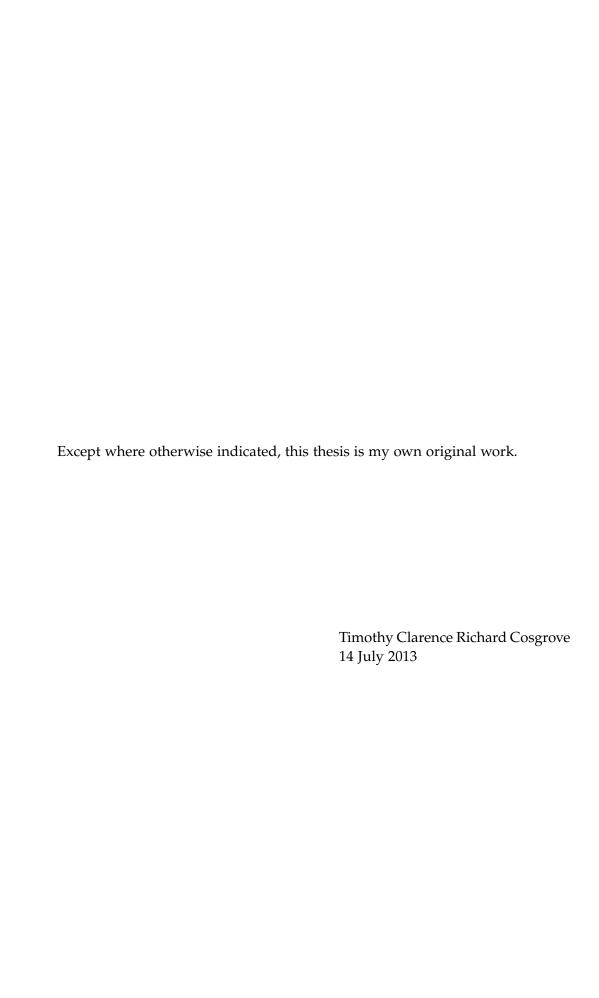
## Term-Indexing for the Beagle Theorem Prover

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A subthesis submitted in partial fulfillment of the degree of Bachelor of Science (Honours) at The Department of Computer Science Australian National University

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# Acknowledgements

Thank you to my Supervisor and all...

# **Abstract**

This should be the abstract to your thesis...

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# An Introduction to My Thesis

- 1.1 The Basis for this Work
- 1.1.1 A Theoretical Framework

## Background

### 2.1 First-Order Logic Terms and Notation

This thesis focuses around the extension of *beagle*, a *first-order logic* (FOL) theorem prover. In order to understand beagle's purpose and functions a basic understanding of the FOL logical system is required. This section provides a rudimentary overview of FOL syntax and uses; but also includes an explanation of any specialised terms and notation used throughout the paper.

### 2.1.1 FOL basics

### 2.1.2 Calculi and FOL problems

### 2.1.3 The Superposition Calculus

Should contain

- Variables
- Symbols
- Predicates
- Quantifiers
- Notion of soundness and completeness
- Description of a 'calculus'
- Positions

## 2.2 Automated Reasoning and Theorem Proving

Automated Reasoning is a rapidly growing field of research where computer programs are used to solve problems stated in first order logic statments or other formal logics.

Some existing theorem provers include:

### **SPASS**

[Weidenbach et al. 1999]

### Vampire

[Riazanov and Voronkov 1999]

E

[Schulz 2002] Should contain

Theorem prover examples

### 2.3 Term Indexing

Term indexing is a technique used to better locate logical terms which match rules in a prover's calculus.

### **Top Symbol Hashing**

**Discriminant Trees** 

### 2.4 Fingerprint Indexing

*Fingerprint Indexing* is a recent technique developed by Schulz [2012], the creator of the E prover.

### 2.5 The Beagle Theorem Prover

The core implementation of Beagle was developed by Peter Baumgartner et al. of NICTA. Its purpose was to demonstrate the capabilities of the *Weak Abstraction with Heirachic Superposition Calculus*; which allows the incorporation of prior knowledge via a 'background reasoning' modules.

### 2.5.1 The Weak Abstraction with Heirachic Superposition Calculus

### 2.5.2 Beagle's Shortcomings

### 2.6 Scala

As mentioned above *beagle* is written in *Scala*, the Scalable Language. Scala is a functional language and may be confusing to those who are not familiar with the functional programming paradigm. This thesis will contain occasional snippets of

Scala code; but note that any snippets used will be accompanied by an explanation and in general an understanding of Scala/funcitonal programming is not required.

# Implementing Fingerprint Indexing

### 3.1 Initial Implementation

Listing 1: Scala implementation of the Fingerprint unification table. [Schulz 2012, p6]

- 3.1.1 Refactoring Current Implementation
- 3.1.2 Initial Problems
- 3.2 Tailoring to Beagle

# **Results**

- 4.1 Why I Did It
- 4.2 What I Did

Results

# Conclusion

5.1 Why this is a Very Clever Thesis

12 Conclusion

# **Some Other Stuff**

A.1 Why I Did It

# **More Stuff**

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