# Automata, Computability and Complexity

Spring Semester 2023
Prof. Dr. Peter Zaspel

## Assignment Sheet 1. Submit on **12:00 (noon), Monday, Feb. 13, 2023**.

**Excercise 1.** (Formal description of finite automata)

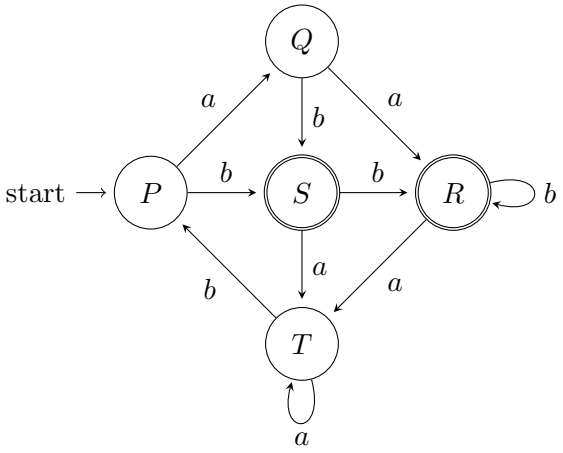
a) Draw the state transition diagram for the finite automaton

$$M_1 = (\{s_0, s_1, s_2, s_3, s_4\},\ \{\alpha, \beta\},\ \delta,\ s_0,\ \{s_0, s_4\})$$

where the transition function $\delta$ is:

| | $\alpha$ | $\beta$ |
|---|---|---|
| $s_0$ | $s_1$ | $s_3$ |
| $s_1$ | $s_1$ | $s_4$ |
| $s_2$ | $s_0$ | $s_1$ |
| $s_3$ | $s_3$ | $s_2$ |
| $s_4$ | $s_1$ | $s_4$ |

b) The state transition diagram of the automaton $M_2$ is given below. Using the usual conventions, describe $M_2$ as a 5-tuple.

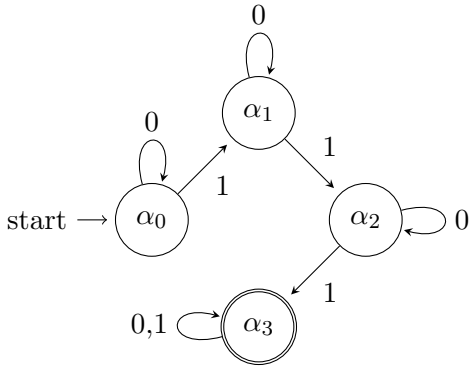



(4 Points)

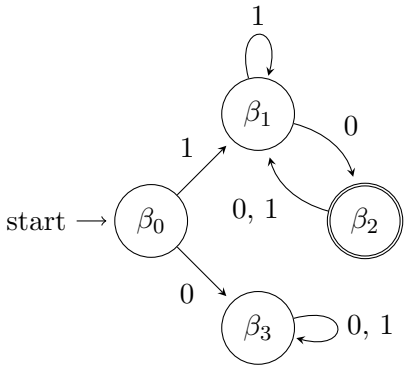
**Excercise 2.** (Languages accepted by automata)

Describe the language accepted by the deterministic finite automata given below.

a)




b)




(4 Points)

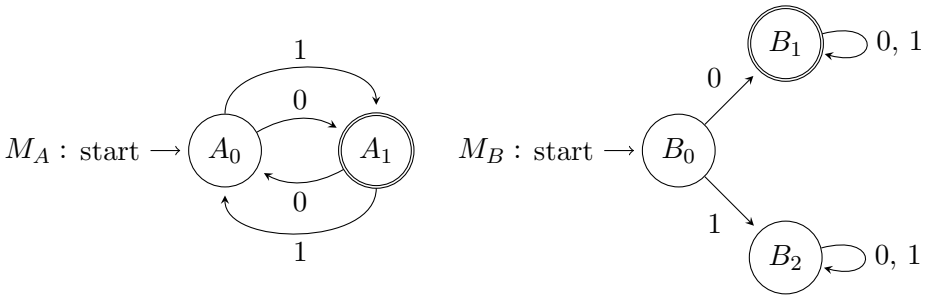
**Excercise 3.** (Regular languages)

Consider the language $L$ over $\Sigma = \{O, E\}$ that contains all words that begin with $O$ and have odd length or begin with $E$ and have even length. Design a finite automaton that accepts $L$.

(4 Points)

**Excercise 4.** (Closure property)

Consider the state transition diagrams of two automata $M_A$ and $M_B$ over a common alphabet $\Sigma = \{0, 1\}$ that accept the languages $A$ and $B$ respectively.




Describe (as a state transition diagram) an automaton $M$ that accepts the language $A \cup B$.

(4 Points)