Seminar 2

Exercise 1. Consider the alphabet $\Sigma = \{0, 1\}$. For each of the languages over the alphabet Σ given below, construct a finite automaton recognizing them.

(i) $L_1 = \{w \mid w \text{ contains only zeros}\}$

(ii) $L_2 = \{w \mid w \text{ contains an even number of zeros}\}$

(iii) $L_3 = \{w \mid w \text{ contains an an odd number of ones}\}$

(iv) $L_4 = \{w \mid w \text{ does not contain the string } 110\}$

(v) $L_5 = \{0^{2n} \mid n \geq 1\}$ and $L_6 = \{1^{2n+1} \mid n \geq 1\}$

(vi) $L_7 = \{0^{2n}1^{2m+1} \mid n, m \geq 1\}$

Exercise 2. Prove, without constructing automata, that the languages L_1 and L_7 from the previous exercise are regular, and that so is the language $L_8 = \{w \mid w \text{ contains an even number of zeros or an odd number of ones}\}$

Exercise 3. In some programming languages (e.g. in `C`), comments are written between delimiters like `/*` and `*/` and cannot be nested. Assume for simplicity that besides comments, the only other symbols in the language are a and b. Construct a finite automaton that recognizes the language C over the alphabet $\{/, *, a, b\}$ of commented strings, defined by $C = \{w \mid w$ starts with `/*`, ends with `*/` disjoint from the initial `/*` substring and contains no other occurrence of `*/` other than the final one$\}$.

Exercise 4. Let $\Sigma = \{0, 1\}$. Suppose the language L over the alphabet Σ is regular. Prove that $\overline{L}$ is regular, where $\overline{L} = \{w \mid w \notin L\}$.