SEAT No. :

[5669]-591

T.E. (Information Technology)
THEORY OF COMPUTATION
(2015 Pattern) (Semester - I)

Time : 2½ Hours]   *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8 and Q.9 or Q.10.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Assume suitable data if necessary.*

Q1) a) Define the following terms with an example.   **[4]**
- i) Alphabet.
- ii) Regular Language.

b) Define formal definition of RE, also give the Regular expression for the following languages :   **[6]**
- i) The Set a strings over the alphabet {a, b} starting with b and ending with odd number of a's or even numbers of b's.
- ii) The Set {10, 1010}
- iii) If L (r) = {€, x,xx, xxx, xxxx, xxxxx) what is r?

OR

Q2) a) Simplified the following grammar :   **[4]**

$$S \rightarrow Ab, A \rightarrow a, B \rightarrow C|b, C \rightarrow D, D \rightarrow E, E \rightarrow a$$

b) Discuss application of RE and FA.   **[3]**

c) Compare Moore machine and Mealy Machine.   **[3]**

Q3) a) Construct the FA from given RE 1* 00 (01)*   **[4]**

b) Give CFG for following languages: **[6]**
- i) Matching parenthesis
- ii) All string without substring 'aaa'
- iii) R = bba * bb + bb

P.T.O.

Q4) a) Convent following left linear grammar to right linear grammar stepwise.**[6]**

   S → A0 | B1

   A → C0 | A1 | 0

   B → B1 | A1 | 1

   C → 0 | A0

   b) State and prove that Pumping Lemma with an application. **[4]**

Q5) a) Design PDA to accept the language containing all odd length palindromes over $\Sigma = \{0,1\}$ by empty stack and final state. **[8]**

   b) Design Post Machine that accept the following languages. **[8]**
   $L = \{a^n b^n c^n \mid n >= 0\}$

Q6) a) Construct a PDA that accepts the language defined by the following grammar : **[8]**

   S --> 0A | 1B | 0

   A --> 0A | B

   B --> c | d

   Here N = {S, A, B}, T = {0, 1, c, d} and S is start symbol.

   b) Construct PDA by final state that accepts the following language. **[8]**
   Simulate for "aaaaa" $L = \{a^{2n} \mid n>0\}$

Q7) a) Design TM which compares two positive integers m & n and produces output **[12]**

   Gt, if m > n; **Lt**, if m < n; and **Eq**, if m = n;

   Simulate the working of the TM for the input i) m = 1, n = 2 ii) m = n = 2.

   b) Write a note on each of the following : **[6]**

   i) Recursively enumerable language.

   ii) Recursive language

   iii) Recursive function.

Q8) a) Construct a TM to compute the following function. **[12]**

   f (a, b) = a – b where a > b

   $\qquad$ = 0 where a < b

   Simulate the working of the TM for the input i) x = 2, y = 2. ii) x = 4, y = 2

   b) Define TM. Explain its working. Give the types of TM & applications of the same. **[6]**

Q9) a) Suppose that there is an NP-complete problem P that has a deterministic solution taking $O(n^{\log 2^n})$ time (here log n denotes log 2^n). What can you say about the running time of any other NP-complete problem Q? **[9]**

   b) Prove that PCP with two lists x= (b, bab^3, ba) and y= (b^3, ba, a) have a solution? **[7]**

OR

Q10) a) Show that PCP over $|\Sigma| \geq 2$ is unsolvable. **[9]**

   b) Find the running time for the Euclidean algorithm for evaluating GCD (a, b) where a, b are positive integers expressed in binary representation. **[7]**

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