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

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

Exercise 7

Given an automation $A$ 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 $P(A)$ for FA $A$. What is the maximum number of states $P(A)$ 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.