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

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# Exercises to the lecture *"Advanced Model Checking"*, winter term 2006

# – Assignment 1 –

**The solutions are collected on Oct. 27th at the beginning of the exercise class.**

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## Organisational matters

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|---|---|---|---|
| Lecture: | Monday | 16:00-17:30 | AH 4 |
| | Thursday | 13:30-15:00 | AH 1 |
| Exercise class: | Friday | 11:45-13:15 | AH 1 |

The webpage of the lecture can be found here:

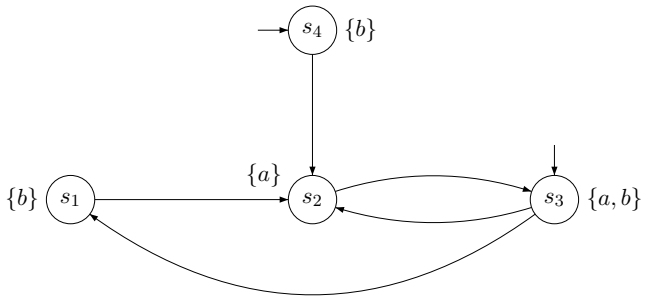
`http://www-i2.informatik.rwth-aachen.de/i2/amc0607/`

- To obtain a Übungsschein, at least 50% of the points have to be achieved and a final exam has to be passed.
- The assignments can be worked on in groups of at most two students. Please indicate your name and matriculation number on the first sheet of your solution.
- The exercise sheets are published every Friday on the website. You can hand in your solution one week later, at the beginning of the exercise class.

The assignments on this exercise sheet will be discussed during the exercise class on Friday, October 27th.

## Exercise 1 ($0.5 * 4 = 2$ points)

Consider the following transition system over the set of atomic propositions $\{a, b\}$:




Indicate for each of the following LTL-formulas the set of states for which these formulas are fulfilled:

(a) $\bigcirc a$

(b) $\bigcirc \bigcirc \bigcirc a$

(c) $\Box\Diamond a \rightarrow \bigcirc b$

(d) $\Box(b \mathsf{U} a) \wedge \Diamond(a \mathsf{U} b)$

## Exercise 2 (4 points)

Prove or disprove the following equivalences:

(a) $\bigcirc\Diamond\varphi \equiv \Diamond \bigcirc \varphi$

(b) $(\varphi_1 \mathsf{U} \varphi_2)\mathsf{U}\varphi_2 \equiv \varphi_1 \mathsf{U} \varphi_2$

(c) $\bigcirc\Diamond\Box\varphi_1 \vee \bigcirc\Diamond\Box\varphi_2 \equiv \bigcirc\Diamond\Box(\varphi_1 \vee \varphi_2)$

(d) $(\Diamond\Box\varphi_1) \wedge (\Diamond\Box\varphi_2) \equiv \Diamond(\Box\varphi_1 \wedge \Box\varphi_2)$

## Exercise 3 (3 points)

Provide an NBA for each of the following LTL-formulas:

(a) $\Box(a \vee \neg \bigcirc b)$

(b) $\Diamond a \vee \Box\Diamond(a \leftrightarrow b)$

(c) $\bigcirc \bigcirc (a \vee \Diamond\Box b)$

(Note: it is not required to apply the algorithms from Chapter 5 of the lecture notes; just an NBA suffices.)