

Compiler Construction 2017

— Exercise Sheet 0 —

General Remarks

- This exercise sheet is meant to recap topics of automata theory and will not be graded.
- The solution for this exercise sheet will be presented in the first exercise class on May 9th.
- If you are still looking for a group or your group has less than 3 members, please post in the L2P forum.

Exercise 1

(0 Points)

Which of the following statements hold?

1. Deterministic finite automata (DFA) are strictly less expressive than regular expressions.
2. Non-deterministic finite automata (NFA) are strictly more expressive than DFA.
3. The languages of regular expressions are closed under...
 - (a) union,
 - (b) intersection,
 - (c) complement,
 - (d) concatenation,
 - (e) Kleene closure.
4. Context Free Languages (CFL) are closed under...
 - (a) union,
 - (b) intersection,
 - (c) complement,
 - (d) concatenation,
 - (e) Kleene closure.
5. DCFL is the set of context free languages that are accepted by deterministic push down automata. Is $DCFL = CFL$?

Exercise 2

(0 Points)

1. Describe the language of the following regular expression in words:

$$r = (0 + 1)^*0(0 + 1)^*0(0 + 1)^*.$$

2. Construct the regular expression for...
 - (a) the set of all strings with at most one pair of consecutive 0's and at most one pair of consecutive 1's,

- (b) the set of all strings with equal number of 0's and 1's such that no prefix has two more 0's than 1's nor two more 1's than 0's.
3. Construct a context free grammar (CFG) for a set of strings of $\{(,)\}^*$ such that every string of the set has equal number of left and right parenthesis, and every prefix has at least as many left parenthesis as right parenthesis.

Exercise 3

(0 Points)

1. Let r and s be regular expressions. Consider the set X such that $X = r.X + s$. Under the assumption that the language of r ($L(r)$) does not contain ε , find X .
2. (a) Show that the language $L = \{0^{i^2} \mid i \in \mathbb{N}\}$ is not regular.
(b) Show that the language $L = \{a^i b^i c^i \mid i \in \mathbb{N}\}$ is not a CFL.