Theoretical Computer Science – Exercise 2

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Please prepare the following exercises at home prior to the tutorial:

Exercise 1

Specify a deterministic finite automaton as a transition diagram that accepts all natural numbers formed by digits 1 to 4 whose digits grow monotonously (= each subsequent digit is greater than or equal to the preceding one). Example: 112444.
Specify the accepted language in set notation.

Exercise 2

In all parts of this exercise you are supposed to construct a DFA with $\Sigma = \{0, 1\}$, whose recognized language consists of all words that contain twice as many zeros as ones, with conditions as follows:

a) No word contains two zeros in direct succession.
b) A maximum of two zeros in direct succession is allowed.
c) No additional conditions.

We will do the following exercises together during the tutorial:

Exercise 3

Given: Automaton with $\Sigma = \{a, b\}$, $Q = \{s0, s1, se\}$, start state $s0$, end state se, and the transition table:

	s0	s1	se
a	s0, se	se	s1
b	-	se	se

a) What does it mean that the transition table contains two states in the column for s0 for input a?
b) Draw the transition diagram for the automaton.
c) How can you fill the entry marked with a dash (-) in the transition table without changing the recognized language L? Add your solution using a different color to the transition diagram of subtask b).
d) Construct an equivalent deterministic automaton and draw the associated transition diagram.

Exercise 4

a) Given is the adjacent NFA.
   What is the recognized language in set notation?
b) Specify the transition table of this NFA.
c) Construct the equivalent DFA.
   Specify its transition table and diagram.

s2

0…9

0…9

0…9

.

s1

s3

0…9

0…9

0…9

−

s0

se

0…9

0…9

0…9