



Discrete Event Systems

Exercise Sheet 3

1 Finite Automata and Regular Languages [Exam]

Consider the NFA A in Figure 1 and further assume $\Sigma = \{0, 1\}$.

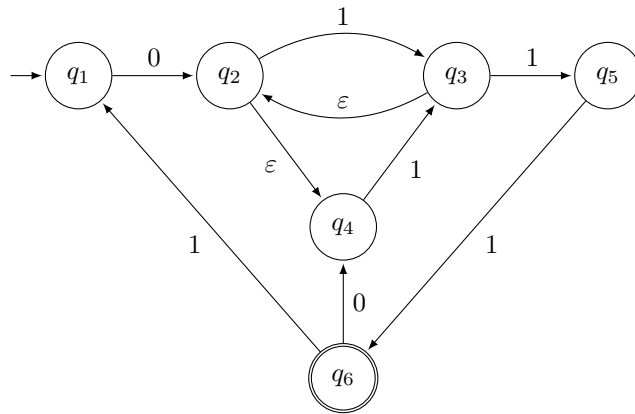


Figure 1: NFA A .

- a) Transform the NFA into an equivalent DFA using the powerset construction of the lecture. (*Hint*: Only construct states which are necessary!)
- b) Which regular language is accepted by the automaton A ?

2 Pumping Lemma [Exam]

Are the following languages regular? Prove your claims!

- a) $L_1 = \{0^a 1^b 0^c 1^d \mid a, b, c, d \geq 0 \text{ and } a = 1, b = 2 \text{ and } c = d\}$
- b) $L_2 = \{0^a 1^b 0^c 1^d \mid a, b, c, d \geq 0 \text{ and if } a = 1 \text{ and } b = 2 \text{ then } c = d\}$

3 Transforming Automata [Exam]

Consider the DFA in Figure 2 over the alphabet $\Sigma = \{0, 1\}$ accepting the language L . Let $\Phi(L)$ be defined as

$$\Phi(L) := \{w \in \Sigma^* \mid \exists x \in \Sigma^*, |x| = |w| \text{ and } wx \in L\} .$$

In other words, $\Phi(L)$ is the set of the front halves of all words in L .

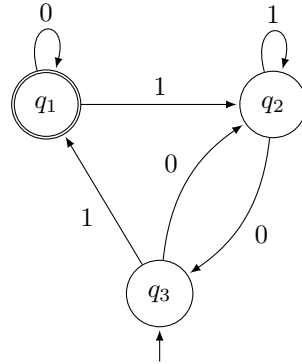


Figure 2: DFA B .

- a) Give a regular expression for the language L accepted by the automaton B .
- b) Construct a DFA which accepts a word w if and only if $w \in \Phi(L)$.