Brno University of Technology
Faculty of Information Technology

Department of Intelligent Systems (DITS) Academic year 2021/2022

Bachelor's Thesis Specification

25013

Student: **Chocholatý David**
Programme: Information Technology
Title: **Abstraction of State Languages in Automata Algorithms**
Category: Algorithms and Data Structures
Assignment:

The goal is to explore possibilities of using various abstractions of automata languages in optimisation of automata algorithms.
We will start with abstracting languages of states to sets of possible word lengths and to Parikh images, represented as semi-linear sets, and exploring options of using them to optimize the construction of synchronous product of automata by pruning pairs of states with incompatible abstractions. We will then continue either towards optimisation of these techniques or towards searching for alternatives or more advanced versions.

1. Study the literature on automata and Parikh images, familiarise yourself with technology of SMT solvers.
2. Implement automata product construction optimised with length abstraction and Parikh image abstraction of state languages.
3. Study the state pruning capabilities of these abstractions.
4. If the pruning capabilities prove promising, study possibilities of their efficient implementation and compare it with standard synchronous product construction on provided data.
5. Otherwise continue the research by elaborating on the principle of using state language abstractions to optimize automata constructions.

Recommended literature:

- Javier Esparza, Pierre Ganty, Stefan Kiefer, Michael Luttenberger: Parikh's Theorem: A simple and direct construction. CoRR abs/1006.3825, 2010.

Requirements for the first semester:

- Items 1 and 2.

Detailed formal requirements can be found at https://www.fit.vut.cz/study/theses/

Supervisor: **Holík Lukáš, doc. Mgr., Ph.D.**
Head of Department: Hanáček Petr, doc. Dr. Ing.
Beginning of work: November 1, 2021
Submission deadline: May 11, 2022
Approval date: November 3, 2021