[5253]-537

T.E. (Computer Engineering)

THEORY OF COMPUTATION

(2015 Pattern)

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 $S = \{\text{strings ending with } 0 \text{ always}\}$ $S = \{ \text{strings representing odd binary numbers}\}$ $S = \{ \text{strings over } \Sigma^* \text{ with total number of } 0\text{'s even}\}$

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

Where

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

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

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

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

Construct an equivalent DFA.

c) Write short notes on :

i) Chomsky Normal Form

ii) Greibach Normal Form

OR

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

b) Construct a Moore and Mealy machine to generate 1’s compliment of a given binary number.

P.T.O.
c) Write CFGs for given CFLs:
   
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.

b) Write short notes on:
   
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 \( \Sigma = \{0,1\} \). OR

Q4) a) Explain the representation of TM.

b) Design a Turing Machine to add two unary numbers.

c) Construct TM for -
   
   \( L = \{ \text{ all strings with equal no. of a’s and b’s} \} \).

Q5) a) Differentiate between FA and PDA.

b) Construct NPDA that accepts the language generated by \( S = S + S | S * S | 4 \).

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

Consider the following grammar:

\[
E \rightarrow E + E | T \\
T \rightarrow T * F | F \\
F \rightarrow \{E\} | id
\]
OR

Q6) a) What are the two different ways to define PDA acceptability? [4]
b) Construct PDA that accepts language generated by following
   \[ CFG : \quad S \rightarrow SS \mid (S) \mid ( ) \]
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 \( \text{HALT}_{TM} = \{ <M, w> \mid M \text{ is a TM and } M \text{ halts on input } w \} \) Prove that \( \text{HALT}_{TM} \) 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]