EXERCISES ABOUT DETERMINISTIC FINITE AUTOMATA

1 Consider the following description of an elevator: ☚

- The elevator moves between 3 floors and can be in floor 0, 1, or 2.
- In each floor there is a single button to call the elevator.
- Inside the elevator there are three buttons to select the destination floor.
- The buttons have no memory.
- Once moving, the elevator moves until it reaches the destination floor, ignoring other requests, internal or external. Those requests to be effective need to be repeated when the elevator is in condition to deal with them.
- When it arrives to a floor, the elevator automatically opens the door and after some time it closes the door automatically.
- When the elevator is in the floor where it's called from, it also opens the door.
- The elevator with the door open does not move.

Predefined inputs:

A, B, C – call to floor 0, 1, or 2, respectively;

0, 1, 2 – button to select the destination floor inside the elevator.

a) Show an automaton describing the elevator functionality.

b) What is the meaning of each button?

2 Give an automaton to read dates in the European format: YYYY-MM-DD or YY-MM-DD, in which the zeros on the left of each field of the date can be omitted. ☚

[Note that the DFA does not need to verify if the dates are valid. As a homework you can think in a DFA that only accepts valid dates.]

3 Draw DFAs that accept the following languages over the alphabet {0,1}:

a) The set of all the strings with 00 as suffix. ☚

b) The set of all the string with three contiguous 0's (not necessarily in the end).

c) The set of all string with 011 as substring.

4 Although the definition of $\delta^\wedge$ is inductive and based on the idea of applying the substring until the last but not one symbol and then do the last step over the last symbol, we can think of $\delta^\wedge$ as a substring that can be split in every point. Prove that $\delta^\wedge(q, xy) = \delta^\wedge(\delta^\wedge(q,x), y)$. Suggestion: use induction in $|y|$. ☚

5 Give the DFA's accepting the following languages over the alphabet {0,1}: ☚

a) The set of all strings which start with a 1 and when interpreted as binary numbers represent numbers multiple of 5.

b) The set of all strings that when interpreted in reverse order as binary integers are divisible by 5.