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:

\[
R^1_\oplus : \frac{P \xrightarrow{a} P'}{(P \oplus Q) \xrightarrow{a} (P' \oplus Q)} \quad R^2_\oplus : \frac{Q \xrightarrow{a} Q'}{(P \oplus Q) \xrightarrow{a} (P \oplus Q')}
\]

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.