S-770

Total Pages : 5 **Roll No. ----------**

MCS-501

Discrete Mathematics

Master of Computer Application (MCA)

3rd Semester, Examination 2022(Dec.)

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 therein.

Section – A

(Long Answer – type questions)

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.

[2 x 19 = 38]

P.T.O.

Q.1. (a) Let R be a relation defined on a set of positive integers such that for all $x, y \in Z^+$ xRy if and only if $x - y$ is divisible by k. Prove that R is an equivalence relation. (10)

(b) Define one-one onto function. Show that the function $f: R \to R$ defined as $f(x) = 5x - 2$ for all $x \in r$ is one to one onto. (9)

Q.2. (a) Describe principal conjunctive and principal disjunctive normal forms with the help of suitable examples. (10)

(b) Check the validity of the following argument. "if I go to school, then I attend all classes, If i attend all classes then Iget 'A' grade. Therefore, if I go to school, then I get grade 'A'. (9)

Q.3. (a) Define principle of mathematical induction. Using mathematical induction prove that for every positive integer $n \geq 0$ x^{n-1}-1 is divisible by $x - 1$. (10)

(b) Solve the recurrence relation

$$a_{r+2} - 3a_{r+1} + 2a_r = r^2 + 1.$$ (9)

Q.4. (a) Define generating function. Find the generating functions corresponding to the following sequence. (1,2,3,.....r,.....). (10)

(b) Prove that A non-empty subset H of a group G is a subgroup of G if (9)

(i) $a \in H, b \in H \Longrightarrow ab \in H$

(ii) $a \in H \Rightarrow a^{-1} \in H$

Q.5. (a) Define permutation group and cyclic group with the help of suitable examples. (10)

(b) Define deterministic finite automaton. Let $\sum = \{a, b\}$, then design a DFA that accepts all the strings that contains exactly three a's. (9)

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.

[4 x 8 = 32]

Q.1. Draw the Venn diagram of the following sets:

(i) $(x \cup Y) - z$

(ii) $Z - (X \cup Y)$

(iii) $(X - Y) - Z$

(iv) $(X \cup Y) - (X \cap Y)$

Q.2. Define Pigeonhole principle. Find the minimum number of students in a class so that at least five students have a same week-day of birth.

Q.3. There are 4 girls and 3 boys in a group. Find the number of ways in which a committee of 5 students can be formed under the following conditions:

(i) There are 2 boys in the committee.

(ii) There are at least 2 boys in the committee.

(iii) There are at most 2 boys in the committee.

(iv) There is no restriction on the number of boys and girls in the committee.

Q.4. Define two different methods of proof by giving suitable example.

Q.5. Prove that the set X = {0,1,2,3,4} is a group under the composition addition modulo 5.

Q.6. Define Chomsky hierarchy.

Q.7. Define Tree, Rooted Tree and Binary Tree with the help of suitable examples.

Q.8. Write predicates for the following sentences:

(i) All animals are black.

(ii) Some rivers in India are clean.

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