[Total No. of Questions - 5] [Total No. of Printed Pages - 4]
(2063)

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MCA 2nd Semester Examination

Discrete Mathematics

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 of sections A, B, C and D. Question no 9 in section E is compulsory.

SECTION - A

1. (a) Prove the equivalence

$$7(P \rightarrow Q) \Leftrightarrow P \wedge 7Q \quad \textbf{(6)}$$

(b) Show that following are equivalent formulas

$$PVQ \Leftrightarrow PV(7P \wedge Q) \quad \textbf{(6)}$$

2. (a) Obtain the principal conjunctive and disjunctive normal forms of

$$(Q \rightarrow P) \wedge (7P \wedge Q) \quad \textbf{(6)}$$

(b) Explain with the help of example rule of inference called modus Ponens and Law of Syllogism. **(6)**

SECTION - B

3. (a) Let $(P, \leq)$ be a partially ordered set. Suppose the length of the longest chains in p is n. Then the elements in p can be portioned into n disjoint antichains. **(6)**

   (b) For algebraic systems defined by lattices state and prove absorption. **(6)**

4. (a) Prove that in a distributive lattice, if an element has a complement then this complement is unique. **(6)**

   (b) Find the values of the Boolean function represented by

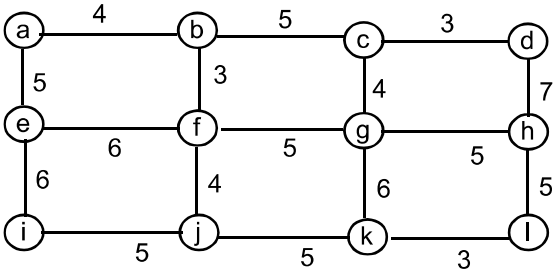
   $F(x, y, z) = xy + \bar{z},$

   where $\bar{z}$ stands for complementation of value of z. **(6)**

SECTION - C

5. (a) Illustrate the concept of a cut-set in graphs. Show that every circuit has an even number of edges in common with every cut-set. **(6)**

   (b) Find the minimum spanning tree for the weighted graph.



(6)

6. (a) Prove that there is always a Hamiltonian path in a directed complete graph. **(6)**

(b) Prove that for any connected planar graph.

$v - e + r = 2$

where v, e and r are the number of vertices, edges and regions of the graph respectively. **(6)**

SECTION - D

7. (a) Solve the recurrence relation

$$a_n = 8a_{n-1} + 10^{n-1}$$

subject to the initial condition a1 = g, using the generating function technique. **(6)**

(b) Find all the solutions of the recurrence relation.

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

Also find the solution when $a_1 = 5$ **(6)**

8. (a) Define a field and prove that the set of all real numbers of the form $a + \sqrt{2}b$, where a and b are real numbers, form a field under the operation of addition and multiplication. **(6)**

(b) Let (A, *) be a group. Show that (A, *) is an abelian group if and only if

$a^2 \times b^2 = (a \times b)^2$ for all a, b in A. **(6)**

[P.T.O.]

SECTION - E

9. (i) Construct truth table for

7(7PVQ)

(ii) Symbolize the expression, All the world cheers a winner.

(iii) Give an example each of a chain and antichain in a partially ordered set.

(iv) What is the principle of quality for lattices?

(v) What is meant by prefix codes?

(vi Give an example of a Boolean algebra.

(vii) Define a path and a circuit in a graph.

(viii) How is asymptotic behaviour of two numeric functions compared?

(ix) State Burn side's theorem.

(x) What is an integral domain? Give an example.

(xi) Give an example of a non-planar graph.

(xii) What are two most fundamental ways of interconnecting switches? **(1×12=12)**