Total No. of Questions :8] *[Total No. of Printed Pages : 2*

Roll No .....

MCADD-604

M.C.A. (Integrated), VI Semester

Examination, May 2023

Theory of Computation

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Write the difference between Mealy and Moore machine. Construct a Moore machine that takes input as set of all strings over $\Sigma=\{1,0\}$ and produces X as if input ends with 10 and produces Y as if input ends with 11 otherwise Z.

   b) For the $\Sigma=\{a, b\}$, Build a Finite automata that accepts for all strings having size:

   i) Atmost 5

   ii) Atleast 5

2 a) Briefly Convert the following given non-deterministic finite automata into minimized deterministic finite automaton. Given NFS:

State/Input	A	B
→p	{q, s}	{q}
*q	{r}	{q, r}
r	{s}	{p}
*s	-	{p}

Where * indicates final state.

b) Obtain an NFA with accepts L= {$w \in (a, b)$ *: |w|≥3 and third symbol of w from right is 'a'}.

3. a) Define the Chomsky classification of Grammar and draw the Chomsky hierarchy.

b) Prove or disprove the following statement about regular expressions:
   i) $(R+S)^* = R^* + S^*$
   ii) $(RS+R)^*RS=(RR^*S)^*$

4. a) What is the Pushdown automaton? Design PDA for $L= \{a^n b^b | n>=1\}$.
   b) Reduce the given grammar $G=(\{S,A,B\},\{a,b\},P,S)$ to Chomsky normal form where P is
   Defined as:
   $S \rightarrow bA|aB$
   $A \rightarrow bAA|aS|a$
   $B \rightarrow aBB|bS|b$

5. a) Define Turing Machine. Design a Turing machine which can multiply two positive integers.
   b) Explain following:
      i) Universal Turing Machine
      ii) Church Turing Hypothesis

6. a) Show that if L_1 and L_2 are recursive language, then $L_1 \cup L_2$ and $L_1 \cap L_2$ are also recursive.
   b) What is Undecidability? Describe halting problem.

7. Write short notes on any four of the following:
   a) Linear Bounded Automata
   b) CNF
   c) Two-way finite automata
   d) Context free grammar
   e) Recursively enumerable sets

8. a) What is the difference between recursive languages and recursive enumerable languages? Also prove that the union of two recursive languages is also recursive.
   b) How P class is different from NP class.

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