VCD S.Y.B.SC. (CS) Theory Of Computation SEM-III 75-MARKS 21/2-HRS

N.B. **1) All questions are compulsory.**
2) Figures to the right indicate marks.
3) Illustrations, in-depth answers and diagrams will be appreciated.
4) Mixing of sub-questions is not allowed.

Q. 1 Attempt All(Each of 5Marks) **(15M)**

(a) Multiple Choice Questions

1. Language of finite automata is.
   a) Type 0 b) Type 1 c) Type 2 d) Type 3
2. Regular expression for all strings starts with ab then any number of a or b and ends with bba.
   a) aba*b*bba b) ab(ab)*bba c) ab(a+b)*bba d) All of the above
3. Statement: Pumping lemma gives a necessary but not sufficient condition for a language to be regular.
   a) true b) false
4. In mealy machine, the O/P depends upon?
   a) State b) Previous State c) State and Input d) Only Input
5. L is a regular Language if and only If the set of _____ classes of L is finite.
   a) Equivalence b) Reflexive c) Myhill d) Nerode

(b) Fill in the blanks

(2, input variants, start symbol, automata, R, output variants, Φ, 1, Grammar, Accepting state)

1. The major difference between Mealy and Moore machine is about _____
2. Concatenation of R with Φ outputs _____
3. The difference between number of states with regular expression (a + b) and (a + b) * is _____.
4. The entity which generates Language is termed as _____.
5. The Grammar can be defined as: G=(V, ∑, p, S). In the given definition, S represents _____.

(c) Short Answers

1. Define Moore Machine.
2. Define Parse tree.
3. Define reverse substitution.
4. Define ε -transition.
5. What are different techniques to represent Turing machine?

Q. 2 Attempt the following (Any THREE)(Each of 5Marks) (15M)

(a) Write short note on transition system with its notations.

(b) Prove that for any transition function δ & for any two input string x&y, δ (q,xy)= δ (δ (q,x),y).

(c) Consider following Grammar G where P consists of

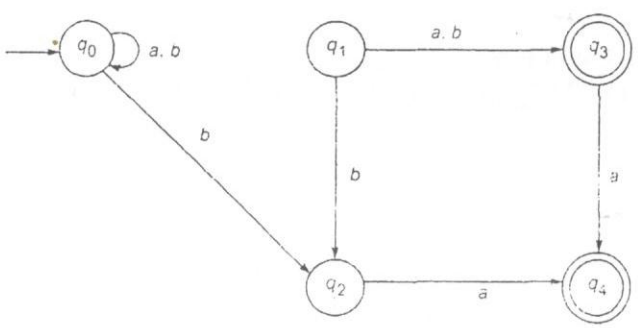
⟨SENTENCE⟩ → ⟨NOUN-PHRASE⟩⟨VERB-PHRASE⟩
⟨NOUN-PHRASE⟩ → ⟨CMPLX-NOUN⟩ | ⟨CMPLX-NOUN⟩⟨PREP-PHRASE⟩
⟨VERB-PHRASE⟩ → ⟨CMPLX-VERB⟩ | ⟨CMPLX-VERB⟩⟨PREP-PHRASE⟩
⟨PREP-PHRASE⟩ → ⟨PREP⟩⟨CMPLX-NOUN⟩
⟨CMPLX-NOUN⟩ → ⟨ARTICLE⟩⟨NOUN⟩
⟨CMPLX-VERB⟩ → ⟨VERB⟩ | ⟨VERB⟩⟨NOUN-PHRASE⟩
⟨ARTICLE⟩ → a | the
⟨NOUN⟩ → boy | girl | flower
⟨VERB⟩ → touches | likes | sees
⟨PREP⟩ → with

Test whether w="a girl with a flower likes the boy" is in L(G).

(d) Construct a Moore machine which is equivalent to the Mealy machine.

Present state	Next state			
	Input a = 0		Input a = 1	
	state	output	state	output
→q_1	q_3	0	q_2	0
q_2	q_1	1	q_4	0
q_3	q_2	1	q_1	1
q_4	q_4	1	q_3	0

(e) Construct DFA equivalent to the NDFA whose transition diagram is given below.



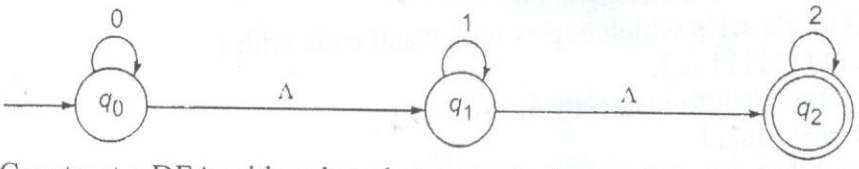
(f) Define Grammar. Consider G =({ S. C}, *{a, b}*, *P*, S), where *P* consists of S-> *aCa*, C -> *aCa* | *b*. Find *L(G)*.

Q. 3 **Attempt the following (Any THREE) (Each of 5Marks)** **(15M)**

(a) What is formal definition of Regular Expression? Explain its order of evaluation.

(b) State Andren's Theorm. Prove equivalence of
(1+00*1)+(1+00*1)(0+10*1)*(0+10*1)=0*1(0+10*1)*.

(c) Consider following ^-NFA to generate NFA.



(d) Construct a DFA with reduced state equivalent to following Regular Expression 10+(0+11)0*1.

(e) What is derivation? What are different types of derivation?
S->aB/aA
S->aS/bAA/a
B->bS/aBB/b
Draw a parse tree for input string "aaabbabbba".

(f) Write a short note on Greibach Normal form.

Q. 4 **Attempt the following (Any THREE) (Each of 5Marks)** **(15M)**

(a) Explain Turing Machine representation by instantaneous descriptions using move-relations.

(b) Explain model of Linear Bounded Automata.

(c) Write short note on variant of Turing machine.

(d) What is Halting problem of Turing Machine?

(e) What are Unsolvable problems?

(f) How to design Turing Machines? Design a TM to recognize all strings consisting of an even number of 1's.

Q. 5 **Attempt the following (Any THREE) (Each of 5Marks)** **(15M)**

(a) Consider the finite state machine whose transition function δ is given by following transition table. Here, $Q = \{q0, q1, q2, q3\}$, $L = \{0, 1\}$, $F = \{q0\}$.
Give the entire sequence of states for the input string 110001.

State	Input	
	0	1
→ q_0	q_2	q_1
q_1	q_3	q_0
q_2	q_0	q_3
q_3	q_1	q_2

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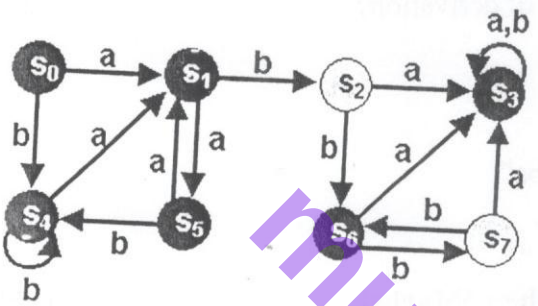
(b) Describe following set by Regular Expression.
L1=set of all strings of 0's & 1's ending in 00.
L2=set of all strings of 0's &1's which begins with 0 and ends with 1.
L3={λ,111,111111,11111111,...}.
L4=set of all stings whose length is exactly 4.

(c) Explain Turing Machine Model.

(d) State the process of minimization of automata.
Consider following automata & minimize the states and draw DFA.



(e) Explain Pumping lemma and its various applications.