K–993

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MCS–501

MCA/MSCIT Ist/IIIrd Semester Examination Dec., 2023

DISCRETE MATHEMATICS

Time : 2 Hours] [**Max. Marks :** 70

Note* :–** This paper is of Seventy (70) marks divided into two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given there in. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

(Long Answer Type Questions) 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. (a) Define an equivalence relation with the help of suitable example. (10)

(b) Define the following terms with the help of suitable examples : (9)

(i) One-One Onto function

(ii) Recursively defined function

2. (a) Define the following terms with the help of suitable examples : (10)

(i) Tautology

(ii) Contradiction

(iii) Conjunctive normal form

(iv) Disjunctive normal form

(b) Check the validity of the following argument.

"If I play, then I dance. I do not dance. Therefore, I do not play". (9)

3. (a) Explain direct method of proof. Using direct method, prove that the square of an even number is an even number. (10)

(b) Solve the recurrence relation : (9)

$$a_n + 4a_{n-1} + 3a_{n-2} = 4n + 3$$

4. (a) Define generating function. Find the numeric function corresponding to the generating function

$G(x) = \frac{x}{1-2x}$. (10)

(b) Show that the set of all positive rational numbers forms an abelian group under the composition $a*b = \frac{ab}{2}$. (9)

5. (a) Define the following graphs with the help of suitable examples :

(i) Complete graph

(ii) Regular graph

(iii) Bipartite graph

(iv) Euler graph (10)

(b) Discuss Chomsky hierarchy. (9)

Section–B

(Short Answer Type Questions) 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Let X = (2, 3, 4) and R = $[(x, y) : x \leq, \forall\, x, y \in X\}$be a relation on X. Find the matrix and draw the graph of the relation R.

2. Draw the Venn diagram of the following sets :

(i) $(X \cup Y) \cap Z$

(ii) $X \cap (Y \cup Z)'$

(iii) $(X \cup Y) - Z'$

(iv) $X' \cap (Y \cup Z)$

3. Define deterministic finite automaton. Let $\Sigma = \{a, b\}$ then design a DFA that accepts all the strings that starts with ab and terminates in *ba*.

4. Write predicates for the following sentences :

   (i) All boys are tall.

   (ii) Some of the animals are not black.

5. Define Tree, Rooted Tree and Binary Tree with the help of suitable examples.

6. Define Moore machine. Design a Moore machine that generates the complement of a binary number.

7. Define a subgroup. Prove that the union of two subgroups is a subgroup if one of them is contained in the other.

8. Prove that the set of integers forms a ring with respect to usual addition and multiplication.

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