



# Supervisor's statement of a final thesis

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**Student:** Bc. Vojtěch Rozhoň  
**Thesis title:** Nested loops and path explosion in symbolic execution  
**Branch / specialization:** System Programming  
**Created on:** 5 June 2024

## Evaluation criteria

### 1. Fulfillment of the assignment

- ▶ [1] assignment fulfilled
- [2] assignment fulfilled with minor objections
- [3] assignment fulfilled with major objections
- [4] assignment not fulfilled

All the objectives of the assignment have been fulfilled.

### 2. Main written part

90/100 (A)

The thesis is well written and does not have too many spelling or grammar mistakes. It is well structured but sometimes delves too much into the what rather than in the why; I would like to see more interpretation of the results, more discussions of the technical choices. Especially, for the evaluation part, I would like to see more experiments trying to validate hypothesis about the structure of the programs and their impact on the performance of the various path explosion techniques, but it looks more like a collection of experiments the goal of which is not totally clear.

### 3. Non-written part, attachments

94/100 (A)

The code is well-tested and well-documented. and uses relevant technologies. Scala is a good choice of implementation language to work on symbolically execution a language (and not machine code).

The experimental part is probably not perfectly repeatable as it uses randomness for the program generation but does not allow to set up the seed for the random number generator.

#### 4. Evaluation of results, publication outputs and awards

89 /100 (B)

The symbolic execution engine works in practice and could be used as a complement of the APR course (a course about static analysis that uses the same language, microC) or as a reference for APT, which has some lecture about symbolic execution.

The thesis rather reproduced existing results rather than brought new findings. The evaluation part could have given more new insights about which path explosion technique to use; I do not think that the thesis gives helpful and clear answers to the question of which techniques should be used, for which kinds of programs, to get better performance and alleviate the path explosion problem.

#### 5. Activity of the student

- ▶ [1] excellent activity
- [2] very good activity
- [3] average activity
- [4] weaker, but still sufficient activity
- [5] insufficient activity

Working with Vojtech was a pleasure. He was hard-working and regularly met with me, well-prepared.

#### 6. Self-reliance of the student

- [1] excellent self-reliance
- ▶ [2] very good self-reliance
- [3] average self-reliance
- [4] weaker, but still sufficient self-reliance
- [5] insufficient self-reliance

Vojtech was very self-reliant for the reading part, for the coding and writing parts. He was able to implement complex techniques, for instance, about loop summarization, from the research articles presenting them. He needed a bit more guidance for the evaluation part.

#### The overall evaluation

91 /100 (A)

Overall, this is a very good thesis and Vojtech implemented symbolic execution on a non trivial language from scratch, including complex path explosion techniques. The written part documents well all the work and is a good presentation of the path explosion techniques. The evaluation part features a large set of experiments but would be more enlightening if the experiments helped to validate/invalidate hypothesis about the advantages and disadvantages of the implemented techniques and why they work well or not for which kind of programs.

## **Instructions**

### **Fulfillment of the assignment**

Assess whether the submitted FT defines the objectives sufficiently and in line with the assignment; whether the objectives are formulated correctly and fulfilled sufficiently. In the comment, specify the points of the assignment that have not been met, assess the severity, impact, and, if appropriate, also the cause of the deficiencies. If the assignment differs substantially from the standards for the FT or if the student has developed the FT beyond the assignment, describe the way it got reflected on the quality of the assignment's fulfilment and the way it affected your final evaluation.

### **Main written part**

Evaluate whether the extent of the FT is adequate to its content and scope: are all the parts of the FT contentful and necessary? Next, consider whether the submitted FT is actually correct – are there factual errors or inaccuracies?

Evaluate the logical structure of the FT, the thematic flow between chapters and whether the text is comprehensible to the reader. Assess whether the formal notations in the FT are used correctly. Assess the typographic and language aspects of the FT, follow the Dean's Directive No. 52/2021, Art. 3.

Evaluate whether the relevant sources are properly used, quoted and cited. Verify that all quotes are properly distinguished from the results achieved in the FT, thus, that the citation ethics has not been violated and that the citations are complete and in accordance with citation practices and standards. Finally, evaluate whether the software and other copyrighted works have been used in accordance with their license terms.

### **Non-written part, attachments**

Depending on the nature of the FT, comment on the non-written part of the thesis. For example: SW work – the overall quality of the program. Is the technology used (from the development to deployment) suitable and adequate? HW – functional sample. Evaluate the technology and tools used. Research and experimental work – repeatability of the experiment.

### **Evaluation of results, publication outputs and awards**

Depending on the nature of the thesis, estimate whether the thesis results could be deployed in practice; alternatively, evaluate whether the results of the FT extend the already published/known results or whether they bring in completely new findings.

### **Activity of the student**

From your experience with the course of the work on the thesis and its outcome, review the student's activity while working on the thesis, his/her punctuality when meeting the deadlines and whether he/she consulted you as he/she went along and also, whether he/she was well prepared for these consultations.

### **Self-reliance of the student**

From your experience with the course of the work on the thesis and its outcome, assess the student's ability to develop independent creative work.

### **The overall evaluation**

Summarize which of the aspects of the FT affected your grading process the most. The overall grade does not need to be an arithmetic mean (or other value) calculated from the evaluation in the previous criteria. Generally, a well-fulfilled assignment is assessed by grade A.