[Total No. of Questions - 9] [Total No. of P[illegible]ed Pages - 3]
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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 $\left[(p \to q) \wedge (q \to r)\right] \to (p \to r)$ is a tautology. (6)

   (b) Show that "A : $p \to (\neg q)$" and "B : $\neg(p \wedge q)$" are logically equivalent. (6)

2. (a) Establish the validity of the argument

$$\begin{array}{l} p \to \neg q \\ r \to q \\ \hline \neg p \end{array} \quad \therefore r$$

   (6)

   (b) Express $p \to (q \wedge r)$ in disjunctive normal form. (6)

SECTION - B

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

$$a \leq b \Leftrightarrow a.b = a \Leftrightarrow a + b = b \quad \forall a, b \in L$$ (6)

   (b) Define distributive lattice. Show that lattice $(L_3, \leq_3)$ of 3-tupple of 0 and 1 is a distributive lattice. °(6)

4. (a) Simplify the Boolean expression Y = (P+Q)(P+Q')(P'+Q). (6)

   (b) Use NAND gates and draw a circuit diagram for $F = X\bar{Y}Z + \bar{Z}Y$. (6)

SECTION - C

5. (a) Let G be graph. Then show that following statements are equivalent.

   (i) G is tree.

   (ii) G is connected and acyclic: without cycles.

   (iii) Between any two vertices of G there is precisely one path. (6)

   (b) Define spanning tree. If T is a binary tree on n vertices. Show that the number of pendant vertices in T is $\frac{n+1}{2}$. (6)

6. (a) A connected multi graph is Eulerian if the degree of each of its vertices is even. (6)

   (b) Differentiate Eulerian and Hamiltonian paths 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 (i) $a, b \in H \Rightarrow a * b \in H$, (ii) $a \in H \Rightarrow a^{-1} \in H$. (6)

   (b) Show that every subgroup of an abelian group is normal. (6)

[P.T.O.]

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

   (b) Define commutative ring. If E be the set all even integers and '+' and '.' be two binary operations. Then discuss is (E, +, .) is a ring or not? (6)

SECTION - E

9. (a) Obtain the principal disjunctive normal form $\neg p \vee q$. (6)

   (b) Construct truth table for biconditional statement $p \leftrightarrow q$.

   (c) Define the terms (i) Distributed Lattice (ii) Complemented Lattice with examples.

   (d) Define consensus terms. The consensus of AB'C and A'BC' is _____.

   (e) Define Rooted tree and binary tree with example.

   (f) Compare and define Euler Circuit and Hamiltonian Circuit.

   (g) Show that $G=\{1, \omega, \omega^2\}$, where ω is a cube root of unity, is a group with respect to multiplication as a binary operation.

   (h) Define ring, illustrate with example.

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

   (j) Considering a suitable figure show that a complete graph of 4 vertices is planar. (12)