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.