Scientific Theory in Informatics A1N
Automata Theory & Computability Theory Exercises

1. Design a DFA that models the behaviour of the elevator in Portalen 3A.

2. Design a DFA that accepts a language A of strings with an even number of 1s.

3. Show that the NFA to recognize language A consisting of all strings over {0,1} containing a 1 in the third position from the end accepts 000100 and rejects 0011.

4. Show that the PDA for the language L(G) = $\{0^n1^n \mid n \geq 0\}$ accepts 000111 and rejects 001.

5. Define a context-free grammar that generates the strings xxO, xxxO, but not Oxx, Oxxx. Modify it, if necessary, to that it also generates the string O.
   [Note: the punctuation marks , and . are not part of the strings above.]

6. Show that the context-free grammar G = (V, Σ, R, <EXPR>)

   V = {<EXPR>, <TERM>, <FACTOR>}
   Σ = {a, +, ×, (,) }
   R: <EXPR> → <EXPR> + <TERM} | <TERM>
   <TERM> → <TERM> × <FACTOR} | <FACTOR>
   <FACTOR> → (<EXPR>) | a

   generates the string (a+a)×a

7. Show that the Turing machine $M_1 = (Q, \Sigma, \Gamma, \delta, q_o, q_{accept}, q_{reject})$ for testing membership in the language $B = \{w\#w \mid w \in \{0, 1\}^* \}$ recognizes 10#10.

8. Show that the Turing machine $M_1 = (Q, \Sigma, \Gamma, \delta, q_o, q_{accept}, q_{reject})$ for testing membership in the language $B = \{w\#w \mid w \in \{0, 1\}^* \}$ does not recognize 10#01.