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Total No. of Questions : 09

M.Sc. (IT) (Sem.–4)
THEORY OF COMPUTATION
Subject Code : MSIT-403
M.Code : 74115
Date of Examination : 11-07-22

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :
1. **SECTIONS-A, B, C & D contains TWO questions each carrying TEN marks each and students have to attempt any ONE question from each SECTION.**
2. **SECTION-E is COMPULSORY consisting of TEN questions carrying TWENTY marks in all.**

SECTION-A

1. What do you mean by regular expression? Discuss various rules for the construction of the denoted languages with the regular expression construction rules? Explain with examples.

2. Construct the deterministic finite automata accepting each of the following languages :

   a) $\{w \in \{a, b\}^* :$ each a in w is immediately preceeded and immediately followed by a b$\}$.

   b) $\{w \in \{a, b\}^* :$ w has abab as a substring$\}$.

   c) $\{w \in \{a, b\}^* :$ w has neither aa nor bb as a substring$\}$.

   d) $\{w \in \{a, b\}^* :$ w has both ab nor ba as substrings$\}$.

SECTION-B

3. What is the role of derivation trees in the context free grammars? Discuss in detail with the help of suitable examples.

4. What is the purpose of having different normal forms of context free grammars? Reduce the grammar with the following productions to the Chomsky Normal form: $S \rightarrow abSb \mid a \mid aAb$, $A \rightarrow bS \mid aAAb$

SECTION-C

5. What is Push Down Automata (PDA)? Design PDA for $\{X^n Y^m \mid n > m\}$.

6. a) State and explain the Pumping lemma for CFG.

   b) Briefly explain the decision problems involving CFGs.

SECTION-D

7. What is a Turing machine? Discuss in detail the working, design and implementation of Turing machines with an example.

8. What are Recursive and Recursive Enumerable Languages? Discuss Closure properties of Recursive Languages.

SECTION-E

9. Answer the following questions briefly :

   a) What is an empty set?

   b) What are Relations? Discuss the properties of relations.

   c) Define pumping lemma.

   d) What is bottom up parsing?

   e) Define Non deterministic Finite Automata.

   f) What do you mean by Regular Expression? What is its use in finite automata theory?

   g) Prove the following property of regular expressions : $R (S + T) = RS + RT$.

   h) What are null and unit productions?

   i) State whether the following statement is true or not. Justify your answer as well :
      If L_1 and L_2 are CFGs, then $L_1 L_2$ need not be a CFG.

   j) Give productions of Chomsky Normal Form.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.