



J. Hoenicke

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Tutorials for Decision Procedures Exercise sheet 9

Exercise 1: DP for quantifier-free $T_{\text{cons}} \cup T_E$

Apply the decision procedure for quantifier-free $T_{\text{cons}} \cup T_E$ to decide satisfiability of the following $\Sigma_{\text{cons}} \cup \Sigma_E$ -formulae:

- (a) $y = \text{cons}(\text{cdr}(x), \text{car}(x)) \wedge x = \text{cons}(\text{car}(y), \text{cdr}(y))$
- (b) $y = \text{cons}(\text{cdr}(x), \text{car}(x)) \wedge x = \text{cons}(\text{car}(y), \text{cdr}(y)) \wedge \text{car}(x) \neq \text{cdr}(x)$
- (c) $\neg \text{atom}(x) \wedge y = \text{cons}(\text{cdr}(x), \text{car}(x)) \wedge z = \text{cons}(\text{cdr}(y), \text{car}(y)) \wedge z \neq x$

Exercise 2: Satisfying Interpretation for T_{cons}

Take the result of applying the congruence closure algorithm on exercise 1.(a):

$$y = \text{cons}(\text{cdr}(x), \text{car}(x)) \wedge x = \text{cons}(\text{car}(y), \text{cdr}(y)).$$

Give a satisfying Interpretation I . Under this interpretation, what is the value of the term $\text{cons}(x, \text{cons}(\text{car}(x), \text{car}(y)))$?

Exercise 3: DP for quantifier-free T_A

Apply the decision procedure for quantifier-free T_A to decide satisfiability of the following Σ_A -formulae:

- (a) $a \langle i \triangleleft e \rangle [j] = e \wedge j \neq i$
- (b) $a \langle i \triangleleft e \rangle [j] = f \wedge a[j] \neq f$
- (c) $a \langle i \triangleleft e \rangle [j] = f \wedge i = j \wedge e \neq f$
- (d) $a \langle i \triangleleft e \rangle \langle j \triangleleft f \rangle [i] = g \wedge e \neq g$
- (e) $a \langle i \triangleleft e \rangle \langle j \triangleleft f \rangle [i] = g \wedge e \neq g \wedge j \neq i$