Formal Proofs of Game Solving Algorithms

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Motivation

To formally demonstrate that a program is correct often tools like model checkers are used. In some cases we even can automatically construct a correct program (synthesis). All of these techniques have in common that they rely on programs to check other programs and we can never be sure that the checking program is actually implemented correctly.

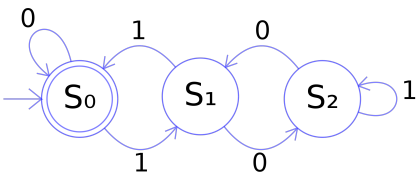
Interactive theorem provers allow one to write a program together with a mathematical proof that it is correct. The proof is checked and partially generated by the computer. We can use this to show that our verification tools are implemented correctly.

Verification procedures can make use of game solving algorithms. The problem is reduced to a two player graph game and we try to find a wining strategy for one of the players that wins against all possible moves of the opponent.

The goal for this thesis is to implement some game solving algorithms in an interactive theorem proof like Isabelle/HOL.

Goals and Tasks

- Learn about game algorithms and interactive theorem proving.
- Implement a game solver
- Proof some (simple) properties



Literature

- T. Nipkow and G. Klein
  Concrete Semantics
  Springer, 2014
  http://www.concrete-semantics.org
- W. Thomas
  Infinite games and verification
  International Conference on Computer Aided Verification

Courses & Deliverables

- ☑ **Introduction to Scientific Working**
  Short report on background
  Short presentation
- ☑ **Bachelor Project**
  Project code and documentation
- ☑ **Bachelor's Thesis**
  Project code
  Thesis
  Final presentation

Recommended if you're studying

☑ CS ☑ ICE ☑ SEM ☑ MATH

Prerequisites

- Knowledge of finite automata
- Interest in logic and proofs

Advisor / Contact

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