



J. Hoenicke  
A. Nutz

1.12.2015  
submit until 8.12.2015, 14:15

## Tutorials for Decision Procedures Exercise sheet 7

### Exercise 1: Constructing the DAG

Describe a procedure that takes the abstract syntax tree of a conjunctive quantifier-free  $\Sigma_E$ -formula and constructs the corresponding DAG. The procedure should run in linear time in the size of the formula on average. You can assume an  $O(1)$  implementation for hash tables.

### Exercise 2: Complexity of $T_E$

Give an upper bound for the complexity of deciding a conjunctive quantifier-free formula of  $T_E$ . Let  $n$  be the number of symbols in  $F$ . The complexity should be given as a polynomial in  $n$ .

### Exercise 3: 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)  $\neg \text{atom}(x) \wedge y = \text{cons}(\text{cdr}(x), \text{car}(x)) \wedge z = \text{cons}(\text{cdr}(y), \text{car}(y)) \wedge z \neq x$