Foundation of Computer Science — FM2

`https://online.stanford.edu/courses/soe-ycsautomata-automata-theory`

Video lectures of "Week 1"

In what follows, finite automata are given as tuples $A = (Q, \Sigma, \delta, q_0, F)$, where Q is the set of its states, Σ is the input alphabet, δ is the transition function, $q_0 \in Q$ is the start state, and $F \subseteq Q$ is the sets of accepting states. If δ is represented by a transition table, then the head row displays the states while the head column contains the input symbols.

1. Let
$$A = (\{z_0, z_1, z_2, z_3, z_4\}, \{a, b, c\}, \delta, z_0, \{z_0\})$$
be a DFA, where the transition relation is given by the following table:

δ	z_0	z_1	z_2	z_3	z_4
a	z_1	z_3	z_0	z_4	z_3
b	z_2	z_0	z_4	z_4	z_3
c	z_2	z_0	z_4	z_4	z_3

   a) Draw the transition diagram of A.

   b) Which of the words ε, *abab*, *ababa*, *caaa* are accepted by A, and which of them are not?

   c) What is the language $L(A)$ that is accepted by A.

2. Give deterministic finite automata accepting the following languages over the alphabet $\{0, 1\}$:

   a) the set of all strings ending with 00,

   b) the set of all strings containing three consecutive 0s,

   c) the set of all strings in which the second symbol from the end is 1.

3. Let
$$A = (\{a, b\}, \{q_0, q_1, q_2, q_3\}, \delta, q_0, \{q_3\})$$
be a nondeterministic finite automaton with

δ	q_0	q_1	q_2	q_3
a	$\{q_0, q_1\}$	$\{q_2\}$	$\{q_3\}$	$\emptyset$
b	$\{q_0\}$	$\{q_2\}$	$\{q_3\}$	$\emptyset$

   a) Decide, for each of the strings $w_1 = \varepsilon$, $w_2 = ab$, $w_3 = aab$, $w_4 = baaab$ and $w_5 = abbba$, whether or not they are accepted by A.

   b) Give the language $L(A)$ accepted by A.

   c) Construct a deterministic finite automaton A', with $L(A') = L(A)$. Use the subset construction (also called power set construction).