Albert-Ludwigs-Universität, Inst. für Informatik
Prof. Dr. Fabian Kuhn
P. Bamberger, Y. Maus,

Theoretical Computer Science - Bridging Course
Summer Term 2017
Exercise Sheet 3

Hand in (electronically or hard copy) by 12:15 pm, November 13th, 2017

Exercise 1: Regular Expressions *(4 Points)*

Consider the regular expression $r = (aa^* + ba)^* \cdot (bbb + ab^*) + (ab)^*$. State for each of the following words whether they are contained in $L(r)$

$$\epsilon, baabbb, bbbb, abab, ababa, ababaa, a.$$

In case that a word is contained in $L(r)$ show how to obtain the word from r, e.g., by marking the corresponding parts in r.

Exercise 2: Regular Expressions 2 *(6 Points)*

1. Let L_1 be the language consisting of words of the form $w_1w_2w_3$ with $w_1, w_2, w_3 \in \{a, b, c\}^*$ **and** w_1 contains **no** a's **and** w_2 contains **no** b's **and** w_3 contains **no** c's.

   Give a regular expression that generates L_1.

2. Let $L_2 \subseteq \{a, b\}^*$ be the language of all words that do not have any of the words $\{aaa, aaaa, \ldots\}$ as a consecutive substring.

   Give a regular expression that generates L_2.

Exercise 3: Pumping Lemma *(6 Points)*

Use the pumping lemma to show that $L = \{a^i b^j \mid i \neq j\}$ is not regular.

Exercise 4: Context Free Grammar *(4 Points)*

Give a context free grammar for the language $L = \{a^i b^j \mid i \neq j\}$.