MCA-09/ M.Sc. IT-09

Discrete Mathematics

Master of Computer Applications/Master of Science in Information Technology

(MCA/M.Sc. IT-11/12/16/17)

3rd Semester Examination 2019

Time: 3 Hrs   **Max Marks : 80**

Note: This paper is of Eighty (80) marks divided into three (03) sections A, B, C. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION -A

(Long answer type questions)

Note: Section 'A' contains four (04) long answer type questions of Nineteen (19) marks each. Learners are required to answer any two (02) questions only.   **(2 x 19 = 38)**

1. (a) Draw the Venn diagram of the following sets:

   (i) $X - Y$ (ii) $X \cap Y'$ (iii) $X \cap (Y \cup Z)$ 6

2. (b) Let $X = \{1,2,3\}$ and R is a relation on X defined as

   $$xRy \iff x \neq y \text{ for all } x,y \in X$$

   Find the elements of the relation R and R^{-1}. Check whether R is transitive?   6

   (c) What do you mean by composition of functions? Let $f : R \rightarrow R$ defined as

   $f(x) = 4x + 3$ and g: $R \rightarrow R$ defined as g$(x) = x/3$. Find f og (x).   7

2. (a) Define disjunctive and conjunctive normal forms. 6

(b) Check the validity of the following argument: "If I go to school, then I attend all classes. I go to school. Therefore, I attend all classes. 6

(c) Write predicates for the following sentences:

(i) Some rivers in India are polluted.

(ii) All students are intelligent. 7

3. (a) There are 5 boys and 6 girls in a group. Find the number of ways to select a team of five student coordinators containing two boys and three girls from the group. 6

(b) Define partially ordered set with the help of a suitable example. 6

(c) Show that the set of integers is a group with respect to addition. 7

4. (a) Define a graph. Prove that the sum of degrees of all vertices in a graph is twice the number of edges. Verify it through one example. 6

(b) Define incidence matrix and adjacency matrix of the graph. 6

(c) Discuss minimal spanning tree in a graph an algorithm to find minimal spanning tree in a graph. 7

SECTION – B

(Short answer type questions)

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. **(4x 8 = 32)**

1. Prove the following set identities:

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

(b) $\overline{(A \cup B)} = \overline{A} \cap \overline{B}$

2. Define equivalence relation with the help of suitable example.

3. Construct the truth table $(P \vee Q) \rightarrow (P \wedge Q)$.

4. Define predicates, quantifiers, free and bound variables. Give suitable examples.

5. Find the number of ways to arrange 3 History and 4 Hindi books in a bookshelf if (i) no restriction on the order of books is given (ii) books of same subject are together.

6. Define a subgroup and group homomorphism.

7. Define a tree. Prove that a graph is a tree if and only if there is exactly one path between every pair of vertices.

8. Discuss depth first traversal with the help of suitable example.

SECTION – C

(Objective type questions)

Note: Section 'C' contains ten (10) short answer type questions of one (01) mark each. All questions of this section are compulsory. (10x 1 = 10)

1. The number of subsets of a set with 5 elements are

    (a) 4   (b) 8   (c) 16   (d) 32

2. $(A' \cup B')'$

    (a) $A' \cup B'$ (b) $A' \cap B'$

    (c) $A \cap B$ (d) None of these

3. Let $X = \{a, b, c\}$. Which of the following is a transitive relation?

    (a) $\{(a, a), (b , a), (a,c) \}$ (b) $\{(b, b), (c, c), (a, a)\}$

(c) {(b, a) , (a, a), (c, b)}   (d) {(a, c) , (c, a), (c, c)}

4. A function $f: R \to R$ defined as $f(x) = x^2$ is

   (a) One–One   (b) Many–One

   (c) Onto   (d) None of these

5. The proposition $\sim (\sim P \to \sim Q)$ is equivalent to

   (a) $\sim P \vee Q$ (b) $P \vee \sim Q$

   (c) $P \wedge Q$ (d) $\sim P \wedge Q$

6. Which of the following is a contradiction

   (a) $\sim P \vee Q \vee P$ (b) $Q \vee P \vee \sim Q$

   (c) $\sim P \wedge Q \wedge P$ (d) $P \wedge \sim Q \wedge P$

7. A relation is said to be 'Partial Order Relation' if it is

   (a) Reflexive, Symmetric and Transitive

   (b) Reflexive, Asymmetric and Transitive

   (c) Reflexive, Antisymmetric and Transitive

   (d) Irreflexive, Symmetric and Transitive

8. The value of ^nC_n is

   (a) n (b) 1   (c) 0   (d) None of these

9. A set S with a binary operation * is called a semi-group if

   (a) S is closed with respect to the binary operation

   (b) S is associative with respect to the binary operation

   (c) S is closed and associative with respect to the binary operation

   (d) None of these

10. A tree with n vertices has ... . . edges.

   (a) n (b) $n + 1$ (c) $2n - 1$ (d) $n - 1$