Formal Languages and Automata Theory
Homework 4 (FSA), Abgabe 14.11.2017

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Exercise 1 *(3 points) Convert the NFA defined by*

- $\delta(q_0,a)=\{q_0,q_1\}$
- $\delta(q_1,b)=\{q_1,q_2\}$
- $\delta(q_2,a)=\{q_2\}$
- $\delta(q_1,\epsilon)=\{q_1,q_2\}$

with initial state q_0 and final state q_2 into an equivalent DFA.

Exercise 2 *(3 points) In converting NFA to DFA, the number of states may increase substantially. Give upper and lower bounds on the increase in number of states for an n-state NFA.*

Exercise 3 *(4 points) Let L be any language. Define* `even(w)` *as the string obtained by extracting from w the letters in even-numbered positions; that is, if $w = a_1a_2a_3a_4a_5a_6...$, then* `even (w)` $= a_2a_4a_6...$

Corresponding to this, we can define a language `even (L)` $= \{even\ (w) : w \in L\}$.

Prove that if L is regular, so is `even (L)`.

Exercise 4 *(4 points) Show that if L is regular, so is L^R.*

Exercise 5 *(4 points) Is it true that for NFA $M = (Q, \Sigma, \delta, q_0, F)$, the complement of $L(M)$ is equal to the set $\{w \in \Sigma^* : \delta^*(q_0, w) \cap F = \emptyset\}$? If so, prove it. If not, give a counterexample.*