Total No. of Questions :8] **SEAT No. :**

P2605 **[Total No. of Pages :3**

[5153] - 581
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) Prove or disprove the given regular expression **[6]**

i) $(r^*s^*) = (r + s)^*$

ii) $s(rs + s)^* r = rr^*s(rr^*s)^*r$

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

$L = \{0^m 1^n 0^{m+n} \mid m>=1 \text{ and } n>=1\}$ is not regular

c) What is the ambiguous grammar? Show that the grammar below is ambiguous, & find the equivalent un ambiguous grammar. **[8]**

i) $s \rightarrow ss \mid a \mid b$

ii) $s \rightarrow ABA, A \rightarrow aAb \mid \in, B \rightarrow bB$

OR

Q2) a) State Principle of Mathematical Induction and apply it to Show that **[6]**

$1+4+7+....(3n-2) = n(3n-1) / 2$ for $n>0$

b) Construct a NFA that accepts the set of strings in $(0+1)^*$ such that some two 0's are Separated by string whose length is 4i, for some $i >= 0$. **[6]**

c) Find an equivalent left linear grammar for the given right linear grammar **[8]**

i) $S \rightarrow bB|b, B \rightarrow bC|aB|b, C \rightarrow a$

ii) $S \rightarrow 0A|1B, A \rightarrow 0C|1A|0, B \rightarrow 1B|1A|1, C \rightarrow 0|0A$

P.T.O.

Q3) a) What is a Turing Machine? Give the formal definition of TM. Design a TM to compute multiplication of two unary numbers. **[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]**

OR

Q4) a) Write short note on: **[8]**

i) Recursively Enumerable Languages.

ii) Halting Problem of Turing Machine.

b) What is a post machine? Give formal definition of Post machine. Construct a Post Machine for Accepting strings having odd length and a or b as centre element. **[10]**

Q5) a) Construct a PDA that accepts the language generated by grammar. **[8]**

i) $S \rightarrow 0S1|A,\ A \rightarrow 1A0|S|\varepsilon$

ii) $S \rightarrow aABB|aAA,\ A \rightarrow aBB|a,\ B \rightarrow bAA|A$

b) Obtain the CFG equivalent to PDA given by the transition function. **[8]**

$\delta(q_0, a, z_0) = \{q_0 a z_0\}$ $\delta(q_0, a, a) = \{q_0 aa\}$

$\delta(q_0, b, a) = \{q_1 \varepsilon\}$ $\delta(q_1 b, a) = \{q_1 \varepsilon\}$

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

OR

Q6) a) What is a PDA? Construct a PDA that accept $L = \{a^n b^n \mid n \geq 1\}$ through Final State. **[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 is Kruskal's Algorithm? How can we solve this problem using Turing Machine? **[8]**

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

OR

Q8) a) What do you mean by NP-Problems? Justify why the Travelling Salesman problem is a NP-Problem. **[8]**

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

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