— Exercise 6 —

Deadline: TODO

Task 1 - Preprocessing

Develop, implement and evaluate some preprocessing techniques. Some suggestions can be found on the slides *Preprocessing, Union Find and Theory Propagation.* You can additionally use papers on this topic for inspiration. For example for more details on term reduction you can take a look at the paper *A decision procedure for equality logic with uninterpreted functions* by Olga Tveretina[1].

Task 2 - Union Find

Consider implementing a union find data structure. Try to implement it as efficiently as possible. Further information on union find as well as term simplification (i.e. curryfing and flattening) can be found amongst others in the paper *Fast congruence closure and extensions* by Robert Nieuwenhuis and Albert Oliveras[2]. This paper furthermore contains some information on an incremental congruence closure algorithm (a congruence closure algorithm is basically what you were implementing).

Task 3 - Theory Propagation

Implement (partial) theory propagation, evaluate the impact it has on your solvers overall performance. Also test different compositions of your solver.

Task 4 - Final Solver

Improve your solver as much as possible using the previously suggested techniques and whatever other approaches you may think of. Test your different ideas and remember to document them including whether they worked out, what combinations worked best (or not at all). Also try to find reasons for the bad performance of approaches that did not improve your solvers performance.

Your final solver must not compute any wrong outputs on the SMT-LIB benchmarks for QF_UF and should cause as little *segfault*s as possible. It should also not return *unknown*. To have *timeout*s or *memout*s on hard input problems is to be expected, however, try to solve as many of the benchmarks as possible.

Task 5 - Presentation

Prepare slides to present your approaches, including their impact on your solvers performance and which of them are used in your final solver, as well as your final results in a short presentation (10-15 minutes) at the next meeting.

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[1] https://link.springer.com/content/pdf/10.1007\%2F978-3-540-30210-0_7.pdf
[2] https://www.sciencedirect.com/science/article/pii/S0890540106001581