The Open University of Sri Lanka

B.Sc. Degree Programme: Level 05

Final Examination- 2007

CSU 3275/PMU 3293/PME 5295 - Automata Theory – Paper I

Duration: Two and Half Hours.

Date:18.06.2007 10.00 am -12.30 pm

Answer Four Questions Only.

1. Let L be the language over the alphabet $\varepsilon = \{0,1\}$ of all stings that contain at least one occurrence of either 10001 or 11111 .
(***hint***: Strings 10011111 & 0010001 belong to L, strings 111 & 111001 do not)

   i) Define L(M) for the above machine M.

   ii) Draw a DFA for L.

   iii) Construct its transition table.

2. A Mealy machine can be implemented using circuitry.

   i)

   a) Explain the role of α , σ and μ using a simple diagram .

   b) Discuss the implementation procedure.

   ii) Given below is the transition table of a Mealy machine.

	State Transition		Outputs	
	I1	I2	I1	I2
S1	S2	S1	P1	P2
S2	S1	S2	P1	P2
S3	S3	S3	P2	P1

a) Implement the machine given by the above transition table.

b) Is the above implementation true? Justify your answer.

c) Determine the morphism between the two machines.

3.

i) Suppose M1,M2 ,M3 are Mealy machines and that ϕ_1 , ϕ_2 are homomorphisms such that $\phi_1 : M1 \rightarrow M2$ and $\phi_2 : M2 \rightarrow M3$. Prove that $\phi_1.\phi_2 : M1 \rightarrow M3$ is a homomorphism, where $\phi_1.\phi_2 = (\alpha, \sigma, \theta)$ and $\alpha = \alpha 1.\alpha 2$, $\sigma = \sigma 1.\sigma 2$, $\theta = \theta 1.\theta 2$.

ii) What do you mean by "two Mealy machines are behaviorally equivalent"?

iii) How do two behaviorally equivalent machines become weaken homomorphism?

iv) If the α - mapping of the machines in part iii) is bijective, are those two machines Identity isomorphisms?

4. i) Give the definition of state and output transitions for a Mealy machine.

ii) Suppose a Mealy machine is defined with the usual notation. Prove for $\forall s \in S^*, i \in I^*$ and, $a \in I^*$,

a) $\delta^*(s,ai) = \delta^*(\delta^*(s,a),i))$

b) $\beta^*(s,ai) = \beta^*(\beta^*(s,a),i))$

iii) Construct a DFA over L = {0, 1} which will accept all the words where the number of 1's is divisible by three(3) .

i) What do you mean by finite automata?

ii) What are the special characteristics of a Non – Deterministic Finite Automaton?

iii) Describe the difference between NDFA and DFA.

iv) Construct a DFA over the alphabet {a, b} which accepts the language $L=\{b^m ab^n$: where m and n are positive }.

i) A finite state recognizer is used to recognize the number sequence 7658 in a telephone number (for example, the number 0118876583). Also, the digit 7 should not be repeated consecutively.

a) Design the above DFA.

b) Show that the machine you designed accepts the sequence 0118876583.

c) Modify the machine to accept sequences with two consecutive 7's.

i) Describe the set of strings recognized by the finite state automaton given below.