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Tutorials for "Automated Reasoning"
Exercise sheet 7

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

$$
\begin{array}{llllllllll}
\neg P & & & \vee & \neg R & & \vee & \neg T & & (1)\\
\neg P & & & & & & \vee & T \vee & \neg U & (2)\\
 & & & & \neg R & & \vee & T \vee & U & (3)\\
 & & \neg Q & \vee & \neg R & \vee S & & & & (4)\\
\neg P & & & \vee & R & \vee \neg S & & & & (5)\\
 & & Q & & & & & & \vee \neg U & (6)\\
 & P & & & & & & & \vee U & (7)\\
 & P \vee & \neg Q & & & & & & \vee \neg U & (8)
\end{array}
$$

Assume that during a DPLL-derivation, we have reached the configuration $P^d Q^d R^d S \neg T U \parallel N$. Give two different backjump clauses that can be used in this situation and give the successor state with respect to $\Rightarrow_{\mathsf{DPLL}}$ 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.

$$(P \vee Q \vee R) \wedge (P \vee \neg R) \wedge (\neg P \vee S) \wedge (\neg P \vee T) \wedge (Q \vee \neg S \vee \neg T) \wedge (\neg Q)$$

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).