

42: 1ST HALF-13 (S)-JP

Con. 6972-13.

GS-9099

(3 Hours)

[Total Marks : 100

- N.B.** (1) Question No. 1 is compulsory.
(2) Attempt any **four** questions from remaining **six** questions.
(3) Draw suitable **diagrams** wherever **necessary**.
(4) Assume **suitable** data, if **necessary**.
(5) **Maximum** weightage is given to technical **notations**.

1. (a) Define the following terms :— 5
(i) Undecidability
(ii) Unrestricted grammar
(iii) Pumping lemma.
(b) Define TM and give its variants. 5
(c) Explain Chomsky hierarchy for formal languages. 5
(d) Give the closure properties of regular languages. 5
2. (a) (i) What is ambiguous CFG ? Give one example of ambiguous CFG. 5
(ii) What is Myhill-Nerode theorem ? Explain necessity of it. 5
(b) Let G be the grammar, find the leftmost derivation, right most derivation and parse tree for the string 00110101 10
$$S \longrightarrow OB / 1A$$
$$A \longrightarrow O/OS/1AA$$
$$B \longrightarrow 1/1S/OBB$$
3. (a) Explain CNF and GNF with example. 10
(b) Give the formal definition of RE and design a DFA corresponding to the regular expression 5
 $(a+b)^* aba (a+b)^*$
(c) Using pumping lemma prove that the following language is regular or not 5
 $L = \{a^n b^n \mid n \geq 1\}$

[TURN OVER

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4. (a) Write NFA for accepting the following RE 10
 $(a+bb)^* (ba^* + \epsilon)$
- (b) Explain DPDA and NPDA with languages of them. 10
5. (a) Find the languages defined by the following grammer : 10
- (i) $S \longrightarrow OA / IC$
 $A \longrightarrow OS / IB / \epsilon$
 $B \longrightarrow 1A / OC$
 $C \longrightarrow OB / 1S$
- (ii) $S \longrightarrow OA / IC$
 $A \longrightarrow OS / IB$
 $B \longrightarrow OC / IA / \epsilon$
 $C \longrightarrow OB / IS$
- (b) Construct the PDA accepting following language 10
 $L = \{a^n b^m a^n \mid m, n \geq 1\}$
6. (a) Differentiate between Moore and Mealy machine with proper example and usage 10
 Carry out conversion of Moore MIC to Mealy MIC.
- (b) Design a Turing machine to accept the language $L = \{a^n b^n \mid n \geq 1\}$ 10
7. Write short notes on any four :— 20
- (a) Recursive and recursively enumerable languages
 (b) Intractable problems
 (c) Simplification of CFGs
 (d) Decision properties of regular languages
 (e) Rice's theorem.
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