[Total No. of Questions - 9] [Total No. of Printed Pages - 3] (2125)

15609

MCA 2nd Semester Examination

Discrete Mathematics (NS)

MCA-203

Time : 3 Hours **Max. Marks : 60**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all selecting one question from each sections A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) Show that $\left[s \to \left(((\neg p) \wedge q) \wedge r\right)\right] \Leftrightarrow \neg\left[\left(p \vee \left(\neg(q \wedge r)\right)\right) \wedge s\right]$. (6)

   (b) Show that "$(p \wedge q) \to (p \vee q)$" is a tautology, while "$\left((\neg p) \wedge q\right) \wedge \left(p \vee (\neg q)\right)$" is a contradiction. (6)

2. (a) Establish the validity of the argument

$$\frac{\begin{array}{c} p \to q \\ (\neg r) \vee (\neg q) \\ r \end{array}}{\neg p}$$

   (6)

   (b) Check, is the statement $\left((p \wedge q) \vee r\right) \wedge \to \left((p \wedge q) \vee (\neg q)\right)$ is in disjunctive normal form. (6)

[P.T.O.]

SECTION - B

3. (a) Let $(L, \leq)$ be a lattice in which '.' And '+' denote the operation of meet and join respectively. Then

$$b \leq c = \begin{cases} a.b \leq a.c \\ a + b \leq a + c \end{cases} \quad \forall a, b, c \in L$$

   (6)

   (b) Define complemented lattice. Show that lattice $(L_3, <_3)$ of 3-tupple of 0 and 1 is a complemented lattice. (6)

4. (a) Simplify the Boolean expression

$$Y = \bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + A\bar{B}\bar{C} + AB\bar{C}$$

   (6)

   (b) Construct NAND gate structure for the expression

$$Z = \left(\bar{A} + B\right)C + \bar{F} + DE$$

   (6)

SECTION - C

5. (a) Prove that connected graph has a spanning tree. (6)

   (b) Define Minimal Spanning Tree. Show that minimum height of a binary tree on n vertices is $[\log_2(n+1)-1]$. (6)

6. (a) A connected multi graph is Eulerian iff its edge set can be partitioned into cycles. (6)

   (b) Explain Multi-graphs and weighted graphs with examples. (6)

SECTION - D

7. (a) Let $(G, *)$ be a group and H is a non empty subset of G, then H is subgroup of G if and only if $a, b \in H \Rightarrow a * b^{-1} \in H$. (6)

   (b) A sub group H of group G is normal in G iff gH = Hg $\forall g \in G$. (6)

8. (a) Using the method of generating function solve the recurrence relation $a_n=2a_{n-1}-a_{n-2}$, $n\geq 2$, given that $a_0=3$, $a_1=-2$. (6)

   (b) Define ring. If Q be the set of all rational numbers and '+' and '.' be two binary operations. Then discuss is (Q, +,.) a ring or not? (6)

SECTION - E

9. (a) Obtain conjunctive normal form of $p \rightarrow (q \wedge r)$. (2)

   (b) Construct truth table for conditional statement $p \rightarrow q$. (1)

   (c) Define the terms (i) Partially Ordered Set (ii) Linearly Ordered Set with examples. (1)

   (d) Define consensus method to simplify Boolean expression. The consensus of AB and A'C is_____. (1)

   (e) Define Cut Set and Cut Edges with examples. (1)

   (f) Compare and define Euler Path and Hamiltonian Path. (1)

   (g) Show that G = {1, –1, i, –i}, where $i=\sqrt{-1}$, is an abelian group with respect to multiplication as a binary operation. (2)

   (h) Define filed, illustrate with example. (1)

   (i) Solve the recurrence relation $a_r-7a_{r-1}+12a_{r-2}=1$. (1)

   (j) Define Plannar and non-planner graphs with examples. (1)