RHEINISCH-
WESTFÄLISCHE
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AACHEN

Prof. Dr. Ir. J.-P. Katoen

T.Han, I.Zapreev

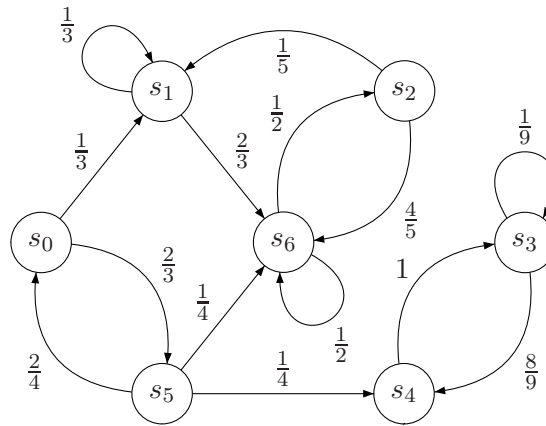# Exercises to the lecture *"Advanced Model Checking"*, **winter term 2006**

– **Assignment 12** –

The solutions are collected on Feb. 2nd at the beginning of the exercise class.
Justify your answers!

Exercise 1 (8 points)

Given a DTMC below:

Everywhere below $C = \{s_0,\ s_1,\ s_4,\ s_6\}$, $B = \{s_2,\ s_3\}$

  a) Compute the probability measure of the union of the following cylinder sets:

$$Cyl(s_0 s_1),\ Cyl(s_0 s_5 s_6),\ Cyl(s_0 s_5 s_4 s_3),\ Cyl(s_0 s_1 s_6)$$

 considering $i_{init}(s_0) = 1.0$

  b) Compute $Pr_{s_0}(\Diamond B)$ using the least fixed point characterization.

  c) Compute $Pr_{s_0}(C\ U^{\leq 5}\ B)$ using the equations for the least fixed point characterization.

  d) Compute $Pr_{s_0}(C\ U^{\leq 5}\ B)$ using the transient probabilities.

Note that $\Theta_n^M = i_{init} \cdot P^n$ *(the current lecture slides have a flaw).*

Exercise 2 (8 points)

Given a DTMC as follows.

s_0

0.7

0.3

s_1

s_2

0.4

0.8

0.2

0.2

s_3

0.4

s_4

1

s_5

0.6

1

1

0.1

s_6

1

s_7

s_8

1

1

0.3

s_9
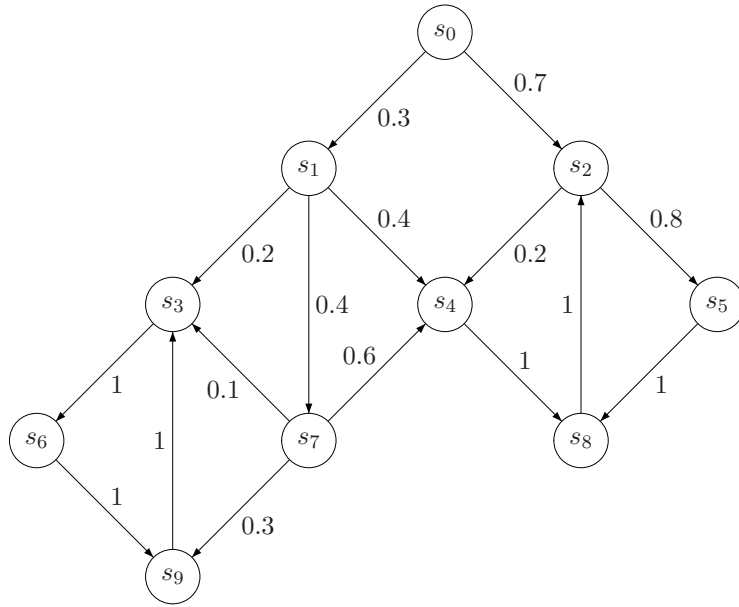
For state sets $B_1 = \{s_1, s_7\}$, $B_2 = \{s_6, s_7, s_8\}$, $B_3 = \{s_1, s_3, s_7, s_9\}$ and $B_4 = \{s_2, s_3, s_4, s_5, s_6, s_7, s_8, s_9\}$ determine whether:

(a) $\Pr(s_0, \Diamond B_1) = 1$?

(b) $\Pr(s_7, \Diamond B_2) = 1$?

(c) $\Pr(s_0, \Box \Diamond B_i) = 1$, $i \in 1 \ldots 3$?

(d) $\Pr(s_0, \Diamond \Box B_2) = 1$?

(e) $\Pr(s_0, \Diamond \Box B_4) = 1$?