2023

INFORMATION TECHNOLOGY

Paper : INT–VC–4036

(Discrete Mathematics)

Full Marks : 60

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Answer the following as directed : 1×7=7

(a) If a set contains n elements, then the number of subsets is _____.

(Fill in the blank)

(b) In a diagonal matrix, all the elements except those in the _____ are zero.

(Fill in the blank)

(c) Write down one difference between permutation and combination.

(d) An edge of a graph that joins a vertex to itself is called a/an _____.

(Fill in the blank)

(e) Power set of empty set has exactly _____ subset.

(Fill in the blank)

(f) In preorder traversal of a binary tree, the first step is

(i) traverse the right subtree

(ii) traverse the left subtree

(iii) traverse the root

(iv) traverse the right subtree and visit the root

(Choose the correct answer)

(g) What do you mean by domain of a relation?

2. Answer the following questions : 2×4=8

(a) Write down the De Morgan's laws.

(b) What do you mean by proper subset? Give example.

(c) What do you mean by in-degree and out-degree of a vertex?

(d) If $|A| = [(3, 4), (1, 2)]$, then find $7|A|$.

3. Answer any *three* of the following questions : 5×3=15

(a) Prove that

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$$

(b) Write down the steps of breadth-first search algorithm.

(c) If $A = \begin{bmatrix} 2 & 5 \\ 3 & 1 \end{bmatrix}$, then find $A^2 - 3A - 13I$.

(d) Describe different types of functions.

(e) Let $W = \{[(a, b), (b, 0)] : a, b \in R\}$. Show that W is a subspace of $R^{\wedge}(2 \times 2)$.

(f) What do you mean by Hamiltonian cycle and Hamiltonian path? Give example.

4. Answer any *three* of the following questions : 10×3=30

(a) Find the inverse of the matrix

$$A = \begin{vmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{vmatrix}$$

(b) If R be a relation in the set of integers Z defined by

$R = \{(x, y) : x \in Z, y \in Z, (x - y)$ is divisible by $3\}$

then prove that R is an equivalence relation.

(c) Write down the steps to convert DNF to CNF. Convert the Boolean function

$$f(x, y) = x \cdot y' + x'y + x'y'$$

to its CNF.

(d) Show that from any three integers, one can always choose two so that $(b-a)$ is divisible by 10. [Pigeonhole principle]

(e) Examine whether the set of all real ordered triplets

$$S = \{(x, y, z) : x^2 + y^2 = z^2\}$$

is a subspace of the vector space R^3 over R.

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