Albert-Ludwigs-Universität, Inst. für Informatik
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Theoretical Computer Science - Bridging Course
Summer Term 2017
Exercise Sheet 2

Hand in (electronically or hard copy) by 12:15 pm, Monday, November 06th, 2017

Exercise 1: Constructing DFAs *(2+2+2+2 Points)*

Construct DFAs that recognize the following languages. Drawing the state diagrams is sufficient. The alphabet is $\Sigma = \{0, 1\}$.

(a) $L_1 = \{w \mid |w| \geq 2 \text{ and } w \text{ contains an odd number of ones}\}$.

(b) $L_2 = \{w \mid w \text{ contains an even number of zeros}\}$.

(c) $L_3 = \{w \mid w \text{ every zero is immediately followed by a one}\}$.

(d) $L_4 = \{w \mid w \text{ ends with } 01\}$.

Exercise 2: Kleene Star *(4 Points)*

For two languages L and K we define

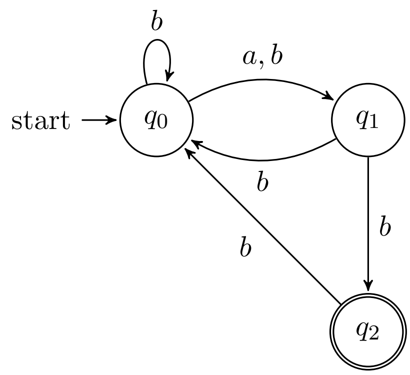
$$L \cdot K := \{ww' \mid w \in L, w' \in K\}.$$

Use counter examples to show that none of the following equalities is valid for general languages K and L.

1. $K \cdot L = L \cdot K$
2. $(K \cdot K)^* = K^*$
3. $K^* \cdot K = K^*$
4. $(LK)^* = (L \cup K)^*$

Exercise 3: From NFA to DFA *(1+2+2 Points)*

Consider the following NFA.



(a) Give a formal description of the NFA by giving the alphabet, state set, transition function, start state and the set of accept states.

(b) Construct a DFA which is equivalent to the above NFA by drawing the corresponding state diagram.

(c) Explain which language the automaton accepts.

Exercise 4: Union of regular Languages *(3 Points)*

Let L_1, L_2 be regular languages. Show that $L_1 \cup L_2$ is also regular without (explicitly!) using the proof which was presented in the lecture.