Homework 4

1. If a regular expression r does not contain any occurrence of $\varnothing$, 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

$$rev(\varnothing) \overset{\text{def}}{=} \varnothing$$
$$rev(\epsilon) \overset{\text{def}}{=} \epsilon$$
$$rev(c) \overset{\text{def}}{=} c$$
$$rev(r_1 + r_2) \overset{\text{def}}{=} rev(r_1) + rev(r_2)$$
$$rev(r_1 \cdot r_2) \overset{\text{def}}{=} rev(r_2) \cdot rev(r_1)$$
$$rev(r^*) \overset{\text{def}}{=} rev(r)^*$$

   and the set

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

   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

$$/* \ldots */$$

   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 $\varnothing$? (iii) How many if they are also not allowed to contain stars? (iv) How many if they are also not allowed to contain $\_ + \_$?