

[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]

$S \rightarrow SS, S \rightarrow 0S1 \ 01$

OR

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

$S \rightarrow iCtS$

$S \rightarrow iCtSeS$

$S \rightarrow a$

$C \rightarrow b$

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

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

$P = \{S \rightarrow aSa \mid bSb \mid a \mid b \mid aa \mid bb\}$

c) Consider the following grammar. [6]

$E \rightarrow E + E \mid E - E \mid id$

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 $L = \{w \mid w \in \{a, b\}^* \mid w \text{ is of the } a^n b^n \text{ with } n \geq 1\}$ through both empty stack and final state and demonstrates the stack operation for the string $aaabbb$. [9]

P.T.O.

- b) Design a push down automation to recognize the language generated by the following

grammar :

$$S \rightarrow S + S \mid S \square S \mid 4 \mid 2$$

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]

$$S \rightarrow S + S \mid S \square S \mid 4 \mid 2$$

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]

