ETTH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

Networked Systems Group (NSG)

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Discrete Event Systems Exercise Sheet 2

1 Pumping Lemma [Exam]

Is the following language regular? Prove your claims!

 $L = \{0^{a}1^{b}0^{c}1^{d} \mid a, b, c, d \ge 0 \text{ and } a = 1, b = 2 \text{ and } c = d\}$

2 Deterministic Finite Automata [Exam]

Transform the NFA A in Figure 1 into an equivalent DFA using the powerset construction presented in the lecture, while assuming $\Sigma = \{0, 1\}$. (*Hint:* Only construct states which are necessary!)



Figure 1: NFA A.

3 Transforming Automata [Exam]

Consider the DFA B in Figure 2 over the alphabet $\Sigma = \{0, 1\}$. 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.



Figure 2: DFA B.

4 Regular and Context-Free Languages

- a) Consider the context-free grammar G with the production $S \to SS \mid 1S2 \mid 0$. Describe the language L(G) in words, and prove that L(G) is not regular.
- b) The regular languages are a subset of the context-free languages. Give the context-free grammar for an arbitrary language L that is regular.