

Principles of Knowledge Representation and Reasoning

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Exercise Sheet 5

Due: November 27th, 2013

Exercise 5.1 (Modal logic: Frame properties, 2+1+2)

State for each of the following frame properties an axiom schema that defines it. Prove that your schema is valid in each frame that has the property. Furthermore, state an appropriate frame that does not have the property and in which the axiom is not valid.

- (a) vRu and vRw implies uRw .
- (b) For each v there exists at most one w with vRw .
- (c) uRv and uRw implies that there exists an x with vRx and wRx .

Exercise 5.2 (Modal logic: Tableaux rules, 2 + 1 + 2)

Use tableaux to prove or disprove the following statements. Construct a counterexample from the tableau when possible.

- (a) $\Box\Diamond p \leftrightarrow \Box\Diamond\Box\Diamond p$ is S4-valid.
- (b) $\Diamond\Box p \rightarrow \Box\Diamond p$ is KT5-valid.
- (c) $\Box(\Box p \rightarrow q) \vee \Box(\Box q \rightarrow p)$ is S4-valid.