B.Tech. IN COMPUTER SCIENCE AND ENGINEERING (BTCSVI)

Term-End Examination

June, 2012

BICS-008 : DISCRETE MATHS STRUCTURE

Time : 3 Hours   *Maximum Marks : 70*

Note : *Attempt **any seven** questions. All questions carry **equal** marks. All the questions are to be answered in english only.*

1. (a)   If R be a relation in the set of integer.   5

     Z defined by

     $R = \{(x,y) : x \in z, y \in z$ and $(x - y)$ is multiple of 3\}

     Prove that R is an equivalence relation.

    (b)   Let A = {1, 2, 3} and B = {a, b, c, d} Let R   5
     be the relation from A to B with Boolean
     Matrices

     $$M_R = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$$

     Find Boolean Matrices of R^{-1} and R^1.

2. Define Big O Notation. Show that $\qquad$ **10**
   $f(x) = x^2 + 2x + 1$ is $O(x^2)$

3. Define a group. Describe properties of a group. **10**
   Show that the set $\{1, 2, 3, 4, 5\}$ is not a group
   under multiplication modulo 6.

4. (a) Find the product of the following two **5**
   permutations and show that it is not
   commutative.

   $$f = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \end{pmatrix} \text{ and } g = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 2 & 1 & 4 \end{pmatrix}$$

   (b) State and prove Lagrange's Theorem. $\qquad$ **5**

5. (a) Show that the relation '$\leq$' is a partial **5**
   ordering on the set of integers Z.
   (b) Show that the lattice (L^3, $\leq_3$) of 3 tuples of **5**
   0 and 1 is complemented.

6. (a) Prove that the set {NAND} is a functionally **5**
   complete set of operations.
   (b) Using Karnaugh map simplify the **5**
   expression AB'+A'B'.

7. (a) State the converse, inverse and **6**
   contra positive of the statement "If it rains
   then the crops will grow".
   (b) Verify that the proposition $\sim(p \wedge q) \vee q$ is a **4**
   tautology.

8. Prove the validity of the following argument "If I get the job and work hard; then I will get promoted. If I get promoted; then I will be happy. I will not be happy. Therefore, either I will not get the job or I will not work hard". **10**

9. Solve the recurrence relation
$a_n - 9a_{n-1} + 20 a_{n-2} = 0$ where
$a_0 = -3, a_1 = -10.$ **10**

10. Write short notes on *any two* of the following : **5+5**
   (a) Euler and Hamiltonian graph
   (b) Pigeon hole Principle
   (c) Tree and Binary search tree

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