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**I Semester M.C.A. Degree Examination, June/July - 2024****COMPUTER SCIENCE****Theory of Computation****(CBCS Scheme 2020-21 - Y2K20)****Paper : 1MCA4****Time : 3 Hours****Maximum Marks : 70****Instructions to Candidates :****Answer All the Parts.****PART - A**Answer any **FIVE** questions.**(5×6=30)**

1. Define automation and briefly outline the key characteristics of different automata types and their sub-classifications.
2. Design a DFA that reads a string of letters in the  $L = \{W / W \in \{a, b \text{ and } |W| \bmod = 0\}$ .
3. Define Regular Expression. Obtain an NFA for the regular expression  $a^*+b^*+c^*$ .
4. Explain Chomsky's Hierarchy of languages.
5. What is ambiguous grammar? Is the following grammar ambiguous?

$$S \rightarrow aS|X$$

$$X \rightarrow aX|a$$

6. Compare Moore and Mealy machines.
7. Explain recursive languages and recursively enumerable languages.
8. What is a restricted Turing machine? Discuss any two restricted Turing machines.

**[P.T.O.]**



(2)

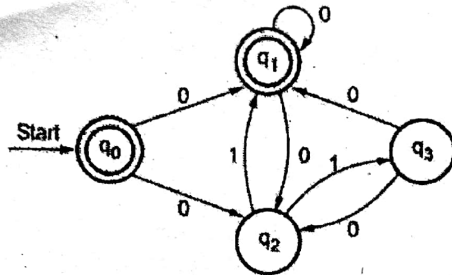
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PART - B

Answer any FOUR questions.

(4×10=40)

9. a) What is NFA? Convert the following NFA to DFA. (6)



b) What does  $\epsilon$ -closure represent? Provide an example to illustrate the usage (4)

10. a) Minimize the following DFA using the table-filling algorithm. (7)

$\delta$	0	1
→ A	B	A
B	A	C
C	D	B
*D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

b) Obtain grammar to generate a string consisting of any number of a's and b's. (3)

11. a) State pumping lemma. Show that  $L = \{a^n b^n | n \geq 0\}$  is not regular. (5)

b) Optimize the CFG given below by reducing the grammar. Where S is the start symbol.

$$S \rightarrow A|0C1$$

$$A \rightarrow B|01|10$$

$$C \rightarrow \epsilon|CD$$

(5)





12. Let language  $L = \{a^n b^n \mid n \geq 1\}$
- a) Obtain a Push Down Automata (PDA) for the given language. (6)
  - b) Write the sequence of moves by PDA to accept the string aaabbb. (2)
  - c) Is PDA corresponding to language deterministic? Justify your answer. (2)
13. Obtain a Turing machine to accept the language  $L(M) = \{0^n 1^n 2^n \mid n \geq 1\}$  with transition table and transition diagram. (10)
14. Write a short note on
- a) Halting Problem (5)
  - b) Post Correspondence Problem (5)
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