ETH
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Distributed Computing Group

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Discrete Event Systems
Exercise 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

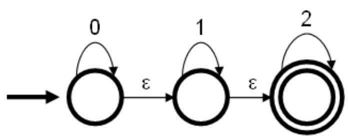
a) Consider the alphabet $\{\diamondsuit, \spadesuit\}$. Construct an NFA with ε-transitions that accepts all strings containing a sub-string $\diamondsuit\spadesuit\spadesuit\diamondsuit$ at least twice.

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

c) 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

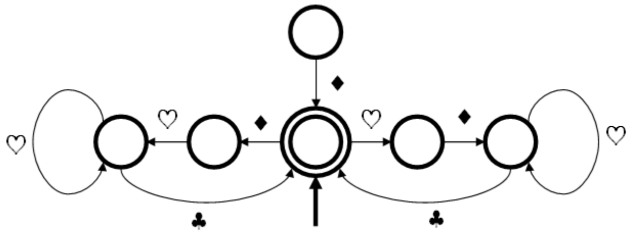
a) Give a regular expression for the following NFA and construct an equivalent NFA *without* ε-transitions.



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 find all lines in a file ending with “password” or “passwort”, followed by an unknown number of vowels.