

Exercises for “Non-Classical Logics” Exercise sheet 9

Exercise 9.1: (4 P)

Prove that the following formulae are valid using the tableau calculus presented in the lecture.

$$(1) \ \diamond(P \vee Q) \rightarrow (\diamond P \vee \diamond Q)$$

$$(2) \ (\diamond P \vee \diamond Q) \rightarrow \diamond(P \vee Q)$$

$$(3) \ \diamond(P \wedge Q) \rightarrow (\diamond P \wedge \diamond Q)$$

Exercise 9.2: (2 P)

Prove that the formula A is satisfiable using the tableau calculus presented in the lecture:

$$A : \ \neg((\diamond P \wedge \diamond Q) \rightarrow \diamond(P \wedge Q))$$

and construct a Kripke model $\mathcal{K} = (S, R, I)$ and a state $s \in S$ such that $(\mathcal{K}, s) \models A$ using a saturated tableau for A .

Exercise 9.3: (2 P)

Construct a saturated or closed tableau starting from the following prefixed formula:

$$T((\Box \diamond P \wedge \diamond P) \rightarrow \diamond \Box P)$$

Exercise 9.4: (2 P)

Compute the translation into first order logic used for checking the validity of a modal formula Φ (of the form $\exists x P_{\neg\Phi}(x) \wedge \text{Rename}(\neg\Phi)$) for the following formula:

$$F := \ \diamond(P \wedge Q) \rightarrow (\diamond P \wedge \diamond Q)$$

Supplementary exercise:

Remember the “wise men” and “muddy children” examples given in the lecture (at the beginning of the section on modal logic).

We will formalize the “wise men” example and show how to derive information about the knowledge of the wise men in the corresponding inference system.

Please submit your solution until Tuesday, January 15, 2013, 14:00. Joint solutions prepared by up to three persons are allowed. Please do not forget to write your name on your solution.

Submission possibilities:

- By e-mail to sofronie@uni-koblenz.de with “Homework Non-Classical Logics” in subject.
- Put your solution in the box close to the printer in Room B 222.