RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE AACHEN

LEHRSTUHL FÜR INFORMATIK 2
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Advanced Model Checking
Summer term 2012

– Series 6 –

Hand in on June 6 before the exercise class.

Exercise 1 (3 points)

Figure 1 shows on its left a transition system TS and on its right a reduced system $\hat{TS}$ that results from choosing $ample(s) = \{\alpha\}$. Check whether TS and $\hat{TS}$ are stutter trace equivalent. If they are not, indicate which of the conditions $(A1) - (A4)$ is (are) violated.

Answer the same question for the transition system in the reduction shown in Figures 2 and 3, where different colors indicate different state labels.

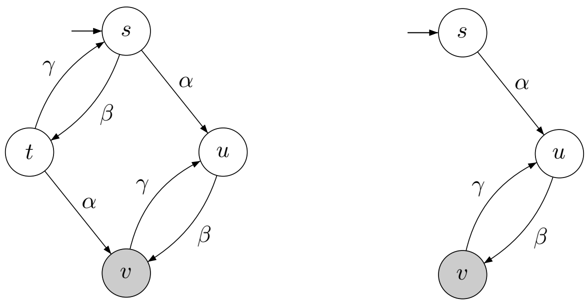


Abbildung 1: Transition system TS (left) and $\hat{TS}$ (right) for the Exercise 1

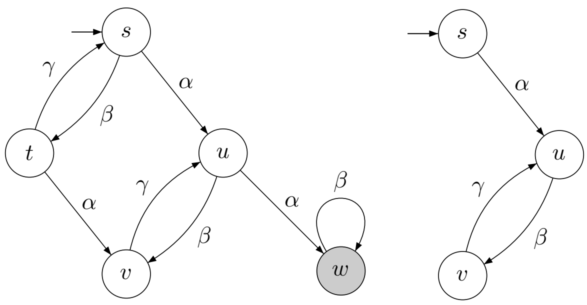


Abbildung 2: Transition system TS (left) and $\hat{TS}$ (right) for the Exercise 1

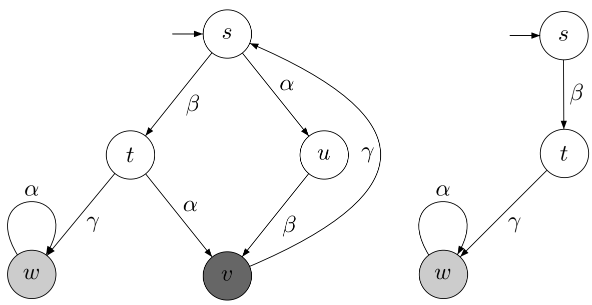
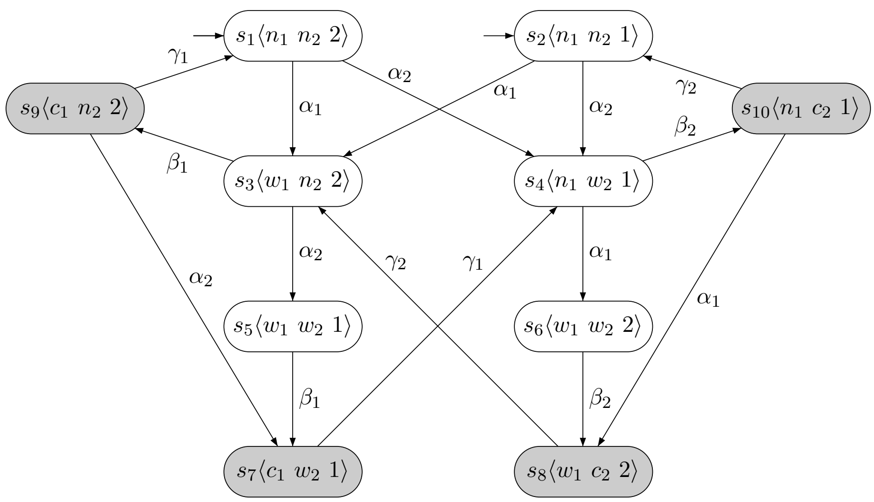


Abbildung 3: Transition system TS (left) and $\hat{TS}$ (right) for the Exercise 1

Exercise 2 **(3 points)**

Consider the transition system TS_{Pet} for the Peterson mutual exclusion algorithm.

(For more details of the algorithm, cf. page 45-47 of the book.)



Questions:

(a) Which actions are independent?

(b) Apply the partial order reduction approach to TS_{Pet} with "small" ample sets according to Algorithm 38 (page 622 of the book) for checking the invariant "always $\neg(crit_1 \wedge crit_2)$", where $AP = \{crit_1, crit_2\}$. Note that c_i in the figure is an abbreviation for $crit_i$.

Exercise 3 **(2 points)**

Let $TS_i = (S_i, Act_i, \rightarrow_i, I_i, AP, L_i)$, $i + 1, ...n$ be action-deterministic transition systems such that $Act_i \cap Act_j \cap Act_k = \emptyset$ if $1 \leq i < j < k \leq n$. We consider the parallel composition with synchronization over common actions, i.e. the transition system

$$TS = TS_1 \parallel TS_2 \parallel ... \parallel TS_n.$$

For each states $s = <s_1, ...s_n>$ of TS, let $Act_i(s) = Act_i \cap Act(s)$ be the set of actions of TS_i that are enabled in s.

Question:

Show that the dependency condition $(A2)$ holds if for each state s of TS the following conditions (i) and (ii) holds:

(i) If $ample(s) \neq Act(s)$, then $ample(s) = Act_i(s)$ for some $i \in \{1, ..., n\}$.

(ii) If $ample(s) = Act_i(s) \neq Act(s)$, then $ample(s) \cap (\bigcup_{1 \leq j \leq n, j \neq i} Act_j) = \emptyset$.

Exercise 4 **(2 points)**

For two transition systems TS (left) and $\widehat{TS}$ (right) find the ample sets $ample(.)$ which reduce TS to $\widehat{TS}$ satisfy conditions (A1)-(A5).