

Formal Methods in Software Development, WS 2018. Homework 2 (due November 4)

1. Decide whether the following sets of clauses are satisfiable using DPLL.

(a) $p \vee q, \neg p \vee q, \neg r \vee \neg q, r \vee \neg q$

(b) $p \vee q \vee r, \neg p \vee \neg q \vee \neg r, \neg p \vee q \vee r, \neg q \vee r, q \vee \neg r$

(c) $\neg q \vee p, \neg p \vee \neg q, q \vee r, \neg q \vee \neg r, \neg p \vee \neg r, p \vee \neg r$

(d) $p \vee q, q \vee \neg r \vee s, \neg p \vee \neg q, \neg p \vee \neg r \vee \neg s, p$

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

2. Decide whether the sets of clauses at Exercise 1 are satisfiable using CDCL.

3. Transform the following formulas into CNF using Tseitin transformation.

- $((p \vee q) \wedge r) \Rightarrow (\neg s)$
- $(a \wedge b) \vee (\neg c \wedge (d \vee e))$

4. Consider the *placement of wedding guests* problem:

- Three chairs in a row: 1, 2, 3
- We need to place Aunt, Sister and Father.
- Constraints:
 - Aunt doesn't want to sit near Father
 - Aunt doesn't want to sit in the left chair
 - Sister doesn't want to sit to the right of Father

Can these constraints be satisfied? Use a SAT solver to answer the question.

The formalization of the problem should be sent as well as the DIMACS encoding and the output of the SAT solver.

5. For the “Assignment of frequencies” problem discussed in the class, study how much it scales in an one minute time frame. (*Hint*: You should instantiate n and k as much as possible such that a solution is found in 1 minute. Document your test and a table.)