Total No. of Questions : 8]

SEAT No. [redacted]

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[6353]-36

T.E. (Computer Engg.)

THEORY OF COMPUTATION

(2019 Pattern) (Semester - I) (310242)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Assume suitable data, if necessary.*

Q1) a) Give Context Free Grammars for the following languages **[9]**

i) L={ w ∈ {a,b}*|w is string of staring with 'a' and ending with 'b'}

ii) RE = 0(0+1)*01(0+1)*1

iii) RE = (011+1)* (01)*

b) Simplify the following grammar as **[8]**

i) Eliminate Useless production

S -> abS | abA | abB

A -> cd

B -> aB

C -> dc

ii) Eliminate Unit Production

S -> Aa | B

A -> b | B

B -> A | a

iii) Eliminate the ∈ Production

$S \rightarrow XYX$

$X \rightarrow 0X \mid \varepsilon$

$Y \rightarrow 1Y \mid \varepsilon$

OR

P.T.O.

Q2) a) $S \rightarrow aB \mid bA$

$A \rightarrow a \mid aS \mid bAA$

$B \rightarrow b \mid bS \mid aBB$

Derive using Leftmost Derivation and Rightmost Derivation : i) bbaaba ii) aaabbb. Draw parse tree for the same. **[9]**

b) Find context Free Grammar generating each of these languages. **[8]**

i) L1 = { $a^i b^j c^k$ such that i = j + k where I, j, k>=1}

ii) L2 = { $a^i b^j c^k$ such that j = i + k where I, j, k>=1}

Q3) a) i) Construct PDA for the given CFG, and test whether 010^4 is acceptable by this PDA.

$S \rightarrow 0BB$

$B \rightarrow 0S \mid 1S \mid 0$

ii) Construct PDA for the given CFG, and test whether 'aaabb' is acceptable by this PDA.

$S \rightarrow aSb$

$S \rightarrow a \mid b \mid \varepsilon$

[10]

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

OR

Q4) a) Construct a PDA accepting the language L ={$a^n b^m a^n$|n,m >=0}by null store. **[6]**

b) Design a PDA for a language L={$XcX^r \mid X \in \{a,b\}^*$ and string X^r is the reverse of string X} **[6]**

c) Obtain a PDA to accept the language - **[6]**

L = {w | w $\in \Sigma^*$, Σ = {a, b} and $n_a(w) = n_a(w)$}by final state

Q5) a) Design the Turing for the function $f(n) = 2n$ is computable. **[9]**

b) What are the different ways for extension of TM? Explain. Design TM for language L={$a^m b^n \mid m < n$} **[9]**

OR

Q6) a) Construct a TM to accept the language over {0,1} containing the substring 001. **[6]**

b) Design a TM to multiply a unary number by 2. **[8]**

c) Design Turing Machine for 1's Complement. **[4]**

Q7) a) What Traveling salesman problem? How to prove that Traveling salesman problem is NP Complete? **[5]**

b) What is post correspondence problem? Why is post correspondence problem undecidable? Explain PCP with following instance of the set of the strings A and B **[12]**

	A	B
1.	1	111
2.	10111	10
3.	10	0

OR

Q8) a) What is reducibility in Computability Theory ? Explain in detail, the polynomial time reduction approach for proving that a problem is NP-Complete. **[8]**

b) State and explain with suitable example : **[9]**

i) Decidable Problem

ii) Undecidable Problem

iii) Church-Turing Thesis.