LIACS
Leiden University

Examination Fundamentele Informatica 2
20 August 2007, 10:00 - 13:00

Question 1: **[2 points]**

a) Give a finite automaton accepting the language L_1 denoted by the regular expression (0+1)*(0+1)1*
b) Give a finite automaton accepting the language L_2 denoted by the regular expression (0+1)*111*.
c) Construct the finite automaton accepting the language $L_1 \cap L_2$.
d) Construct the finite automaton accepting the complement of the language L_2.

Question 2: **[2,5 points]**

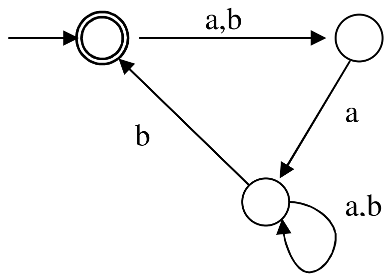
Let M be a nondeterministic finite automaton with Λ-transition with alphabet {a,b}, states {1,2,3,4}, initial state 1, final state {4}, and transition function given by

q	δ(q, Λ)	δ(q, a)	δ(q, b)
1	{4}	∅	{2,3}
2	∅	{3}	∅
3	{4}	∅	∅
4	∅	∅	{4}

a) Compute for each state $q \in \{1,2,3,4\}$ the set $\Lambda(\{q\})$.
b) Construct a nondeterministic finite automaton M' without Λ-transition equivalent to M.
c) Use the powerset construction to find a deterministic version of your automaton M'.

Question 3: **[2 points]**

Using the method of Brzozowski and McCluskey to construct a regular expression for the language recognized by the following finite automaton



Question 4: **[1,5 points]**

a) Give the definitions of context free grammar and of regular grammar.
b) Construct a finite automaton accepting the language generated by the grammar

$S \rightarrow aA \mid bB \mid bS$
$A \rightarrow bS \mid b$
$B \rightarrow bA \mid aB \mid b$.

Question 5: **[2 points]**

a) When is a context free grammar ambiguous?
b) Show that the following context free grammar is ambiguous

$S \rightarrow S\ X\ S \mid a$
$X \rightarrow x \mid y$.

c) Find a non-ambiguous grammar generating the same language.

The final score is given by the sum of the points obtained.