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LEHRSTUHL FÜR INFORMATIK 2
RWTH Aachen · D-52056 Aachen
http://www-i2.informatik.rwth-aachen.de/

Prof. Dr. Ir. J.-P. Katoen
Dr. T. Han and A. Mereacre

Introduction to Model Checking
Summer term 2010

– Series 6 –

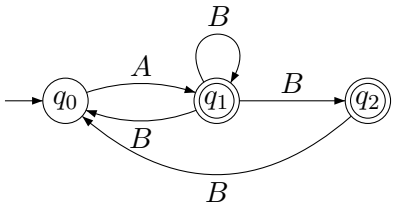
Hand in on June 16 before the exercise class.

Exercise 1 (3 points)

Show that the class of languages accepted by DBA is not closed under complement!

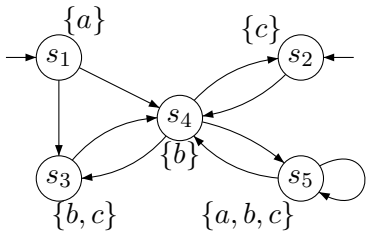
Exercise 2 (2 points)

Consider the GNBA outlined on the right with acceptance sets $F_1 = \{q_1\}$ and $F_2 = \{q_2\}$. Construct an equivalent NBA using the transformation introduced in the lecture.



Exercise 3 ($6 \times 0.5 = 3$ points)

Consider the transition system TS over the set of atomic propositions $AP = \{a, b, c\}$:



Decide for each of the LTL formulas φ_i below, whether $TS \models \varphi_i$ holds. Justify your answers! If $TS \not\models \varphi_i$, provide a path $\pi \in Paths(TS)$ such that $\pi \not\models \varphi_i$.

$$\varphi_1 = \Diamond\Box c \qquad \varphi_4 = \Box a$$
$$\varphi_2 = \Box\Diamond c \qquad \varphi_5 = a \mathsf{U} \Box(b \vee c)$$
$$\varphi_3 = \bigcirc\neg c \rightarrow \bigcirc\bigcirc c \qquad \varphi_6 = (\bigcirc\bigcirc\, b) \mathsf{U} (b \vee c)$$

Exercise 4 ($4 \times 1 = 4$ points)

Prove or disprove the following equivalences of LTL–formulas:

$$\Box\varphi \rightarrow \Diamond\psi \equiv \varphi \mathsf{U} (\psi \vee \neg\varphi) \qquad \Diamond\Box\varphi \rightarrow \Box\Diamond\psi \equiv \Box(\varphi \mathsf{U} (\psi \vee \neg\varphi))$$
$$\Box\Diamond\varphi \rightarrow \Box\Diamond\psi \equiv \Box(\varphi \rightarrow \Diamond\psi) \qquad \Diamond\,(\varphi \mathsf{U} \psi) \equiv \Diamond\psi$$