Theory of Computer Science

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Exercise meeting 4

Exercise 4.1

Consider the following regular expressions over the alphabet $\Sigma = \{0, 1\}$. For each regular expression, specify two words that are in the corresponding language and two words that are not in the corresponding language.

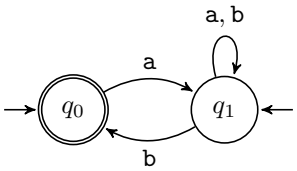
(a) $0|1^*|1\emptyset 0$

(b) $1^*(\epsilon|0)(01)^*$

Exercise 4.2

We consider regular languages over the alphabet $\Sigma = \{a, b\}$.

(a) Provide all reasons why the following finite automaton is an NFA but not a DFA.



(b) Specify a deterministic finite automaton that accepts the language of all words over Σ with an even number of bs.

Exercise 4.3

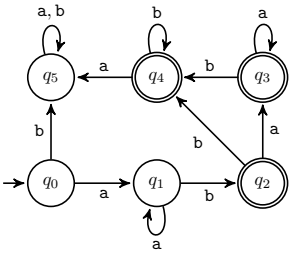
Are the following languages over $\Sigma = \{\mathtt{a}, \mathtt{b}, \mathtt{c}, \mathtt{d}\}$ regular? If so, prove it by specifying a regular expression which describes the language. If not, prove it with help of the Pumping-Lemma.

(a) $L_1 = \{\mathtt{a}\mathtt{b}^n\mathtt{c}^m\mathtt{d}^2 \mid n, m \in \mathbb{N}_0\}$

(b) $L_2 = \{w \in \{\mathtt{a}, \mathtt{b}\}^* \mid w \text{ contains as many } \mathtt{a}s \text{ as } \mathtt{b}s\}$

Exercise 4.4

Consider the following DFA M:



(a) Specify a regular expression that describes $\mathcal{L}(M)$.

(b) Specify the state diagram of an NFA with at most 4 states that accepts the same language.