Total No. of Questions : 8]

SEAT No. :

P2509

[Total No. of Pages : 3

[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, Q7or 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 = {strings ending with 0 always**}**

S = { strings representing odd binary numbers**}**

S = { strings over Σ^* 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

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

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

$$\delta(q_0, 0) = \varnothing$$

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

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 compliment 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 l'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 -

L = { all strings with equal no. of a's and b's}. **[8]**

Q5) a) Differentiate between FA and PDA. **[4]**

b) Construct NPDA that accepts the language generated by S= S+S | S*S | 4. **[6]**

c) Illustrate the working of Shift Reduce parser for id+id*id.

Consider the following grammar: **[6]**

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

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

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

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 $HALT_{TM}$ = { <M, w> where M is a TM and M 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 Kruskals's Algorithm? How can we solve this problem using Turing Machine? **[8]**