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LEHRSTUHL FÜR INFORMATIK 2
RWTH Aachen · D-52056 Aachen
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Advanced Model Checking   C. Dehnert & F. Sher
**Summer term 2014**

– Series 6 –

Hand in on 28 May before the exercise class.

Note: From now on, if you have questions regarding the lecture or the exercises, please contact Chris (dehnert@cs.rw...)

Exercise 1 (3 points)

Consider the following transition system TS. Compute the simulation preorder $\preceq_{\text{TS}}$ using (the first version of) the HHK algorithm presented in the lecture (slide 199). Whenever there are multiple states k such that $\text{Sim}_{\text{old}}(k) \neq \text{Sim}(k)$, then pick the **largest** such k.
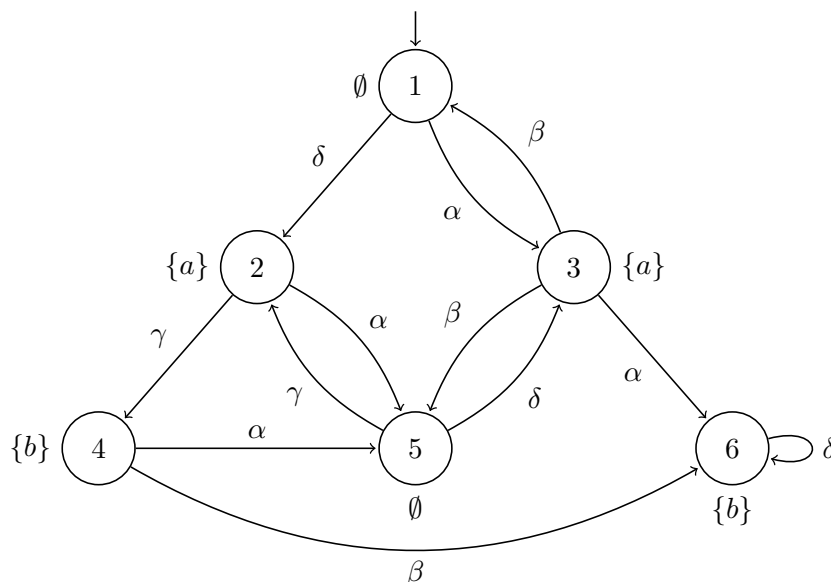
Exercise 2 (7 points)

For a transition system $\text{TS} = (S, Act, \longrightarrow, I, AP, L)$ without terminal states, a stutter simulation for TS is a binary relation $\mathcal{R} \subseteq S \times S$ such that for all $(s_1, s_2) \in \mathcal{R}$:

(i) $L(s_1) = L(s_2)$.

(ii) If $s_1' \in Post(s_1)$ with $(s_1', s_2) \notin \mathcal{R}$, then there exists a finite path fragment $s_2 u_1 \ldots u_n s_2'$ with $n \geq 0$, $(s_1, u_i) \in \mathcal{R}$ for $1 \leq i \leq n$ and $(s_1', s_2') \in \mathcal{R}$.

Let $s_1 \preceq_{\text{TS}}^{\text{st}} s_2$ if there exists a stutter simulation $\mathcal{R}$ for TS such that $(s_1, s_2) \in \mathcal{R}$.

(a) Show that $\preceq_{\text{TS}}^{\text{st}}$ is a preorder.

(b) Which logical fragment A of CTL* characterizes[1] the kernel[2] of $\preceq_{\text{TS}}^{\text{st}}$? Justify your answer.

(c) Suppose for all $\Phi \in A$, we have $s_2 \models \Phi$ if and only if $s_1 \models \Phi$. Show that $L(s_1) = L(s_2)$.

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[1] That is, two states are equivalent if and only if they satisfy the same formulae of the logic.
[2] The kernel of a binary relation $\mathcal{R}$ is defined as the intersection $\mathcal{R} \cap \mathcal{R}^{-1}$.