Brno University of Technology
Faculty of Information Technology

Department of Intelligent Systems (DITS) Academic year 2020/2021

Master's Thesis Specification

Student: **Stupinský Šimon, Bc.**
Programme: Information Technology
Field of study: Software Verification and Testing
Title: **Advanced Methods for Synthesis of Probabilistic Programs**
Category: Formal Verification
Assignment:

1. Study the current methods for automated design and synthesis of probabilistic programs including methods based on MDP abstraction and counter-example guided inductive synthesis.
2. Evaluate these methods on practically relevant case-studies and identify their limitations.
3. Design possible improvements and extensions of the methods including the support of optimal synthesis and synthesis for multi-property specifications.
4. Implement the improvements and extensions within an existing probabilistic model-checker (e.g. STORM or PRISM).
5. Carry out a detailed evaluation of the implemented methods including an extension of the existing benchmarks.

Recommended literature:

1. Milan Češka, Nils Jansen, Sebastian Junges, and Joost-Pieter Katoen. Shepherding hordes of Markov chains. In Proc. of TACAS'19. Springer, 2019.
2. Milan Češka, Christian Hensel, Sebastian Junges, and Joost-Pieter Katoen. Counterexample-Driven Synthesis for Probabilistic Program Sketches. In Proc. of FM'19. Springer, 2019.

Requirements for the semestral defence:

- Items 1, 2 and partially item 3.

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

Supervisor: **Češka Milan, RNDr., Ph.D.**
Consultant: Andriushchenko Roman, Ing., UITS FIT VUT
Head of Department: Hanáček Petr, doc. Dr. Ing.
Beginning of work: November 1, 2020
Submission deadline: May 19, 2021
Approval date: November 11, 2020