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Tutorials for Decision Procedures
Exercise Sheet 11

Exercise 1: Nondeterministic Nelson–Oppen Method 2 Points

Apply the nondeterministic version of the Nelson–Oppen theory combination method to decide $T_{\mathsf{cons}} \cup T_{\mathbb{Q}}$-satisfiability of the following formula.

$$cons(x, y) = z \land car(z) = 1 \land 2x + y \leq 4 \land x + 2y \geq 5$$

Exercise 2: Deterministic Nelson–Oppen Method 4 Points

Apply the deterministic version of the Nelson–Oppen theory combination method to decide $T_{\mathsf{E}} \cup T_{\mathbb{Q}}$-satisfiability of the following formulae.

(a) $x + y = z \land f(z) = x + y \land f(f(x + y)) \neq z$.

(b) $g(x + y, z) = f(g(x, y)) \land x + z = y \land z \geq 0 \land x \geq y \land g(x, x) = z \land f(z) \neq g(2x, 0)$

Exercise 3: Equality Propagation 4 Points

The deterministic version of the Nelson–Oppen theory combination method requires that the involved theories propagate new equalities between the shared variables.
The congruence closure algorithm for the theory of equality T_{E} can easily be modified to propagate all implied equalities. Describe such a modification.

Exercise 4: DPLL(T) 2 Points

Compute the propositional core of the following $\Sigma_{\mathbb{Q}}$-formula in CNF.

$$(z \leq 1 \rightarrow x \leq y) \land y + z \leq x \land 0 \leq z \land (z > 1 \rightarrow x + z \leq y)$$