Total No. of Questions :8]

SEAT No. :

P1755

[Total No. of Pages :3

[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) $S \rightarrow 0A0 \mid 1B1 \mid BB, A \rightarrow C, B \rightarrow S \mid A, C \rightarrow S \mid \in$

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]**

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

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

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

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? Listall 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]**