Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Distributed Computing

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Discrete Event Systems

Exercise Sheet 3

1 Finite Automata and Regular Languages [Exam]

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

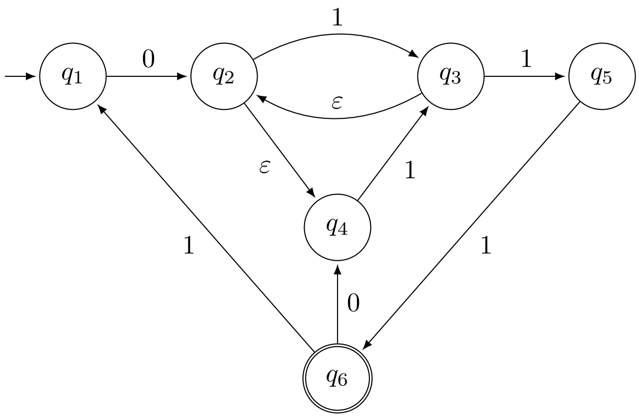

Figure 1: NFA A.

a) Transform the NFA into an equivalent DFA using the powerset construction of the lecture. (*Hint:* Only construct states which are necessary!)

b) Give a regular expression for the language 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.

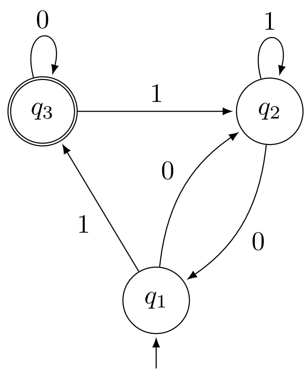

Figure 2: DFA B.

a) Give a regular expression for the language L accepted by the automaton B. If you like, you can do this by ripping out states as presented in the lecture (slide 1/84 ff.).

b) Construct a DFA which accepts a word w if and only if $w \in \Phi(L)$.