Exercise 1

Given the finite automaton (FA) $A_1$ as shown on the right. Specify $A_1$ formally as a 5-tuple, including all of its components. Is $\varepsilon \in L(A_1)$, $abb \in L(A_1)$ and $baa \in L(A_1)$? Justify your answers.

Exercise 2

Construct an FA $A_2 := (S_2, I_2, \Sigma_2, T_2, F_2)$ with $\Sigma_2 := \{a\}$ such that $L(A_2)$ exactly contains all words $w$ over $\Sigma_2$ such that the length of $w$ is a multiple of 3. Draw $A_2$ and specify it formally as a 5-tuple.

Exercise 3

Let $P_3 := A_3 \times A_4$ be the product automaton of FA $A_3$ and FA $A_4$ as shown on the right. Draw $P_3$ and fully specify it formally as a 5-tuple. Find three words $w$ with $w \in L(P_3)$. What is the maximum number of states $P_3$ can have in theory? Justify your answers.

Exercise 4

Let $A$ and $B$ be two arbitrary FA and $P := A \times B$. Explain in your own words why the following proposition is true:

$$w \in L(P) \text{ if and only if } w \in L(A) \text{ and } w \in L(B).$$