

Exercises for “Non-Classical Logics” Exercise sheet 1

Exercise 1.1: (2 P)

Determine which of the following formulas are valid/satisfiable/unsatisfiable:

- (1) $(P \wedge Q) \rightarrow P$
- (2) $Q \wedge \neg Q$
- (3) $\neg(\neg P \vee \neg\neg P)$
- (4) $((Q \rightarrow P) \wedge (R \rightarrow \neg P)) \rightarrow (\neg Q \vee \neg R)$

Exercise 1.2: (2 P)

Determine the polarity of the following subformulae of

$$F = \neg((\neg(P \wedge \neg Q)) \vee (R \vee \neg S)) \vee (U \wedge V)$$

- (1) $(P \wedge \neg Q)$
- (2) Q
- (3) $(R \vee \neg S)$
- (4) S
- (5) V
- (6) $((\neg(P \wedge \neg Q)) \vee (R \vee \neg S))$

Exercise 1.3: (3 P)

Let F be the following formula:

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

- (1) Compute the negation normal form (NNF) F' of F .
- (2) Convert F' to CNF using the satisfiability-preserving transformation described in the lecture.

Exercise 1.4: (3 P)

Consider the following formulae:

- $F_1 = P \rightarrow (\neg Q \vee (R \wedge S))$
- $F_2 = P$
- $F_3 = \neg S$
- $F = \neg Q$

Show that $\{F_1, F_2, F_3\} \models F$.

Hint: Use the fact that $\{F_1, F_2, F_3\} \models F$ iff $F_1 \wedge F_2 \wedge F_3 \wedge \neg F$ is unsatisfiable. In order to show that $F_1 \wedge F_2 \wedge F_3 \wedge \neg F$ is unsatisfiable compute the CNF for this conjunction and use resolution.

Please submit your solution until Wednesday, November 2, 2011 at the lecture. Please do not forget to write your name on your solution.

Submission possibilities:

- By e-mail to sofronie@uni-koblenz.de with the keyword “Homework Non-Classical Logics” in the subject.
- Put it in the box in front of Room B 225 (if you prefer to submit the written exercise like this please tell me such that I can prepare such a box).