Technische Universität München **Winter term 2017/18**
I7
Prof. J. Esparza / Dr. M. Blondin **27.10.2017**

Automata and Formal Languages — Homework 2

Due 06.11.2017

Exercise 2.1

Consider the regular expression $r = (a + ab)^*$.

(a) Convert r into an equivalent NFA-ε A.

(b) Convert A into an equivalent NFA B. (It is not necessary to use algorithm *NFAεtoNFA*)

(c) Convert B into an equivalent DFA C.

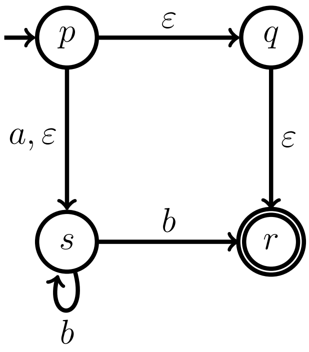
(d) By inspecting B, give an equivalent minimal DFA D. (No algorithm needed).

(e) Convert D into an equivalent regular expression r'.

(f) Prove formally that $L(r) = L(r')$.

Exercise 2.2

Convert the following NFA-ε to an NFA using the algorithm *NFAεtoNFA* from the lecture notes (see Sect. 2.3, p. 33). You may verify your answer with the Python program `nfa-eps2nfa`.



Exercise 2.3

For every $n \in \mathbb{N}$, let $L_n = \{w \in \{0,1\}^* : |w| \geq n \text{ and } w_{|w|-n+1} = 1\}$.

(a) Exhibit an NFA with $O(n)$ states that accepts L_n.

(b) Exhibit a DFA with $\Omega(2^n)$ states that accepts L_n.

(c) Show that any DFA that accepts L_n has at least 2^n states.