Total No. of Questions : 8]

SEAT No. :

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[6180]-46A
T.E. (Computer Engineering)
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) Check whether the string *10010* is a member of the language generated by following grammar by using Cocke-Younger-Kasami Algorithm- **[9]**

$S \rightarrow AB|BC$

$A \rightarrow BA|0$

$B \rightarrow CC|1$

$C \rightarrow AB|0$

b) Obtain grammar to generate the following language : **[8]**

$L = \{w : n_a(w) \bmod 2 = 0 \text{ where } w \in \{a, b\}^*\}$

i.e. Language of a and b in which number of number of a's in the string is either zero or in multiple of 2 only.

OR

Q2) a) **[9]**

$S \rightarrow aB|bA$

$A \rightarrow a|aS|bAA$

$B \rightarrow b|bS|aBB$

Derive using Leftmost Derivation and Rightmost Derivation:

i) bbaaba ii) aaabbb.

Draw parse tree for the same.

P.T.O.

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) Construct a PDA equivalent to following CFG **[10]**

i)

$X \rightarrow 0$

$X \rightarrow 0X$

$X \rightarrow 1XX$

$X \rightarrow XX1$

$X \rightarrow X1X$

ii) $S \rightarrow BD|BC$

$D \rightarrow SC$

$C \rightarrow AA$

$B \rightarrow 0$

$A \rightarrow 1$

b) Design a PDA for a language $L=\{a^n b^{2n} | n >= 1\}$ **[8]**

OR

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

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

c) Obtain a PDA to accept the language -

$L=\left\{w | w \in \sum^*, \sum = \{a,b\} \text{ and } n_a(w) = n_b(w)\right\}$ by final state **[6]**

Q5) a) Design a Turing machine for well formed parenthesis. **[6]**

b) Design a TM that accepts all strings over {1,0} with even number of 0's and even number of 1's. **[8]**

c) Construct TM that recognizes language over alphabet 0,1 such that string ends in 10. **[4]**

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 l's Complement. **[4]**

Q7) a) What is post correspondence problem? Explain PCP with following instance of the set of the strings A and B. **[8]**

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

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

i) Decidable Problem

ii) Undecidable Problem

iii) Church-Turing Thesis.

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) Explain with suitable example and diagrams **[9]**

i) Halting problem of TM

ii) Multitape TM

iii) Universal TM

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