



Weidenbach

October 24, 2024

Tutorials for “Automated Reasoning WS24/25”  
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.  $[\neg(\neg P \vee (Q \wedge R))] \rightarrow [P \wedge (\neg Q \leftrightarrow \neg R)]$
4.  $P \wedge \neg[(Q \leftrightarrow R) \vee (S \rightarrow T)]$
5.  $\neg[(P \wedge (P \rightarrow Q)) \leftrightarrow (P \vee Q)]$

**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:**

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

**Exercise 2.4:**

Use CDCL to decide satisfiability of the following clause set.

- |                              |                             |                         |
|------------------------------|-----------------------------|-------------------------|
| (1) $\neg P_1 \vee \neg P_2$ | (2) $P_3 \vee P_2 \vee P_4$ | (3) $P_2 \vee \neg P_4$ |
| (4) $\neg P_3 \vee P_2$      | (5) $P_1 \vee P_2 \vee P_4$ |                         |

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