

Theory of Computer Science

M. Helmert
F. Pommerening
Spring Term 2016

University of Basel
Computer Science

Exercise Sheet 6

Due: Wednesday, April 13, 2016

Note: Submissions that are exclusively created with \LaTeX will receive a bonus mark. Please submit only the resulting PDF file (or a printout of this file).

Exercise 6.1 (Regular Expressions; 2 Points)

Consider the following regular expressions over the alphabet $\Sigma = \{a, b\}$. For each regular expression, specify two words that are in the corresponding language and two words that are not in the corresponding language.

- (a) bba|bbb (c) (a(a|b)|b)(a|b)^*
(b) $\text{b^*a(b^*ab^*ab^*)^*}$ (d) $\text{(\varepsilon|a)b|b\emptyset a}$

Exercise 6.2 (NFAs for Regular Expressions; 2 Points)

Construct an NFA for the regular expression ((ab)^*|a^*) over the alphabet $\Sigma = \{a, b\}$. Use the construction rules from the lecture (chapter C3 slides 10–13) and please specify all intermediate steps, i.e., NFAs for a , b , ab , $(ab)^*$, a^* and ((ab)^*|a^*) .

Exercise 6.3 (Pumping Lemma for Regular Languages; 4 Points)

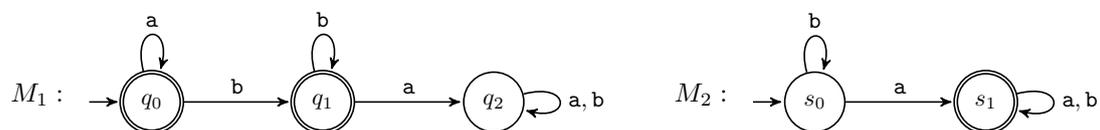
Are the following languages over $\Sigma = \{a, b, c, d\}$ regular? If so, prove it by specifying a regular expression which describes the language. If not, prove it with help of the Pumping-Lemma.

- (a) $L_1 = \{a^n b^m c^{n+m} \mid m, n \in \mathbb{N}\}$
(b) $L_2 = \{a^n b^3 c^m d^3 \mid m, n \in \mathbb{N}\}$

Note on marking: One of the languages is regular, the other one is not. The subtask with the regular language is worth 1 point, the other subtask 3 points.

Exercise 6.4 (Product Automaton; 2 Points)

Given the following DFAs M_1 and M_2 .



Specify the product automaton that accepts $\mathcal{L}(M_1) \cap \mathcal{L}(M_2)$.