Nov-Dec-2012

Total No. of Questions : 12]

SEAT No. :

P1241

[Total No. of Pages : 4

[4263] - 352

T.E. (IT)

THEORY OF COMPUTATION

(2008 Pattern) (Sem. - I)

Time :3 Hours] *[Max. Marks :100*

Instructions to the candidates:-

1) ***Answer 3 questions from Section I and 3 questions from Section II.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams should be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Design an NFA equivalent to following RE- **[6]**

$(0 + 1)^*(00 + 11)(0 + 1)^*$

b) Give RE for the following languages over $\Sigma = \{0,1\}$. **[6]**

i) Strings containing even number of 1's followed by odd number of 0's.

ii) Strings that do not contain three consecutive 0's.

iii) Strings that contain at most three 0's.

c) Give the difference between NFA and DFA. **[4]**

OR

Q2) a) Find all strings of length 5 or less in the regular set represented by the following - **[6]**

i) $(ab + a)^* (aa + b)$

ii) $(a^*b + b^*a)^*a$

iii) $a^* + (ab + a)^*$

b) Show that - **[6]**

i) $R^*R = R^+$

ii) $(P + Q)^* = (P^*Q^*)^*$

iii) $(R^*)^* = R^*$

c) Give the difference between Mealy machine and Moore machine. **[4]**

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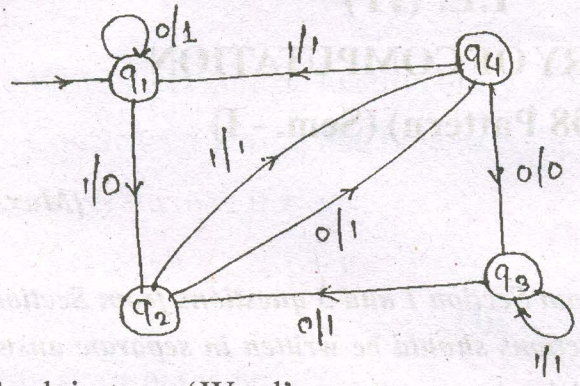
Q3) a) Design a DFA for a language of strings of 0's and 1's such that - **[10]**

i) Substring is 10.

ii) Strings ending with 101.

b) Convert the following Mealy machine to its equivalent Moore machine - **[6]**



c) Explain term 'Word'. **[2]**

OR

Q4) a) Design an NFA to accept set of all strings which end with 00. Where I = {0, 1}. Convert this NFA into its equivalent DFA. **[8]**

b) Obtain a DFA to accept strings of *a*'s and *b*'s such that -

$L = \{W/W \in (a + b)^*$ such that $N_a(W) \bmod 3 = 0$ and $N_b(W) \bmod 2 = 0\}$ **[10]**

Q5) a) Construct a CFG to generate following language **[6]**

$L = \{0^m\ 1^m\ 2^n \mid m \geq 1$ and $n \geq 0\}$

b) Show that the grammar **[6]**

$S \rightarrow aB \mid ab$

$A \rightarrow aAB \mid a$

$B \rightarrow ABb \mid b$

is ambiguous for the string *aaabbb*.

c) Explain Chomsky Hierarchy with example. **[4]**

OR

Q6) a) Consider the following productions **[8]**

$S \rightarrow aB \mid bA$

$A \rightarrow aS \mid bAA \mid a$

$B \rightarrow bS \mid aBB \mid b$

For the string *aaabbabbba*, find -

i) The leftmost derivation.

ii) The rightmost derivation.

iii) Parse tree.

b) Convert the following grammar in CNF [8]

$A \rightarrow 01XY$

$X \rightarrow 1XY \mid \in$

$Y \rightarrow YXa \mid X \mid \in$

SECTION - II

Q7) a) Construct left linear and right linear grammar for the RE$(0+1)^* 00(0+1)^*$ [8]

b) Prove that -
$L = \{a^i b^i c^i \mid i \geq 1\}$ is not a CFL. [8]

OR

Q8) a) Construct a DFA to accept the language generated by the left linear grammar given below -

$S \rightarrow B1 \mid A0 \mid C0$

$B \rightarrow B1 \mid 1$

$A \rightarrow A1 \mid B1 \mid C0 \mid 0$

$C \rightarrow A0$ [6]

b) Prove that CFLs are closed under union, concatenation and closure. [10]

Q9) a) i) Explain the concept of Post machine. [4]

ii) Give the difference between PDA & FSM. [4]

b) Construct a PDA that accepts the language generated by following grammar [8]

i) $S \rightarrow aA$

$A \rightarrow aABc \mid bB \mid a$

$B \rightarrow b$

$C \rightarrow c$

ii) $S \rightarrow AA \mid a$

$A \rightarrow SA \mid b$

OR

Q10) a) i) What are the applications of PDA? **[4]**

ii) Define PDA. **[4]**

b) Construct a PDA that accepts by empty stack all strings over {0, 1} with equal number of zeroes and ones. **[8]**

Q11) a) Write short note on unsolvability of Turing machine. **[6]**

b) Construct a Turing machine to compute - **[12]**

$f(x, y) = x + y$; if $x \geq y$

$= 0$; if $x < y$

OR

Q12) Write short notes on - **[18]**

a) Composite TM.

b) Halting problem of TM.

c) Church Turing hypothesis.