Ultimate Eliminator at SMT-COMP 2022

Max Barth, Daniel Dietsch, Matthias Heizmann, and Andreas Podelski
University of Freiburg, Germany

Abstract
Ultimate Eliminator is a tool for eliminating quantifiers in SMT formulas. At the SMT-COMP 2022 we participate with a user interface that takes SMT-LIB 2.6 compatible input, tries to eliminate quantifiers in this input and passes the modified input to the MathSAT SMT solver. The first three sections of this system description were copied from last year’s submission. In Section 4 we present some technical data of this year’s tool.

1 Overview
Quantified formulas are notoriously difficult to solve and several state-of-the-art SMT solvers support only quantifier-free formulas. We found out that, perhaps surprisingly, the quantifier elimination algorithms that are implemented in the Ultimate software verification framework can often find quantifier-free formulas that are logically equivalent to formulas in SMT-LIB benchmarks. Hence, these quantifier elimination algorithms empower existing SMT solvers without support for quantifiers to solve quantified formulas. E.g., a formula of the form \(\exists x. \varphi(x) \land x = t\) is transformed to \(\varphi(t)\) and the formula \(\forall a. \text{select}(a, k) = \text{select}(a, i)\) is transformed to \(k = i\).

2 Quantifier Elimination in Ultimate
A key algorithm [?] of several software verifiers [?] in the Ultimate framework \(^1\) does an iterative application of the strongest post predicate transformer to a sequence of statements resp. an iterative application of the weakest precondition predicate transformer. Both variants of the algorithm produce quantified formulas and the handling of these quantified formulas often was a bottleneck for the overall software verification approach. The performance of the tool improved significantly when the developers started to apply quantifier elimination techniques to every intermediate result. As a consequence, in the last years an increasing number of quantifier elimination techniques was implemented into the Ultimate framework.

3 Ultimate Eliminator
Ultimate Eliminator \(^2\) is a user interface that takes SMT-LIB 2.6 compatible input tries to eliminate quantifiers in this input and passes the modified input to a user defined SMT-LIB 2.6 compatible solver. Ultimate Eliminator is implemented in Java as a plug-in of the Ultimate framework. The source code is available in a public repository \(^3\).

\(^{1}\)https://ultimate.informatik.uni-freiburg.de/
\(^{2}\)https://ultimate.informatik.uni-freiburg.de/eliminator/
\(^{3}\)https://github.com/ultimate-pa/ultimate/
4 SV-COMP 2022 Submission

We submitted a version of Ultimate Eliminator that wraps the MathSAT SMT solver\textsuperscript{4} and participate only in divisions with quantifiers. Our \texttt{ULTIMATEELIMINATOR+MathSAT-5.6.7} submission wraps the version 5.6.7 of the MathSAT SMT solver. We call MathSAT without any additional arguments. Since StarExec does not yet support Java 11, we added OpenJDK 11.0.2+9 to our archive. Adding OpenJDK increased the size of our archive from about 15MiB to about 200MiB.

Our wrapper tool participates in the Single Query Track, in the Incremental Track, and in the Unsat Core Track.

References

\begin{itemize}
\end{itemize}

\textsuperscript{4}http://mathsat.fbk.eu/