First Bonus Homework for Languages & Machines

Instructions. The solutions to these exercises must be handed in by Friday, March 13, 17:30, via Canvas (a scan of handwritten solutions is ok). You must hand in your solutions in pairs of two students, with the student group Bonus Homework L&M. Clearly mark your name(s) and student number(s) on the top of the sheet.

Exercises. Consider the two (incomplete) DFA

$$\begin{aligned} P_1 &= (\{q_0, q_1, q_2\}, \{a, b, c\}, \delta_1, q_0, \{q_0, q_1, q_2\}) \\ \text{and } P_2 &= (\{r_0, r_1, r_2\}, \{a, b\}, \delta_2, r_0, \{r_1\}) \end{aligned}$$

with transition functions δ_1 and δ_2 defined as follows:

$$\begin{aligned} & \delta_1(q_0, c) = q_2, \quad \delta_1(q_1, c) = q_0, \quad \delta_1(q_1, b) = q_0, \quad \delta_1(q_2, a) = q_1 \\ \text{and } & \delta_2(r_0, a) = r_1, \quad \delta_2(r_0, b) = r_2, \quad \delta_2(r_1, a) = r_0, \quad \delta_2(r_1, b) = r_1. \end{aligned}$$

1. Draw the state diagrams of P_1, P_2 and of the reachable part of the parallel composition $P = P_1 \parallel P_2$.

   Don't forget to mark initial and accepting states!

2. Draw the state diagram of the NFA-λ P' such that P' is isomorphic to $P \setminus \{c\}$, and has states $\{s_0, s_1, \ldots, s_7\}$.

   Observe: This means that the solution for P in Exercise 1 has 8 states.

3. Transform P' into a complete DFA P'', then minimise P''.

   Show your transformations; in particular, show an input transition function. The solution has 4 reachable states.

4. Give a regular expression that describes the language accepted by P''.

You do not need to draw or further consider unreachable states in any of the exercises above.