RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE AACHEN

LEHRSTUHL FÜR INFORMATIK 2
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Introduction to Model Checking
Winter term 08/09

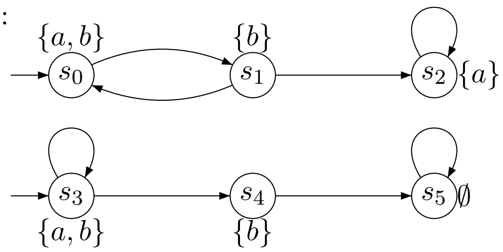
– Series 7 –

Hand in on December 19 before the exercise class.

Exercise 1 (4 points)

Let $AP = \{a, b, c\}$. Consider the transition system TS over AP outlined below

$TS:$



and the LTL fairness assumption $fair = (\Box\Diamond(a \wedge b) \rightarrow \Box\Diamond\neg c) \wedge (\Diamond\Box(a \wedge b) \rightarrow \Box\Diamond\neg b)$.

a) Specify the fair paths of TS!

b) Decide for each of the following LTL formulas φ_i whether it holds $TS \models_{fair} \varphi_i$:

$$\varphi_1 = \bigcirc\neg a \rightarrow \Diamond\Box a \qquad \varphi_2 = b\,\mathsf{U}\,\Box\neg b \qquad \varphi_3 = b\,\mathsf{W}\,\Box\neg b.$$

In case $TS \not\models_{fair} \varphi_i$, indicate a path $\pi \in FairPaths(TS)$ for which $\pi \not\models \varphi$ holds.

Exercise 2 (3 points)

For the LTL-formula

$$\varphi = a \wedge \bigcirc(b\,\mathsf{U}\,a)\,,$$

give $closure(\varphi)$ and the set of all elementary sets $B \subseteq closure(\varphi)$.

Exercise 3 (2 points)

Let φ be an LTL-formula over a set of atomic propositions AP. Prove the following property:
For all elementary sets $B \subseteq closure(\varphi)$ and for all $B' \in \delta(B, B \cap AP)$, it holds:

$$\neg\bigcirc\psi \in B \iff \psi \notin B'.$$

Exercise 4 (4 points)

Consider the following LTL-formula $\varphi = a\,\mathsf{U}\bigcirc a$ over the set of atomic propositions $AP = \{a\}$. Construct an equivalent GNBA $\mathcal{G}$ (i.e. $\mathcal{L}_\omega(\mathcal{G}) = Words(\varphi)$) according to the algorithm given in the proof of Theorem 5.37 of the lecture.