# 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

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

   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

```
/* ... */
```

   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.)