Tutorials for “Automated Reasoning”
Exercise sheet 7

Exercise 7.1: (4 P)
Let \( N \) be the following set of propositional clauses:

\[
\begin{align*}
\neg P & \lor \neg R & \lor \neg T & (1) \\
\neg P & \lor T & \lor \neg U & (2) \\
\neg R & \lor T & \lor U & (3) \\
\neg Q & \lor \neg R & \lor S & (4) \\
\neg P & \lor R & \lor \neg S & (5) \\
Q & \lor \neg U & (6) \\
P & \lor U & (7) \\
P & \lor \neg Q & \lor \neg U & (8)
\end{align*}
\]

Assume that during a DPLL-derivation, we have reached the configuration \( P^d Q^d R^d S^d T \lor N \). Give two different backjump clauses that can be used in this situation and give the successor state with respect to \( \Rightarrow_{\text{DPLL}} \) for each of these backjump clauses.

Exercise 7.2: (4 P)
Use a DPLL procedure to check whether the following formula is satisfiable or not.

\[
(P \lor Q \lor R) \land (P \lor \neg R) \land (\neg P \lor S) \land (\neg P \lor T) \land (Q \lor \neg S \lor \neg T) \land (\neg Q)
\]

Exercise 7.3: (3 P)
Prove the second part of Lemma 2.16.

Exercise 7.4: (4 Bonus Points)
The 2-SAT problem is: for given formula in CNF such that each clause has at most 2 literals we have to decide if it is satisfiable or not.

Using the results from the exercises 6.3 and 6.4 (sheet 6) show that the 2-SAT decision problem
has a deterministic polynomial time algorithm (polynomial with respect to the number of variables).

Submit your solution in lecture hall 001 during the lecture on May 31. Please write your name and the date of your tutorial group on your solution.

Note: Joint solutions are not permitted (work in groups is encouraged).