



The Open University of Sri Lanka

B.Sc. Degree Programme: Level 05  
Final Examination- 2008

CSU 3275/PMU 3293/PME 5293 - Automata Theory – Paper I

Duration: Two and Half Hours.

26.06.2008

10.00 am -12.30 pm

Answer Four Questions Only.

- 1.
- i) Describe the following languages over an alphabet  $A = \{a,b\}$  in natural words.
- a)  $L_3 = \{ a^m b^m : m > 0 \}$       b)  $L_2 = \{ a^m b^n : m > 0, n > 0 \}$   
c)  $L_4 = \{ b^m a b^n : m > 0, n > 0 \}$   
( *hint*:  $L = \{ ab, ab^2, \dots \}$ ,  $L$  consists of all words which begin with an 'a' followed by one or more 'b's.)
- ii) Construct DFAs to identify each of the languages defined in part i) above.
- iii) Consider the DFA  $M$  given by the following transition table where  $M = (\{S_0, S_1, S_2, S_3, S_4\}, \{a, b\}, \delta, S_0, \{S_4\})$ .

M	State Transition( $\delta$ )	
	a	b
S0	S4	S1
S1	S2	S1
S2	S4	S3
S3	S4	S3
S4	S4	S4

- a) Draw the directed graph for the above table.  
b) Show that  $\delta^*(S_0, aaa(bab)^* b) = S_4$ .  
c) Check whether  $aaaba^*baaa$  is a string accepted by  $M$ .
- 2.
- i) What do you mean by finite automata?
- ii) What are the special characteristics of Non – Deterministic Finite Automata?
- iii) Describe the difference between NDFAs and DFAs.
- iv) Construct a DFA that accepts strings over the alphabet  $\{0,1\}$  that have at least one 1 and an even number of 0s after the last 1.

3. A Mealy machine can be implemented using circuitry.

i)

a) Explain the role of  $\alpha$ ,  $\sigma$  and  $\mu$  using a simple diagram.

b) Discuss the implementation procedure.

ii) Implement the machine given below using the procedure discussed in part i) b).

M1

	1	2	1	2
S1	S2	S3	b	a
S2	S1	S3	b	a
S3	S2	S4	a	b
S4	S1	S4	a	b

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

b) Determine the morphism between M1 and the implemented machine.

4. An elevator can be in first, second or third floor at any given moment. In each floor the elevator door can be either open or closed. In order to move, the elevator door must be closed always. There are three buttons that indicate the floor number which the elevator can travel once it is pressed. Apart from that there are two buttons to open and close the door of the elevator. Identify the states and inputs of the elevator. Give the state graph for the above elevator.

5. Let  $L$  be a language over the alphabet  $\Sigma = \{0,1\}$  consisting of all strings that contain at least one occurrence of either 110001 or 111111 .  
( *hint*: Strings 100111111 & 00110001 belong to  $L$  and Strings 1111 & 111001 do not )

i) Construct the DFA for accepting  $L$ .

ii) Construct its transition table.

6. You are given the task of designing a coffee machine for a local cafeteria. The machine takes Rs. 1/= and Rs. 2/= as inputs, with a selection button (C) for choosing the coffee. In order to retrieve the coffee the button C should be pressed after inserting correct amount of money. A cup of coffee is priced Rs. 4/=. If a person inputs coins more or less than the price of a coffee and presses the selection button (C) the machine will proceed to a message state (M), which guides the user for the of next action. You don't need to worry about returning excess change or the messages that are displayed.

i) Identify the input and states of this DFA.

ii) Construct a DFA for the above machine, stating any assumptions, if there are any.

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