

Homework 4

1. If a regular expression r does not contain any occurrence of \emptyset , is it possible for $L(r)$ to be empty?
2. 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.

3. 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.

4. Assume the delimiters for comments are $/*$ and $*/$. Give a regular expression that can recognise comments of the form

$$/* \dots */$$

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.)

5. How many basic regular expressions are there to match the string $abcd$?
(ii) How many if they cannot include ϵ and \emptyset ? (iii) How many if they are also not allowed to contain stars? (iv) How many if they are also not allowed to contain $_ + _$?