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Tutorial 1

Theory of Computation

Questions marked (S) are self-test questions with solutions provided at

`http://infolab.stanford.edu/~ullman/ialcsols/sol2.html`

Questions marked (A) are assignment questions.

Exercise 1 **Construction of DFAs** (S)

Give a DFA that accepts precisely the following language :

1. the set of all strings that end in 00.
2. the set of all strings beginning with 1 that, when interpreted as binary integer, is a multiple of 5.

(These are exercises 2.2.4 (a) and 2.2.6 in the textbook.)

Exercise 2 **Language of a DFA** (S)

Consider the DFA with the following transition table:

	0	1
$\rightarrow A$	A	B
$*B$	B	A

If A is the starting state and B is (the only) accepting state, what is the language of this automaton? Give a proof by induction that your description is correct.

Exercise 3 **Construction of NFAs** (S)

Construct an NFA that precisely accepts all strings over the alphabet $\{0, 1, \ldots, 9\}$ so that the final digit has appeared before. (This is exercise 2.3.4. (a) in the textbook.)

Exercise 4 **Automata with ϵ-transitions** (S)

Consider the following automaton with ϵ-transitions:

a	ϵ	a	b	c
$\rightarrow p$	$\emptyset$	$\{p\}$	$\{q\}$	$\{r\}$
q	$\{p\}$	$\{q\}$	$\{r\}$	$\emptyset$
$*r$	$\{q\}$	$\{r\}$	$\emptyset$	$\{p\}$

with starting state p and final state r as indicated above.

1. Compute the ϵ-closure of each state.
2. List all strings of length ≤ 3 accepted by this automaton.
3. Convert this automaton to an equivalent DFA.

(This is exercise 2.5.1 in the textbook.)

Exercise 5 **DFAs and NFAs** (A)

Fix the alphabet $\Sigma = \{a, b\}$.

1. Given an NFA that precisely accepts all strings over Σ that begin and end with the same letter.
2. Construct a DFA that accepts the same language.