Decision Procedures and Verification

Seminar 6

1. (1 point) Show that the problem of satisfiability in equality logic is NP-complete.

2. (1 point) Extend Ackermann's reduction for multiple uninterpreted functions and arity higher than 1. Transform the following formula to equivalently valid one in equality logic:

$$(x_1 = x_2) \wedge (F(x_1) = x_3) \rightarrow (G(F(x_1), F(F(x_2))) = G(x_3, F(x_3)))$$

3. (1 point) Extend the CONGRUENCE-CLOSURE algorithm for function of higher arity than 1. Use it to decide validity of the formula from the previous exercise.

4. (1 point) Consider the set of constraints :

$$x_1 \geq -x_2 + \frac{11}{5}$$
$$x_1 \leq x_2 + \frac{1}{2}$$
$$x_1 \geq 3x_2 - 3$$

   Find out if it has

   1. real solution (using general simplex)
   2. integer solution (using branch and bound)

5. (1 point) Suggest a method for equivalence checking of the following two circuits that use gates C,D,F,G,H,K and memory components $L_1, \ldots, L_5$, $L'_1, \ldots, L'_5$: