Examination Automated Reasoning

Code 2IMF25, January 29, 2018, 9.00 - 12.00

This examination consists of 5 problems each having the same weight. The final result for this course will be the average of the result for the practical assignment and the result for this examination, as long as both results are at least 5. Here for the practical assignment the average of both parts is taken.

Problem 1.

a. Establish whether the CNF consisting of the following clauses is unsatisfiable, by using the four rules UnitPropagate, Decide, Fail and Backtrack; as the first decision literal choose p^d. Make clear at every step what is the corresponding list M of literals and which clause was used.

(1)	$p \vee q \vee r$	(4)	$p \vee q \vee \neg r$
(2)	$\neg q \vee \neg r$	(5)	$\neg p \vee q$
(3)	$\neg p \vee \neg q \vee r$		

b. Apply the Davis Putnam procedure on the same CNF.

Problem 2.

Compute the ROBDD of $2p + q + r + s \leq 2$ with respect to the order $p < q < r < s$, in which true is identified with 1 and false is identified with 0.

Problem 3.

Establish whether the following conjunction of linear inequalities on $x, y \geq 0$ is feasible by the Simplex method.

$$x + y \geq 2 \wedge x + 2y \leq 5 \wedge x - y \geq 3.$$

Problem 4.

a. Compute $x_2\sigma$ for σ being the most general unifier of $f(x_1, x_2, g(x_1, x_1))$ and $f(h(y_1), g(y_2, y_1), y_2)$.

b. Bring

$$(\forall x : P(x)) \leftrightarrow (\exists x : Q(x))$$

to prenex normal form and apply Skolemization on the result.

Problem 5.

The term rewriting system R consists of the two rules

$$f(g(x, h(y))) \to g(f(y), g(x, y)),$$

$$h(f(x)) \to f(f(h(x))).$$

a. Prove that R is terminating.

b. Give all non-trivial critical pairs of R.

c. Determine whether R is confluent.