

[5253]-537

T.E. (Computer Engineering)
THEORY OF COMPUTATION
(2015 Patern)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Attempt questions Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume Suitable data, if necessary.

Q1) a) Construct DFA for language defined by $\Sigma = \{0,1\}$ where [6]

$S = \{\text{strings ending with 0 always}\}$

$S = \{\text{strings representing odd binary numbers}\}$

$S = \{\text{strings over } \Sigma^* \text{ with total number of 0's even}\}$

b) Let $M = \{\{q_0, q_1\}, \{0,1\}, \delta, q_0, \{q_1\}\}$ be an NFA [6]

Where

$$\delta(q_0, 0) = \{q_0, q_1\}$$

$$\delta(q_0, 1) = \{q_1\}$$

$$\delta(q_1, 0) = \emptyset$$

$$\delta(q_1, 1) = \{q_0, q_1\}$$

Construct an equivalent DFA.

c) Write short notes on : [8]

- i) Chomsky Normal Form
- ii) Greibach Normal Form

OR

Q2) a) Design a FA which checks the divisibility by 4 for a decimal number. [6]

b) Construct a Moore and Mealy machine to generate 1's complement of a given binary number. [6]

P.T.O.

- c) Write CFGs for given CFLs : [8]
- i) Languages containing the strings with equal number of a's and b's
 - ii) Languages containing the strings containing a's and b's with at least 2 a's

- Q3)** a) Define Turing Machine. Comment on language acceptance by Turing Machine. [4]
- b) Write short notes on : [6]
- i) Universal Turing Machine
 - ii) Multi-tape Turing Machine
 - iii) Limitation of Turing Machine
- c) Construct a Turing Machine to accept the language of even number of 1's and even number 0's over $\Sigma = \{0,1\}$. [8]

OR

- Q4)** a) Explain the representation of TM. [4]
- b) Design a Turing Machine to add two unary numbers. [6]
- c) Construct TM for - [8]
- $L = \{ \text{all strings with equal no. of a's and b's} \}$.

- Q5)** a) Differentiate between FA and PDA. [4]
- b) Construct NPDA that accepts the language generated by $S = S+S \mid S^*S$ [4]. [6]
- c) Illustrate the working of Shift Reduce parser for $id+id*id$. [6]
- Consider the following grammar:

$$E \rightarrow E + E \mid T$$

$$T \rightarrow T * F \mid F$$

$$F \rightarrow \{E\} \mid id$$

OR

Q6) a) What are the two different ways to define PDA acceptability? [4]

b) Construct PDA that accepts language generated by following

CFG : $S \rightarrow SS \mid (S) \mid ()$

c) Explain closure property of CFL with suitable example. [6]

Q7) a) What do you mean by NP- problems? Justify that Travelling Salesman problem is NP problem. [8]

b) Define Undecidability. Let $HALT_{TM} = \{ \langle M, w \rangle \text{ where } M \text{ is a TM and } M \text{ halts on input } w \}$ Prove that $HALT_{TM}$ is undecidable. [8]

OR

Q8) a) Define and explain Recursive and Recursively enumerable languages. [8]

b) What is a Kruskal's Algorithm? How can we solve this problem using Turing Machine? [8]

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