

Exercises for “Decision Procedures for Verification” Exercise sheet 14

Exercise 14.1:

Let $\mathcal{T} = LI(\mathbb{Q})$, and let $Q := y \leq 1, R := x \leq y, P := y + y \leq 2$. Use a DPLL(\mathcal{T}) method to check the satisfiability w.r.t. \mathcal{T} of the following set of clauses:

$$\{\neg R \vee P, \neg Q \vee \neg P, R \vee P\}$$

Exercise 14.2:

In what follows we consider the theory of arrays defined in the lecture. We assume that the theory of indices \mathcal{T}_i is $LI(\mathbb{Z})$, and the theory of elements \mathcal{T}_e is $LI(\mathbb{Q})$.

Which of the formulae below are in the array property fragment and which are not? Justify your answer. (The universally quantified variables i, j are sort index; the indices k, l which are not universally quantified are considered to be constants of sort index)

- (1) $\forall i (a[i + 1] > a[i])$
- (2) $\forall i (i < a[k] \rightarrow a[i] = a[k])$
- (3) $\forall i, j (l_1 \leq i \leq u_1 < l_2 \leq j \leq u_2 \rightarrow a[i] \leq a[j])$
- (3) $\forall i, j (l_1 < i \leq u_1 < l_2 \leq j \leq u_2 \rightarrow a[i] \leq a[j])$.

Exercise 14.3:

Consider the following array property formula (where l and u are constants):

$$F : \forall i (l \leq i \leq u \rightarrow a[i] = b[i]) \wedge \neg \forall i (l \leq i \leq u + 1 \rightarrow \text{write}(a, u + 1, b[u + 1])[i] = b[i])$$

Apply to the formula F the Steps 1–6 of the transformation procedure for formulae in the array property fragment presented in the lecture.

Please submit your solution until Monday, February 4, 2013 at 9:00. Joint solutions prepared by up to three persons are allowed. Please do not forget to write your name on your solution. Submission possibilities:

- By e-mail to mbender@uni-koblenz.de with the keyword “Homework DP” in the subject.
- Put it in the box in front of Room B 222.