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Theoretical Computer Science - Bridging Course
Exercise Sheet 2

Due: Wednesday, 5th of May 2021, 12:00 pm

Exercise 1: Constructing DFAs *(7 Points)*

Construct DFAs that recognize the following languages. The alphabet set is $\Sigma = \{a, b\}$.

1. $L_0 = \{w \mid w \text{ ends with } ab\}$.
2. $L_1 = \{w \mid w \text{ is any string except } aa \text{ and } aaa\}$.
3. $L_2 = \{w \mid w \text{ contains at least two } a\text{'s and at most one } b\}$.
4. $L_2 \backslash L_1 = \{w \mid w \in L_2 \text{ and } w \notin L_1\}$.

Exercise 2: Closure under Symmetric Difference *(7 Points)*

Let L, L_1, L_2 be regular languages. Show that the following languages are regular by constructing the corresponding DFAs

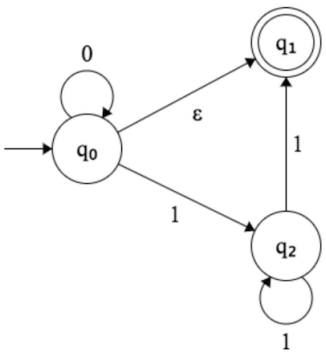
- $\overline{L} := \Sigma^* \setminus L$
- $L_1 \cap L_2$

Deduce that the symmetric difference $L_1 \Delta L_2$ is also regular. Recall that $L_1 \Delta L_2 = (L_1 \setminus L_2) \cup (L_2 \setminus L_1)$

Remark: *No need for drawing state diagrams. Show how a DFA for the language in question can be constructed presuming the existence of DFAs for L, L_1, L_2.*

Exercise 3: From NFA to DFA *(6 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.