

Total No. of Questions : 8]

SEAT No. :

PA-1442

[Total No. of Pages : 3

[5926]-58

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, and Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figure to the right indicate full marks.
- 4) Assume suitable data if necessary.

Q1) a) Convert the following grammar to Chomsky Normal form (CNF) [9]

$S \rightarrow a \mid aA \mid B$

$A \rightarrow aBB \mid \epsilon$

$B \rightarrow Aa \mid b$

b) Convert the following grammar to GNF. [9]

$S \rightarrow XB \mid AA$

$A \rightarrow a \mid SA$

$B \rightarrow b$

$X \rightarrow a$

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]

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

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

P.T.O.

- 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

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

- b) Design a PDA for accepting a language $\{ a^n b^{2n} \mid n \geq 1 \}$ [9]

Simulate this PDA for the input string “ $aaabbbbbb$ ”.

OR

- Q4)** a) Design a PDA for accepting a language $\{ 0^n 1^m 0^n \mid m, n \geq 1 \}$.

Simulate this PDA for the input string “ 0011100 ”. [9]

- b) Construct a PDA for $L = \{ 0^n 1^m 2^m 3^n \mid m, n \geq 0 \}$ [6]

- c) Compare FA and PDA. [3]

- Q5)** a) Write a short note on Halting problem of Turing machine. [4]

- b) 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.

- c) Design a Turing Machine that reads a string representing a binary number and erases all leading 0's in the string. However, if the string comprises of only 0's it keeps one 0. [5]

OR

- Q6)** a) Write short notes on: [4]
- i) Reducibility
 - ii) Multi-tape Turing Machine
- b) Construct a Turing Machine for $R=aba^*b$ [6]
- c) Design a TM that multiplies two unary numbers over $\Sigma=\{1\}$. Write simulation for the string $11*111$. [8]
- Q7)** a) Justify “Halting problem of Turing machine is undecidable” [8]
- b) Define and compare class P and class NP problem with suitable diagram [8]

OR

- Q8)** a) Explain in brief the term “recursively enumerable”. [6]
- b) Explain examples of problems in NP. [6]
- c) Differentiate between P Class and NP class. [4]

