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Tutorials for Decision Procedures
Exercise sheet 6

Exercise 1: Sufficient Set

For $T_{\mathbb{Q}}$ the algorithm in the lecture examines terms $\frac{s+t}{2}$ for all $s, t \in S$. Suppose we split up S in S_A, S_B, S_C depending on whether the term t comes from an (A) $x < t$, (B) $t < x$, or (C) $x = t$ literal. Based on this distinction, give a smaller set of terms that is still sufficient.

Exercise 2: Quantifier Elimination for $T_{\mathbb{Z}}$

Apply quantifier elimination to the following $\Sigma_{\mathbb{Z}}$-formulae:

(a) $\exists y. \, (x = 2y \land y < x)$

(b) $\forall y. \, (25 < x + 2y \lor x + 2y < 25)$

(c) $\forall y. \, (x + y < 8 \rightarrow x + 2y < 8)$

Exercise 3: Deciding T_E

Apply the DAG-based decision procedure to decide satisfiability for the following Σ_E-formulae:

(a) $f(x) = x \land f(a) \neq a$

(b) $f(x) = x \land a = f(f(x)) \land f(a) \neq a$

(c) $f(g(x)) = g(f(x)) \land f(g(f(y))) = x \land f(y) = x \land g(f(x)) \neq x$

(d) $p(x) \land f(f(f(f(x)))) = x \land f(f(f(x))) = f(f(x)) \land \neg p(f(x))$