

Model Checking | SS 2012 | 703521

Week 1–2 | March 14, 2012

Homework

1. Use DPLL to check if the following formulas are satisfiable:

   1.1 $(\neg a \vee b) \wedge (\neg b \vee c) \wedge (a \vee \neg c) \wedge (\neg a \vee \neg b \vee \neg c)$

   1.2 $(a \vee b \vee \neg d) \wedge (c \vee d) \wedge (\neg a \vee \neg c) \wedge (c \vee b \vee \neg d) \wedge (\neg b \vee \neg d) \wedge (\neg b \vee \neg c)$

2. Consider the sequence of decisions a, b, c in the following CNF formula and show that it leads to a conflict:
   $(\neg c \vee \neg a \vee \neg e) \wedge (e \vee f) \wedge (\neg b \vee e \vee \neg d) \wedge (d \vee \neg a \vee g) \wedge (\neg f \vee e \vee d \vee \neg h) \wedge (\neg c \vee \neg f \vee \neg i) \wedge (\neg g \vee h \vee i)$

   1.1 Construct the conflict graph.

   1.2 Determine the unique implication points.

   1.3 Determine which cuts give rise to backjump clauses and give the corresponding results of applying the backjump rule.

3. Use Tseitin's transformation to convert the following formula to an equisafisfiable CNF formula:

   - $\neg((a \rightarrow b) \wedge \neg(c \vee d))$

4. Encode the formulas from Exercise 1 in the DIMACS format and run a SAT solver on them (for example MiniSAT: `http://www.minisat.se/`)

5. Consider binary numbers modulo 4. Is there a number x where $x \neq 0$ and a number y where the digits of y are different, such that the result of addition $x + y$ is equal to x with its digits swapped? Encode the problem and find a solution using a SAT solver.