Universität Koblenz-Landau

FB 4 Informatik

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Exercises for "Decision Procedures for Verification"
Exercise sheet 9

Exercise 9.1: (*6 P*)
Check the satisfiability of the following ground formulae using the algorithm based on congruence closure presented in the lecture.

(1) $\phi_1 : f(f(f(a))) \approx a \wedge f(f(f(f(f(a))))) \approx a \wedge f(a) \not\approx a$

(2) $\phi_2 : f(a) \approx f(b) \wedge a \not\approx b.$

(3) $\phi_3 : h(c,e) \approx d \wedge g(d) \approx e \wedge h(c,g(d)) \approx b \wedge g(h(c,b)) \approx b \wedge g(g(h(c,b))) \not\approx e.$

Exercise 9.2: (*4 P*)
Check the satisfiability of the following formulae in (positive) difference logic w.r.t. $\mathbb{Q}$; in case of satisfiability find a satisfying assignment.

(1) $\phi_1 = x - y \leq 3 \ \wedge \ y - z \leq 2 \ \wedge \ x - z \leq 1 \ \wedge \ x - u \leq -3.$
(2) $\phi_2 = x - y \leq 3 \ \wedge \ y - z \leq 2 \ \wedge \ x - z \leq 1 \ \wedge \ x - u \leq -3 \ \wedge u - x \leq 1.$
(3) $\phi_3 = x - y \leq 3 \ \wedge \ y - z \leq 2 \ \wedge \ x - z \leq 1 \ \wedge \ x - u \leq -3 \ \wedge \ u - z \leq 3 \ \wedge \ z - x \leq 1.$

(Note that all graphs have the same sets of nodes, and ϕ_2 and ϕ_3 are obtained from ϕ_1 by adding some constraints.)

Hint: It is sufficient to check the existence of negative cycles in $G(\phi_i)$ by looking at the graphs; in this assignment you do not have to use the Bellman-Ford algorithm for this.

Please submit your solution until Friday, December 16, 2011 at 17:00 by e-mail to `sofronie@uni-koblenz.de` with the keyword "Homework DP" in the subject.

Joint solutions prepared by up to two persons are allowed.
Please do not forget to write your name on your solution!