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:

\[(x_1 = x_2) \land (F(x_1) = x_3) \rightarrow (G(F(x_1), F(x_2)) = G(x_3, F(x_3)))\]

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:

\[\begin{align*}
x_1 & \geq -x_2 + \frac{11}{5} \\
x_1 & \leq x_2 + \frac{1}{2} \\
x_1 & \geq 3x_2 - 3
\end{align*}\]

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 \(L_1, \ldots, L_5, L_1', \ldots, L_5'\):