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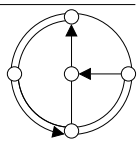
Swiss Federal Institute of Technology Zurich



WS 2005/2006 Prof. R. Wattenhofer / Thomas Moscibroda / Stefan Schmid

Discrete Event Systems
Exercise 3[1]

1 Regular Languages and Finite Automaton

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

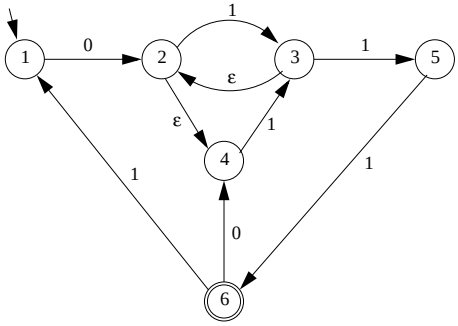


Figure 1: NFA A.

(i) Transform the NFA into an equivalent deterministic finite automaton.

(ii) Which regular language is accepted by A?

2 Non-Regular Languages

(i) Consider the following language L_1:

$$L_2 = \{0^a 1^b 0^c 1^d \mid a, b, c, d \geq 0 \text{ and } a = 1, b = 2, \text{ and } c = d\}.$$

Is the language L_1 regular? Prove your answer!

(ii) Consider the following slightly adapted language L_2:

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

Is the language L_2 regular? Be careful when proving your answer!

[1] All problems in this series have appeared in previous exams.

3 Adapting a Finite Automaton

Consider the DFA in Figure 3, which accepts the language L and let the alphabet be $\Sigma = \{0, 1\}$. Further, let $\Phi(L)$ be defined as $\Phi(L) = \{w \in \Sigma^* \mid \exists x \in \Sigma^*, |x| = |w| \text{ and } wx \in L\}$. That is, $\Phi(L)$ denotes the set of *first halfs* of all strings in L.

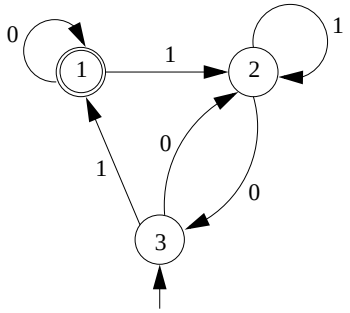


Figure 2: DFA B.

(i) Give a regular expression that describes the language L.

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