Group: _____	Assignment 5
Name: _____	**Formal Models**
Matr.Nr.: _____	Summer Semester 2010
Points: _____	**Due: 22.04.2010 08:30**

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Exercise 17

Let $P = Q \parallel_\Theta R$ where Q and R are defined as in Exercise 16: $Q = a.b.t.Q$, $R = d.t.R + c.R$. Let $\Sigma = \Sigma(P) = \Sigma(Q) \cup \Sigma(R) = \{a,b,c,d,t\}$. Draw the LTS for $P = Q \parallel_\Theta R$ where...

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

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

Exercise 18

Draw the LTS for the model of the railroad crossing presented in the lecture (slide 28). Find out whether accidents can happen in the model or not. Justify your answer. You may use abbreviated (but unambiguous) notation for actions such as car, up etc.

Exercise 19

Let $\oplus$ denote an alternative PA-operator for non-deterministic choice. The semantics of $\oplus$ are defined in the following rules:

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

Assume that $+$ is replaced by $\oplus$ in the model of the railroad crossing from Exercise 18. Under this assumption, find the shortest possible sequence of transitions which yields a state where an accident can happen. You need not draw all states but only those which are needed for the solution of this exercise.

Exercise 20

Consider rule $R_\parallel$ for the parallel composition of an arbitrary number of processes (lecture slide 26). Explain why condition $\exists P_i \quad P_i \xrightarrow{a} P_i'$ is required. Justify your answer in detail. Illustrate by means of a small concrete example the semantical effects of dropping this condition from the definition of $R_\parallel$.