Bachelor's Thesis
Program optimization based on concolic execution

DI Lukas Makor, BSc
Institute for System Software
T +43-732-2468- 3435
lukas.makor@jku.at

Student: Thomas Hackl
Advisor: DI Lukas Makor, BSc
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Concolic testing uses a mixture between symbolic and concrete execution to generate new test input with the goal of increasing test coverage. In this project a similar idea should be explored:

Execute a program with user-supplied inputs and keep track of computation results (branches taken, computed values, variable assignments). Then identify optimization potentials from the gathered information and report it to the user.

The goal is to implement a tool in Java that performs this task.

The optimization targets of this tool are non-interactive (i.e. non user input based), computation-heavy programs.

So, instead of generating test inputs, the user of the tool is required to supply a comprehensive set of inputs that comprise all required functionality including all edge cases that need to be supported.

The tool should instrument the targeted program and execute it with all supplied inputs. The information gathered through instrumentation should be used to detect optimization opportunities.

The minimum information that the tool should be able to track is: methods that are never called, branches that are never taken, primitive fields and local variables that always hold the same value (i.e., are effectively constant), methods that always return the same value (for primitive types) and whether the execution count of loops is constant across all test inputs.

Finally, the tool should report the detected optimization opportunities back to the user, such that the user can decide what they want to optimize.

Both the language that should be analyzed as well as the language in which the tool should be implemented in is Java.

Modalities:
The progress of the project should be discussed at least every three weeks with the advisor. A time schedule and a milestone plan must be set up within the first 3 weeks and discussed with the advisor. It should be continuously refined and monitored to make sure that the thesis will be completed in time. The final version of the thesis must be submitted not later than **30.4.2025**.