

Total No. of Questions :8]

SEAT No. :

P2605

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[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]

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

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

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

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

OR

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

$$1+4+7+\dots(3n-2) = n(3n-1) / 2 \text{ for } n > 0$$

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 $i \geq 0$. [6]

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

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

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

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

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]

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

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

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

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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