Universität Koblenz-Landau

FB 4 Informatik

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Exercises for "Non-Classical Logics"
Exercise sheet 10

Exercise 10.1: *(2 P)*

(1) Give a property of R that is necessary and sufficient for $\mathcal{F} = (S, R)$ to validate the schema $\Diamond^2 A \rightarrow \Box\Diamond^2 A$.

(2) Can you find an axiom schema which characterized the following property of the relation in a frame: $\forall s_1 \forall s_2 \forall s_3 (R^4(s_1, s_2) \wedge R^2(s_1, s_3) \rightarrow R(s_2, s_3))$

Exercise 10.2: *(1 P)*
Prove that in any Kripke structure $\mathcal{K} = (S, R, I)$ and for every $s \in S$ the following holds:

- $(\mathcal{K}, s) \models \Box^n F$ if and only if for all $t \in S$ with $R^n(s, t)$ we have $(\mathcal{K}, t) \models F$.

Exercise 10.3: *(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) $(\Diamond P \vee \Diamond Q) \rightarrow \Diamond(P \vee Q)$

Exercise 10.4: *(2 P)*
Prove that the formula A is satisfiable using the tableau calculus presented in the lecture:

$$A : \quad \neg((\Diamond P \wedge \Diamond Q) \rightarrow \Diamond(P \wedge Q))$$

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 10.5: *(2 P)*
Construct a saturated or closed tableau starting from the following prefixed formula:

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

Please submit your solution until Monday, January 26, 2015, at 18:00. Joint solutions prepared by up to three persons are allowed. Please do not forget to write your name(s) 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 222.