

Homework 4

1. Why is every finite set of strings a regular language?
2. What is the language recognised by the regular expressions $(\emptyset^*)^*$.
3. If a regular expression r does not contain any occurrence of \emptyset , is it possible for $L(r)$ to be empty?
4. Define the tokens and regular expressions for a language consisting of numbers, left-parenthesis $($, right-parenthesis $)$, identifiers and the operations $+$, $-$ and $*$. Can the following strings in this language be lexed?
 - $(a + 3) * b$
 - $)() + + - 33$
 - $(a/3) * 3$

In case they can, can you give the corresponding token sequences.

5. Assume that s^{-1} stands for the operation of reversing a string s . Given the following *reversing* function on regular expressions

$$\begin{aligned} rev(\emptyset) &\stackrel{\text{def}}{=} \emptyset \\ rev(\epsilon) &\stackrel{\text{def}}{=} \epsilon \\ rev(c) &\stackrel{\text{def}}{=} c \\ rev(r_1 + r_2) &\stackrel{\text{def}}{=} rev(r_1) + rev(r_2) \\ rev(r_1 \cdot r_2) &\stackrel{\text{def}}{=} rev(r_2) \cdot rev(r_1) \\ rev(r^*) &\stackrel{\text{def}}{=} rev(r)^* \end{aligned}$$

and the set

$$Rev A \stackrel{\text{def}}{=} \{s^{-1} \mid s \in A\}$$

prove whether

$$L(rev(r)) = Rev(L(r))$$

holds.

6. Give a regular expression over the alphabet $\{a, b\}$ recognising all strings that do not contain any substring bb and end in a .
7. Assume the delimiters for comments are $/*$ and $*/$. Give a regular expression that can recognise comments of the form

`/* ... */`

where the three dots stand for arbitrary characters, but not comment delimiters. (Hint: You can assume you are already given a regular expression written `ALL`, that can recognise any character, and a regular expression `NOT` that recognises the complement of a regular expression.)