BTS (C) – III – 057 (A)

# *B. Tech Degree III Semester Examination*
# *November 2005*

**IT/CS 303 DISCRETE MATHEMATICAL STRUCTURES**

*(1999 Admissions onwards)*

Time : 3 Hours | Maximum Marks : 100

I. (a) Verify by truth table –

$\sim(p \wedge q) \equiv \sim p \vee \sim q.$ (5)

(b) Prove that $(p \wedge q) \rightarrow (p \leftrightarrow q)$ is a tautology. (5)

(c) By mathematical induction, prove that –

$$1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}.$$ (10)

**OR**

II. (a) Find the number of distinct permutations that can be formed from all the letters of the word 'RADAR'. (6)

(b) In how many ways can a committee consisting of three men and two women be chosen from seven men and five women. (6)

(c) Box A Contains five red marbles and three blue marbles and box B contains three red and two blue marbles. A marble is drawn at random from each box. Find the probability that both marbles are red. Find the probability that one is red and one is blue. (8)

III. (a) Let $A = \{1,2,3,\ldots\ldots 9\}$ and let $\sim$ be the relation on $A \times A$ defined by $(a,b) \sim (c,d)$ if $a+d = b+c$. Prove that $\sim$ is an equivalence relation. (10)

(b) Draw the digraph corresponding to following matrices :

(i) $M = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 \\ 0 & 2 & 0 & 0 \end{bmatrix}$ (ii) $M = \begin{bmatrix} 0 & 1 & 2 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 2 & 1 \\ 0 & 1 & 0 & 0 \end{bmatrix}$ (10)

**OR**

IV. (a) Let $R$ and $S$ be the relations on

$A = \{1,2,3,4\}$ defined by

$R = \{(1,1),(3,1),(3,4),(4,2),(4,3)\}$

$S = \{(1,3),(2,1),(3,1),(3,2),(4,4)\}$

Find the composition relation RoS. (10)

(b) Define a partition of a non-empty set S. Find all partitions of $X = \{a,b,c,d\}$. (10)

V. (a) Define a Eulerian graph and draw a graph with six vertices which is Hamiltonian but not Eulerian. (10)

***(Turn Over)***

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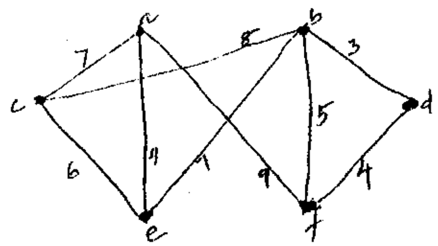
(b) Define a Hamiltonian graph and prove that a finite connected graph G is an Eulerian if and only if each vertex has even degree. (10)

**OR**

VI. (a) Find the minimal spanning tree using Prim's algorithm. (10)




(b) Explain the Fleury algorithm to produce Euler tour for the graph. (10)

VII. (a) Define a group and an abelian group. (10)
(b) Show that identity element in a group is unique. (5)
(c) Show that inverse of any element in a group is unique. (5)

**OR**

VIII. Define a group homomorphism. Let G be the group of real numbers under addition and let G be the group of positive real numbers under multiplication. Show that the mapping $f : G \to G'$ defined by $f(a) = 2^a$ is a homomorphism. (20)

IX. Define a lattice. Let $S$ be the power set of $\{a, b, c\}$. Draw the Hasse diagram of $S$. (20)

**OR**

X. (a) Explain the properties of a lattice. (10)
(b) If L is a lattice, then prove that $a \wedge b = a$ if and only if $a \vee b = b$. (10)

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