Total No. of Questions : 8]

SEAT No. :

P2458

[Total No. of Pages : 3

[5253]-181

T.E. (Computer)

THEORY OF COMPUTATION

(2012 Pattern) (Semester - I)

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) Determine a Regular Expression over the alphabets {0, 1} for the following **[6]**

i) All strings containing exactly two 0's

ii) All strings that do not end with 01

iii) All strings starting with 11

b) Define Pumping Lemma and apply it to prove the following : **[6]**

$L = \{0^m\ 1^n\ 0^{m+n} | m, n >= 1\}$ is not regular.

c) Give the Right & Left linear grammar for the following DFA shown in **Fig 1** **[8]**

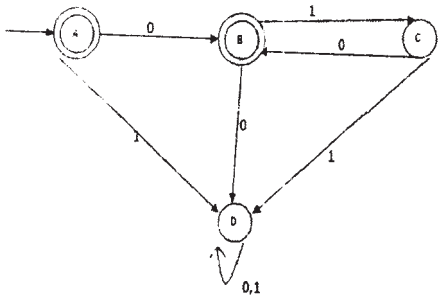

Fig 1

OR

P.T.O.

Q2) a) State Principle of Mathematical Induction and apply it to show that $n^4 - 4n^2$ is divisible by 3 for all n>0. **[6]**

b) Make use of Arden's theorem to determine the regular expression for the finite automata shown in **Fig 2**. **[6]**

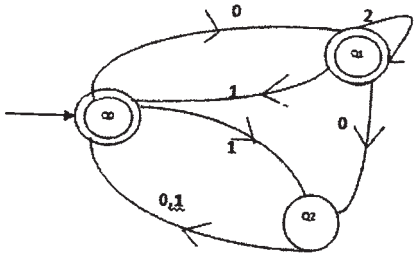

Fig 2

c) Construct a DFA for the following left linear grammar **[8]**

$S \rightarrow B1|A0|C0,\ B \rightarrow B1|1,\ A \rightarrow A1|B1|C0|0,\ C \rightarrow A0$

Q3) a) What is a Turing Machine? Give the formal definition of TM. Design a TM that replaces every occurrence of xyy by yxx. **[9]**

b) Write short note on : **[9]**

i) Halting Problem of Turing Machine.

ii) Universal Turing Machine (UTM).

iii) Recursively Enumerable Languages.

OR

Q4) a) What is a post machine? Give formal definition of Post Machine. Construct a Post Machine for Accepting strings for the language $a^{'s}$ & $b^{'s}$. **[9]**

b) What are the different ways for extension of TM? Explain. Construct a two tape TM to convert an input W into WW^R. **[9]**

Q5) a) Construct a PDA that accept $L = \{a^n b^n | n \geq 1\}$ through Empty stack **[7]**

b) Obtain CFG for the PDA given below : **[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) What is PDA? What are the different ways of constructing a PDA? Explain each with example. **[8]**

b) What is NPDA? Construct a NPDA for the set of all strings over {a,b} with odd length palindrome. **[8]**

Q7) a) What do you mean by NP-Problems? Justify why the Travelling Salesman problem is a NP-Problem. **[8]**

b) What do you mean by Polynomial Time Reduction? Explain with suitable example. **[8]**

OR

Q8) a) What is Kruskal's Algorithm? How can we solve this problem using Turing Machine? **[8]**

b) What is Clique Problem? Show that it is a NP-Complete problem. **[8]**