices of logical connectives. It generalizes results of B. Martin and F. Madelaine from the CSP to PCSP, provides partial results toward a full complexity classification, and identifies interesting computational problems with unknown complexity. The results were, to a large extend, obtained during S. Butti's three month research visit at the department.

The third chapter records a joint work of Kristina, V. Dalmau, and myself on left-hand side restricted PCSPs. It was partly obtained during Kristina's one month research visit of V. Dalmau. This work is not yet published. Its main value is in introducing the framework of left-hand side restricted PCSPs and in simplifying and generalizing M. Grohe's celebrated result on left-hand side restricted CSPs.

I consider results in all of the three chapters interesting and nontrivial. Kristina's contributions to these results are significant. I recommend Kristina Asimi be awarded a PhD in Mathematics.

Prague, 24 July 2023

Libor Barto