

# Formal Models SS 2015: Assignment 2

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Due 19.03.2015

## Exercise 5

Draw an FA  $A$  with input-alphabet  $\Sigma := \{a, b\}$  having *exactly* 3 states such that...

1. ... $A$  is non-deterministic and incomplete.
2. ... $A$  is deterministic and incomplete.
3. ... $A$  is non-deterministic and complete.
4. ... $A$  is deterministic and complete.

Justify each of your solutions.

## Exercise 6

Let  $A_1$  be an *arbitrary* FA and  $\mathbb{P}(A_1) := (S, I, \Sigma, T, F)$  be the power automaton of  $A_1$ . Describe in your own words the formal definition of  $\mathbb{P}(A_1)$ , including all of its components. What are the basic properties of a power automaton? Is the following proposition true? Justify your answer.

$$|S' \xrightarrow{a} | = 1 \text{ for all } S' \in S \text{ and for all } a \in \Sigma.$$

## Exercise 7

Given an automaton  $A$  with state  $S = \{A, B, C, D\}$ , alphabet  $\Sigma = \{a, b\}$ , initial states  $I = \{A, C\}$ , final state  $F = \{B, D\}$ , and transitions  $T = \{(A, b, B), (A, b, C), (B, a, B), (C, b, C), (C, b, D), (D, b, D), (B, a, D)\}$ ,

Draw the power automaton  $\mathbb{P}(A)$  for FA  $A$ . What is the maximum number of states  $\mathbb{P}(A)$  can have in theory? Justify your answer.

## Exercise 8

Draw a *deterministic* FA  $A$  with  $\Sigma := \{a, b\}$  having *at least* 3 states such that  $L(C(A)) \neq \overline{L(A)}$ , where  $C(A)$  denotes the complement-automaton of  $A$ . Explain your solution.