Quantified Boolean Formula Solver

Solving QBF by converting to EPR

David Green
BSc(Hons) Computer Science and Mathematics
Project report for third year project under the supervision of Konstantin Korovin done in the School of Computer Science at the University of Manchester

May, 2016

Abstract

abstract goes here

Contents

1 Introduction **3**

2 Background **4**
- 2.1 Boolean Logic . . . 4
  - 2.1.1 Propositional Logic and EPR . . . 4
  - 2.1.2 Quantified boolean formulas . . . 4
- 2.2 Complexity of Satisfiability . . . 4
  - 2.2.1 SAT is NP complete . . . 4
  - 2.2.2 QBF is PSPACE complete . . . 4
- 2.3 Automated Reasoning . . . 4

3 Converting QBF to EPR **5**
- 3.1 Raising QBF to First Order Logic . . . 5
- 3.2 Removing Existential Quantifiers by Skolemization . . . 5
- 3.3 Removing Function Symbols Introduced by Skolemization . . . 5
- 3.4 Dependency Schemes . . . 5

4 Technical Details **6**
- 4.1 Language Choice . . . 6
- 4.2 Input and Output Formats . . . 6
  - 4.2.1 QDIMACS . . . 6
  - 4.2.2 TPTP . . . 6
- 4.3 Data Structures . . . 6
- 4.4 Algorithms . . . 6
  - 4.4.1 Skolemization . . . 6
  - 4.4.2 Removing Functions . . . 6
  - 4.4.3 Dependency Scheme Construction . . . 6
- 4.5 Testing . . . 6

5 Future work **7**
- 5.1 Dependency Scheme Optimisations . . . 7

5.2 Anti-prenexing 7

6 Evaluation **8**
6.1 Comparison Against Direct QBF Solvers 8
6.2 Comparison Against EPR Converters 8

7 Project plan **9**

8 Conclusion **10**

9 Bibliography **11**

Chapter 1

Introduction

Introduction goes here

Chapter 2

Background

Background goes here

2.1 Boolean Logic

2.1.1 Propositional Logic and EPR

2.1.2 Quantified boolean formulas

2.2 Complexity of Satisfiability

2.2.1 SAT is NP complete

2.2.2 QBF is PSPACE complete

2.3 Automated Reasoning

Chapter 3

Converting QBF to EPR

acronym-ise header

Detailed conversion goes here

3.1 Raising QBF to First Order Logic

3.2 Removing Existential Quantifiers by Skolemization

3.3 Removing Function Symbols Introduced by Skolemization

3.4 Dependency Schemes

Chapter 4

Technical Details

probably give it a better name

4.1 Language Choice

4.2 Input and Output Formats

4.2.1 QDIMACS

4.2.2 TPTP

4.3 Data Structures

4.4 Algorithms

4.4.1 Skolemization

4.4.2 Removing Functions

4.4.3 Dependency Scheme Construction

4.5 Testing

Chapter 5

Future work

Future work goes here

5.1 Dependency Scheme Optimisations

5.2 Anti-prenexing

Chapter 6

Evaluation

evaluation goes here

6.1 Comparison Against Direct QBF Solvers

6.2 Comparison Against EPR Converters

Chapter 7

Project plan

project plan goes here

Chapter 8

Conclusion

conclusion goes here

Chapter 9

Bibliography

[1] University of Manchester logo from Wikipedia by source, fair use
https://en.wikipedia.org/w/index.php?curid=43485475
2014