Implementing Tableaux Using Binary Decision Diagrams

Research Plan

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1 Project Description

The method of semantic tableaux has been used extensively in computer science to automate reasoning in many modal and description logics. In many applications, there is a need for provers to handle larger and larger problem sizes, so there is a need to find good data structures which allow such scaling.

Binary Decision Diagrams (BDDs) have been used as data-structures by the model checking community to produce spectacularly efficient model checkers.

Question: can we used BDDs to implement efficient tableaux provers?

2 Learning Objectives

• Learn about method of semantic tableaux for automated reasoning and BDD package Buddy.
• Implement tableaux provers for some basic normal modal logics using BDDs as the underlying data structure.
• Find a methodology which leads to efficient provers. There may be none but this is fine as long as a sensible approach has been taken to reach this conclusion.

3 Supervisors

Rajeev Gore, Jimmy Thomson

4 Schedule

• Week 1-4: Reading: modal logic, semantic tableaux methods
• Week 5-6: Research semantic tableaux provers, implement naive prover
• Week 6-7: Research BDDs, applications in model checking and related areas
• Week 7: Formulate hypotheses, research content of report
• Break: Implementation of BDD based provers, research content of report
• Week 8: Implementation of BDD based provers, report writing
• Week 9-11: Refining provers, performance testing, initial report draft
• Week 12: Prepare final presentation, review of report draft
• Week 13-14: Finalize report and presentation