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**Tutorials for “Automated Reasoning”**  
**Exercise sheet 3**

**Exercise 3.1:** (10 P)

Convert the following formulas to equivalent 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.  $P \wedge \neg[(Q \leftrightarrow R) \vee (S \rightarrow \top)]$

**Exercise 3.2:** (4 P)

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 3.3:** (4 P)

Prove that resolution is still complete using the semantic tree method if Subsumption is added.

Submit your solution in lecture hall E1.3, Room 001 during the lecture on November 22. Please write your name and the date of your tutorial group (Wed-Fabian, Wed-Tobias) on your solution.

Joint solutions, prepared by up to three persons together, are allowed (but not encouraged). If you prepare your solution jointly, submit it only once and indicate all authors on the sheet.