Advisor	Magnus Madsen (Primary) & Anders Møller
Students	Søren Baadsgaard
Languages	English / Danish
Text tools	LaTeX
Other tools	Scala (Programming language)

Project Description (at least 10-20 lines)

Testing programs thoroughly requires good selections of input values, to make sure that all corner cases of the programs are reached. Symbolic execution is a classic technique for automatically obtaining such input values. Instead of running programs using concrete values, it uses symbolic expressions together with automated theorem proving tools. Within the last decade, a variant called directed automated random testing, which combines concrete and symbolic execution, has become widely used. In this project we will investigate these techniques, starting with classic symbolic execution and moving on to more modern approaches. We will review and discuss research papers within this field, and we will also be working on a small prototype tool to perform symbolic execution on a simple toy language that we design.

This gives the following tasks:

- -1: Design a toy language for the prototype tool. And make a concrete interpreter for it.
- 0: Review the literature and summarize the ideas and techniques presented in them.
- A: Implementation of basic symbolic execution in the prototype tool.
- B: Extending the prototypes with other techniques, and possibly extend the toy language.
- C: Discussion of the strengths and weaknesses of the different methods used. What are their strengths and limitations?

Provisional Table of Contents

- Abstract (10-20 lines)
- Section 1: Introduction (1-2 pages)
- Section 1a: Design of simple language to implement a prototype for (Task -1, 1-2 pages).
- Section 2: Review of literature (Task 0, 4-8 pages)
- Section 3: Basic symbolic execution of the toy language(Task A, 4-8 pages)
- Section 4: extending the prototype with other methods(Such as those described in the DART paper). (Task B, 4-8 pages)
- Section 5: Discussion of strength and weaknesses of different method. What are the possibilities and limitations of these techniques? (Task C, 4-8 pages)
- Section 6: Comparison to other work and ideas for future work (2-4 pages)
- Section 7: Conclusion (1-2 pages)
- Acknowledgements (3-5 lines)
- References ($\frac{1}{2}$-1 page)
- Appendix with programming code, tables, full proofs, etc. (5-20 pages)

Provisional Time Plan

First week of February (15 hours)
Planning of activities, including the production of the Bachelor's contract. Also making a first edition of the toy language, and interpreting this.

Rest of February and first half of March (3×15 hours)
Read the three given articles and review the ideas and methods that are presented in them. Make draft of Section 2 in Bachelor's report. Also do some initial work on task A.

Rest of March and first week of April ($2 \times 15 + 2 \times 30$ hours)
Completion of task A and make draft of Section 3 in Bachelor's report.

Rest of April (3×30 hours)
Completion of task B and make draft of Section 4 in Bachelor's report.

First three weeks of May (3×30 hours)
Completion of task C and make draft of Section 2 in Bachelor's report.

Last week of April of first half of June (3×30 hours)
Write the missing parts, put drafts together, make things consistent, proof reading.