

SAT and SMT Solving | WS 2022 | LVA 703147

Exercises 3 | November 4, 2022

[3] 1 Apply the Branch & Bound algorithm or the binary search algorithm to the formula

$$\varphi = \neg y \wedge (x \vee y) \wedge (\neg x \vee z) \wedge (\neg x \vee y) \wedge (\neg x \vee \neg y) \wedge (x \vee z) \wedge (\neg x \vee \neg y \vee z) \wedge (y \vee \neg z) \wedge z$$

to determine minUNSAT(φ).

2 Implement a minUNSAT solver based on binary search, e.g. in Python while using the `z3` library for satisfiability checks.

[3] (a) Write a function `minUNSAT` which takes a list of list of `z3` variables representing a CNF formula φ, and returns minUNSAT(φ). Test it on the examples of Exercise 1 and the slides of Week 3.

[1] (b) Also return a corresponding valuation, i.e., a valuation that minimizes the number of unsatisfied clauses.

[3] 3 Consider the configuration problem from slide 20 of week 3. Rudy wants to buy a new car and would like to have, if possible, engine E_1, gearbox G_2, control unit C_2, dashboard D_2, D_3 or D_4, navigation system N_2, air conditioning system AC_1, alarm system AS_1, and radio R_2.

Build a maxSAT encoding using `z3` and find out how many preferences can be maximally satisfied. You might want to look at `optimize.py` to see how optimization is supported.

[3] ⋆ 4 Prove by induction on the number of variables in a formula φ that the Branch and Bound algorithm run on a formula φ returns minUNSAT(φ).