Formal Models SS 2017: Assignment 4

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Due 06.04.2017

To indicate that you solved an exercise and that you can present it in the exercise group, tick it off in our MOODLE course until **11am on the day of the exercise**.

Exercise 13

Draw the LTS for PA system $P = Q \,||\, R \,||\, S \,||\, T, Q = a.b.Q, R = b.c.R, S = d.c.S, T = a.c.T$

Exercise 14

Let $P = b.c.P$ and $Q = a.b.Q$. Show that action

$$((b.Q + b.a.Q) \,||\, (b.P + b.c.P)) + (a.Q \,||\, b.P) \xrightarrow{b} a.Q \,||\, P$$

can be executed by subsequently applying the semantical rules of PA.

Exercise 15

Let $P = Q \,||_\Theta R$ where Q and R are $Q = a.b.t.Q$, $R = d.t.R + c.R$. Let $\Sigma = \Sigma(P) = \Sigma(Q) \cup \Sigma(R) = \{a,b,c,d,t\}$. Draw the LTS for $P = Q \,||_\Theta R$ where...

   a) $\ldots \Theta = \{b,t\} \subseteq \Sigma$.

   b) $\ldots \Theta = \{b,c\} \subseteq \Sigma$.

Exercise 16

If the LTS for the railroad crossing is done completely, there will be no deadlock. Let $\oplus$ denote an alternative PA-operator for non-deterministic choice. The semantics of $\oplus$ are defined as follows:

$$R_\oplus^1 : \quad \frac{P \xrightarrow{a} P'}{(P \oplus Q) \xrightarrow{a} (P' \oplus Q)} \qquad\qquad R_\oplus^2 : \quad \frac{Q \xrightarrow{a} Q'}{(P \oplus Q) \xrightarrow{a} (P \oplus Q')}$$

Assume that $+$ is replaced by $\oplus$ in the model of the railroad crossing from slide 28. Under this assumption, find the shortest possible sequence of transitions which yields a state where an accident can happen. You do not have to draw all states but only those which are needed for the solution of this exercise.