Eidgenössische Technische Hochschule Zürich
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Networked Systems Group (NSG)

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based on Prof. R. Wattenhofer's material

Discrete Event Systems

Exercise Sheet 2

1 Filter for an Input Stream [exam problem]

We would like to construct an automaton that recognizes substrings from an input stream. The input stream consists of symbols $\{a, b\}$ and the substrings that the automaton should detect are of the form bab^*. In other words, the input of the automaton is a series of a's and b's. The automaton should go into an accepting state whenever the most recently received symbols form a string of the form bab^*. For example, in the input stream $b\ \underline{a}\ \underline{b}\ \underline{b}\ \underline{b}\ \underline{a}\ a\ a\ a\ b\ \underline{a}\ \underline{b}\ \underline{a}\ a$, the automaton should be in an accepting state exactly after the reception of an underlined symbol. Construct a deterministic finite automaton that precisely fulfils the above specification.

2 Nondeterministic Finite Automata

a) Consider the alphabet $\{a, b\}$. Construct an NFA that accepts all strings containing the substring $a\,b\,b\,a$ at least twice. (This means that words containing $a\,b\,b\,a\,b\,b\,a$ as a substring should also be accepted!)

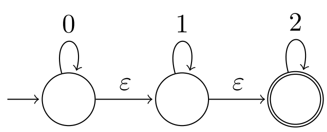
b) Construct an NFA which accepts the following regular expression: $(00 \cup (0(0 \cup 1)^*))^*$.

c) Construct an NFA accepting $1^*0^*1^+$ with as few states as possible. (cf. Exercise 1.1.a)

d) Consider a machine $M := (Q, \Sigma, \delta, q_0, Q)$. Is it possible to make a statement about the strings being accepted by M? Does it make a difference whether M is deterministic or not?

3 De-randomization

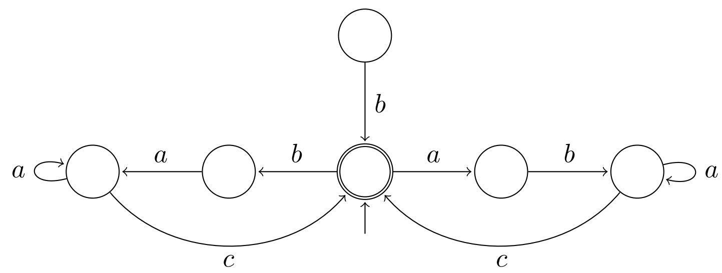
a) Give a regular expression for the following NFA and construct an equivalent NFA *without* ε-transitions.



b) Finally, transform the machine into a deterministic automaton.

4 States Minimization

Simplify the following automaton. Explain why your changes are allowed. Finally, give the corresponding regular expression.



5 “Regular” Operations in UNIX

In this exercise you are asked to provide a UNIX command to output all lines in a file ending with “password” or “passwort”, followed by an unknown number (potentially zero) of vowels.