Total No. of Questions : 8]

SEAT No. :

P269

[Total No. of Pages : 2

[6003]-347
T.E. (Computer Engineering)
THEORY OF COMPUTATION
(2019 Pattern) (Semester-I) (310242)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Give a Context Free Grammar for the following language. **[9]**

i) L1=$\{a^i b^j c^k \mid i = j + k\}$ such that $i, j, k > 0$

ii) L2=$\{a^i b^j c^k \mid j = i + k\}$ such that $i, j, k > 0$

b) Reduce the following grammar to Greibach Normal form. **[9]**

S→SS, S→0S1 01

OR

Q2) a) Show that the following grammar is ambiguous. **[6]**

S-> iCtS

S-> iCtSeS

S-> a

C-> b

b) Convert the following grammar to Chomsky Normal Form (CNF). **[6]**

G=({S}, {a,b}, P,S)

P={S → aSa | bSb | a | b | aa | bb}

c) Consider the following grammar. **[6]**

E -> E + E | E – E | id

Derive the string id-id*id using

i) Leftmost derivation

ii) Rightmost derivation

Q3) a) Find the transition rules of PDA for accepting a language L={w □{a,b}*|w is of the $a^n b^n$ with n ≥1}through both empty stack and final state and demonstrates the stack operation for the string aaabbb. **[9]**

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b) Design a push down automation to recognize the language generated by the following
grammar :
S→S + S | S □ S | 4 |2
Show the acceptance of the input string 2+2*4 by this PDA. **[8]**

OR

Q4) a) What is NPDA? Construct a NPDA for the set of all strings over {a,b} with odd length palindrome. **[9]**

b) Design a push down automation to recognize the language generated by the following. **[8]**
S→S + S | S □ S | 4 |2
Show the acceptance of the input string 2+2*4 by this PDA.

Q5) a) Design a Turing Machine for the following language by considering transition table and diagram. **[9]**
i) TM that erases all non blank symbols on the tape where the sequence of non blank symbols does not contain any blank symbol B in between.
ii) TM that find 2's complement of a binary machine.

b) What is TM? Design TM to check well formedness of parenthesis. Expand the transition for (())() **[9]**

OR

Q6) a) How turing machine can be use to compute the functions? Design turing machine for multiplication of two numbers. **[9]**

b) Elaborate the following terms. **[9]**
i) Universal Turing Machine (UTM)
ii) Recursively Enumerable Languages
iii) Halting problem of Turing Machine

Q7) a) Define and Compare Class P and Class NP Problem with suitable diagram. **[9]**

b) What do you mean by polynomial time reduction? Explain with suitable example. **[8]**

OR

Q8) a) Explain Satisfiability Problem and SAT Problem and comment on NP Completeness of the SAT Problem. **[9]**

b) What makes a problem NP-Complete? How do we prove a problem is NP-complete? Are all decision problems NP-complete? **[8]**

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