CBCS SCHEME

USN

15CS54

Fifth Semester B.E. Degree Examination, July/August 2022
Automata Theory and Computability

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. List the applications of Finite Automata. Design DFSM for following languages.
i) L = {W | $|n_o|$ $mod_2 = 0$ & $|n_1|$ mod 3 = 0}.
ii) L = {strings of a's and b's which start with ab and ends with a}. **(10 Marks)**

b. Define Finite State Transducers. Obtain and equivalent Moore machine for the Mealy machine given below. **(06 Marks)**

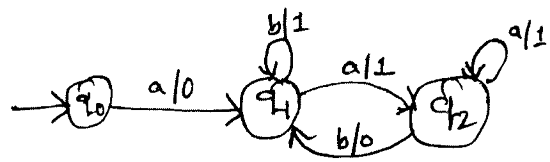


Fig. Q1(b)

OR

2 a. Define Power of an Alphabet. Consider the DFSM given below with accepting states (D, F, G) and compute. **(08 Marks)**

δ	0	1
A	B	C
B	D	E
C	F	G
*D	D	E
E	F	G
*F	D	E
*G	F	G

i) Distinguishable & Equivalent States ii) Minimization of Finite State Machine.

b. Define eps ( ). Obtain an equivalent DFSM for Finite Automata given below. **(08 Marks)**

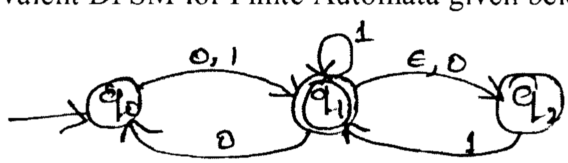


Fig. Q2(b)

Module-2

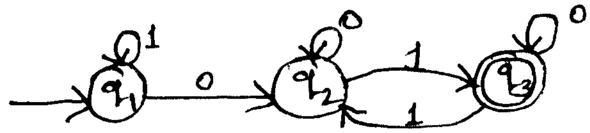
3 a. Define Regular Expression. Construct the Regular expression for the languages given below
i) $L = \{a^n b^m \mid n, m \geq 1, mn \geq 3\}$ ii) $L = \{a^n b^m \mid m + n \text{ is even}\}$
iii) L = {Strings of 0's & 1's which does not contain two consecutive 0's and ends with 0}. **(08 Marks)**

b. State and prove the pumping Lemma for Regular Languages. Prove that, the language $L = \{a^n b^m c^n \mid n, m \geq 0\}$ is not regular. **(08 Marks)**

OR

4 a. Obtain Regular expression for Finite State Machine given below and give the language defined by Regular expression. (08 Marks)

Fig. Q4(a)



b. List the closure properties of Regular Languages construct the Regular Grammar for following : i) $L = \{(01)^* 101 (0 + 1)^*\}$ ii) $L = \{a^{n+1} b^{2m+1} \mid n, m \geq 0\}$ iii) $L = \{(01 + 1)^* (0 + 10)^*\}$. (08 Marks)

Module-3

5 a. Define CFG. Construct CFG for the languages given below :
i) $L = \{W \mid n_a(W) = n_b(W)\}$ ii) $L = \{a^{2n+1} b^m c^m c^{2n} \mid n, m \geq 0\}$. (08 Marks)

b. Define CNF. Design PDA for the language $L = \{0^n b^m 1^{2n} \mid n, m \geq 0\}$. Write the Instantaneous Description for the string 0bb11. (08 Marks)

OR

6 a. Consider the Grammar
$E \rightarrow E + E \mid E - E \mid E * E \mid E/E \mid (E) \mid I$
$I \rightarrow 0 \mid 1 \mid a \mid b \mid Ia \mid Ib \mid I0 \mid I1$
and compute the following for input string (a1 + b0 * 00).
i) LMD ii) RMD iii) Parse Tree iv) Is this ambiguous? Justify your answer. (08 Marks)

b. List out the simplification techniques of CFG. Explain PDA and obtain an equivalent PDA for CFG given below : $S \rightarrow a \mid b \mid a S b \mid b S a$. (08 Marks)

Module-4

7 a. List the Closure properties of CFLs and prove that language $L = \{a^{2n} b^n c^{2n} \mid n \geq 0\}$ is not context free language. (08 Marks)

b. Define TM. Explain working of TM with neat diagram. (08 Marks)

OR

8 a. Design and construct TM to accept the language L = {W | W is balance parenthesis}. Show the moves made by TM for string W = (( ) ( )). (08 Marks)

b. List the techniques for TM construction. Explain the concept of string membership in CFL using context free grammar and Push Down Automata. (08 Marks)

Module-5

9 a. List the variants of TM. Prove that for every language accepted by multi tape TM is accepted by some Single tape TM. (08 Marks)

b. Define Linear Bounded Automata (LBA). Explain the model of LBA with neat diagram and state the relation between LBA and context sensitive language. (08 Marks)

OR

10 a. State the definition of Algorithm by Church – Turing. Explain the Quantum computers. (08 Marks)

b. Define P, NP classes with respect to TM. Explain post correspondence problem and prove that PCP with two list x = (01, 1, 1) ; $y = (01^2, 10, 1^1)$ has no solution. (08 Marks)

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