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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?

$$S \rightarrow aS \mid X$$

$$X \rightarrow aX \mid a$$

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.]

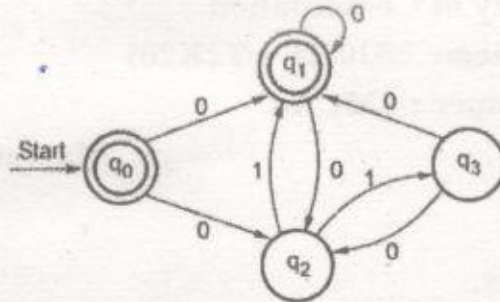


PART - B

Answer any FOUR questions.

(4×10=40)

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



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

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

δ	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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