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**Tutorials for “Automated Reasoning WS18/19”
Exercise sheet 2**

Exercise 2.1:

Convert the following formulas in CNF using both \Rightarrow_{BCNF} and \Rightarrow_{ACNF} :

1. $P \wedge \neg(Q \leftrightarrow R)$
2. $[(P \rightarrow S) \wedge \neg Q] \leftrightarrow [R \vee (\neg S \rightarrow Q)]$
3. $\neg[(P \wedge (P \rightarrow Q)) \leftrightarrow (P \vee Q)]$

Exercise 2.2:

Prove that the following formula is valid via resolution:

$$(P \rightarrow Q) \rightarrow [(R \vee P) \rightarrow (R \vee Q)]$$

apply \Rightarrow_{ACNF} to the negated formula and the resolution calculus to the resulting clauses until you derive the empty clause.

Exercise* 2.3:

Let N be a finite set of propositional clauses and P a propositional variable. Assume that we don't have duplicate literals in clauses and that no clause contains Q and $\neg Q$ for any propositional variable Q . Let $P \vee C_1, \dots, P \vee C_k$ be all clauses in N containing the literal P and $\neg P \vee D_1, \dots, \neg P \vee D_l$ be all clauses in N containing literal $\neg P$. Define the set $\mathcal{E}(P, N) = (N - \{P \vee C_i \mid 1 \leq i \leq k\} - \{\neg P \vee D_j \mid 1 \leq j \leq l\}) \cup \{C_i \vee D_j \mid 1 \leq i \leq k, 1 \leq j \leq l\}$. Prove that N is satisfiable iff $\mathcal{E}(P, N)$ is satisfiable.

It is not encouraged to prepare joint solutions, because we do not support joint exams.