

Total No. of Questions :8]

SEAT No. :

P1755

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[5058] - 395**T.E. (Computer)****THEORY OF COMPUTATION****(2012 Course) (Semester - I) (310241)***Time : 2½ Hours]**[Max. Marks :70**Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Assume suitable data, if necessary.*

- Q1)** a) What is Kleen Closure? What is Positive Closure? For a given language L under what circumstances will L^+ and L^* be equal? [6]
- b) Construct a DFA over the alphabets $\{0, 1\}$ for accepting the strings having number of 1's as multiple of 3. [6]
- c) Check whether the given grammar is in CNF. If not then find its equivalent CNF. [8]

$$S \rightarrow bA \mid aB, A \rightarrow bAA \mid aS \mid a, B \rightarrow aBB \mid bS \mid b$$

OR

- Q2)** a) Define a Language of Polynomials recursively and give derivation for $7X^4 - 3X^3 + 15X$ [6]
- b) Construct finite automata for the following regular expressions. [6]
- i) $01 [((10)^* + 111)^* + 0]^* 1$
 - ii) $1 (1 + 10)^* + 10 (0 + 01)^*$
- c) Simplify the following grammar [8]
- i) $S \rightarrow Ab, A \rightarrow a, B \rightarrow C \mid b, C \rightarrow D, D \rightarrow E, E \rightarrow a$
 - ii) $S \rightarrow 0A0 \mid 1B1 \mid BB, A \rightarrow C, B \rightarrow S \mid A, C \rightarrow S \mid \epsilon$

P.T.O.

Q3) a) “If L_1 & L_2 are recursive languages, then $L_1 \cup L_2$ and $L_1 \cap L_2$ are also recursive.” Justify. [6]

b) What is NDTM? Construct a NDTM to recognize words of the form WW over alphabet $\{a, b\}$. [12]

OR

Q4) a) What is a post machine? Give formal definition of Post Machine. Construct a Post Machine for Having odd length and a^s as center element. [10]

b) Write short note on (Any two): [8]

i) Universal Turing Machine (UTM).

ii) Languages accepted/ decided by TM.

iii) Recursively Enumerable Languages.

Q5) a) What is PDA? What are the different types of PDA? Give its applications. [7]

b) Obtain the CFG for the PDA given by $M = \{\{q_0, q_1\}, \{0, 1\}, \{z_0, X\}, \delta, q_0, z_0, \phi\}$ where δ is given as. [9]

$$\delta(q_0, 1, z_0) = \{q_0, xz_0\} \quad \delta(q_0, 1, x) = \{q_0, xx\}$$

$$\delta(q_0, 0, x) = \{q_1, x\} \quad \delta(q_0, \epsilon, z_0) = \{q_0, \epsilon\}$$

$$\delta(q_1, 1, x) = \{q_1, \epsilon\} \quad \delta(q_0, 1, z_0) = \{q_0, z_0\}$$

OR

Q6) a) Construct a PDA that accept $L = \{a^n b^n \mid n \geq 1\}$ through Empty Stack. [6]

b) What is NPDA? Construct a NPDA for $L = \{a^i b^j c^k \mid i \neq j \text{ or } j \neq k\}$ [10]

- Q7)** a) What do you mean by NP - Complete Problems? List all the problems in this class and Explain any one with suitable example. [8]
- b) Why do we need to reduce existing problems to NP-Complete problems? Explain with suitable example. [8]

OR

- Q8)** a) What is SAT problem? Explain in detail. [8]
- b) What are Tractable and Intractable problems? Explain. [4]
- c) What is Computational Complexity? Explain. [4]



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