Total No. of Questions : 8]

SEAT No. :

P1751

[Total No. of Pages : 3

[5460] - 581
T.E. (Computer Engineering)
THEORY OF COMPUTATION
(2015 Pattern)

Time : 2½ Hours] *[Max. Marks :70*

Instructions to the candidates:

1) ***Attempt questions Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data, if necessary.***

Q1) a) Define the following terms with example - **[6]**

i) Alphabets

ii) String

iii) Regular Expression

b) Design a DFA which accepts a ternary number divisible by 4. **[6]**

c) Design FA accepting the following language over the alphabet {0, 1} **[8]**

i) Set of all strings having at least three consecutive zeros.

ii) Set of all strings that begin and end with same symbol.

OR

Q2) a) Define the following terms with example **[6]**

i) DFA

ii) NFA

iii) NFA - ε

b) Eliminate the useless symbols in the grammar below - **[6]**

$S \rightarrow aA \mid bB$

$A \rightarrow aA \mid a$

$B \rightarrow bB$

$D \rightarrow ab \mid Ea$

$E \rightarrow aC \mid d$

P.T.O.

c) Construct a DFA accepting the following languages over the alphabet {a, b} **[8]**

i) Set of all strings that begin with the substring ab.

ii) Set of all strings with at most two consecutive b's.

Q3) a) Write short notes on - **[4]**

i) Universal Turing Machine

ii) Multi - tape Turing Machine

b) Construct a Turing Machine for R = (a + b)*bb. **[6]**

c) Construct a Turing Machine to accept the language $L = \{a^n b^n a^n \mid n \geq 1\}$. **[8]**

OR

Q4) a) Write short notes on - **[4]**

i) Unsolvable problems.

ii) Applications of TM.

b) Construct a Turing Machine for R = (aba*b). **[6]**

c) Construct Turing Machine that accepts strings with equal number of 0's and 1's over Σ = {0, 1}. **[8]**

Q5) a) Prove that CFLs are closed under union, concatenation and Kleene's closure. **[6]**

b) Design PDA for the following language - **[6]**

$L = \{a^n b^{2n} \mid n > 0\}$

c) Explain the working of Bottom - up parser with example. **[4]**

OR

Q6) a) Convert the following CFG to PDA - **[6]**

$S \rightarrow aSb \mid A$

$A \rightarrow bSa \mid S \mid \varepsilon$

b) Show that CFLs are not closed under intersection and complementation. **[6]**

c) Explain acceptance by PDA - **[4]**

i) By final state

ii) By empty state

Q7) a) Explain Tractable and Intractable problem. **[6]**

b) How the Kruskal's Algorithm can be solved by using Turing machine? **[6]**

c) Explain the Satisfiability Problem with an example. **[4]**

OR

Q8) a) Prove that the Satisfiability Problem is NP - complete. **[6]**

b) What do you mean by Polynomial Time reduction? Explain with suitable example. **[6]**

c) Differentiate between P and NP classes. **[4]**

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