Group: ______________________ | Supplementary Exercises

Name: ______________________ **Formal Models**

Matr.Nr.: ______________________ Summer Semester 2010

Points: ______________________

Institute for Formal Models and Verification, Dr. Robert Brummayer, Dipl.-Ing. Florian Lonsing

Please note: *The following exercises are offered in order to get additional preparation for the lecture exam. They will* ***not*** *influence final grading, therefore you do* ***not*** *have to submit your solution on paper. Results will be discussed informally in class on Thursday, 24th June, where participation is voluntary but recommended.*

Exercise 41

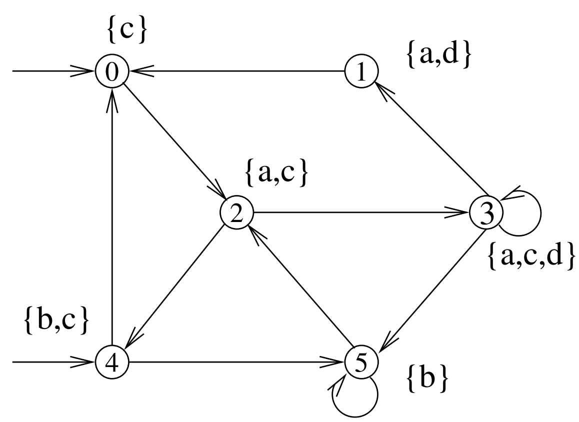
Given Kripke structure K as shown below. For the following infinite traces π of K and LTL formulae f, determine whether $\pi \models f$ or not. Justify your answer.

a) $\pi := (0,2,4)^\omega$ and $f := c\,\mathbf{U}\,b$

b) $\pi := (0,2,4)^\omega$ and $f := d\,\mathbf{U}\,c$

c) $\pi := (2,3,5)^\omega$ and $f := \mathbf{G}(b \rightarrow \mathbf{X}\neg b)$

d) $\pi := 0,2,(3)^\omega$ and $f := \mathbf{FG}\,d$



Exercise 42

For each of the following temporal formulae, check whether there is an equivalent formula in LTL^{det}. If so, then specify such an equivalent formula meeting the syntactic criteria for LTL^{det} as given on lecture slide 69. Note that subformulae p and q are atomic propositions, i.e. $p, q \in \mathcal{A}$.

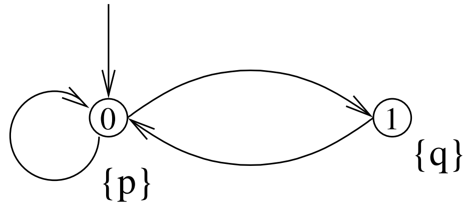
a) $p \rightarrow \mathbf{AX}\,q$

b) $(\mathbf{AF}p) \wedge \mathbf{AX}\neg p$

c) $\mathbf{EG}\,\mathbf{AX}\,p$

d) $\neg((\mathbf{EX}\neg q) \vee (\mathbf{EF}\neg p))$

Exercise 43



Given Kripke structure K as shown above. Justify your answers to the following questions.

a) Does $K \models f$ for ACTL formula $f := \mathbf{AX}\, p \vee \mathbf{AX}\, q$?

b) Let $g := f \setminus \mathbf{A}$. Does $K \models g$?

c) Based on the results of a) und b): are f and g equivalent?

d) Based on the results of a), b) and c): is there an LTL formula which is equivalent to f?

Exercise 44

Apply the semantical rules of CTL in order to prove that CTL formulae $\mathbf{EG}\, f$ and $\neg\mathbf{AF}\, \neg f$ are equivalent.