

Subject Code—4274

M.C.A. (Second Year) EXAMINATION

(5 Years Integrated Course))

(Re-appear)

MATHEMATICS—II

MCA-205

Discrete Mathematical Structures

June, 2008

Time : 3 Hours

Maximum Marks : 100

Note : Attempt any *Five* questions. All questions carry equal marks.

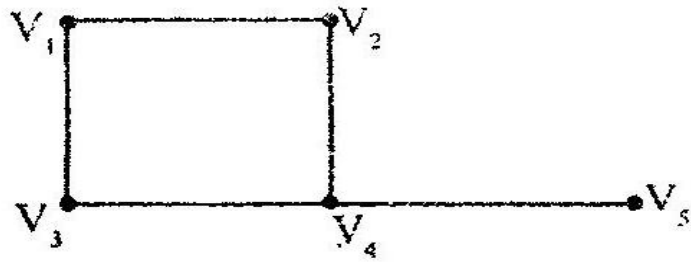
1. (a) Give group axioms. Show that the set Z of all integers, $-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5, \dots$ is a group with respect to the operation of addition of integers.

P.T.O.

4274 = 1/5

- (b) Explain bounded lattice and Hasse diagram. Draw the Hasse diagram of $(P(A), \subseteq)$, where :
- $A = \{0, 1\}$
 - $A = \{0, 1, 2, 3\}$
6. (a) What do you mean by Boolean Algebra ?
Prove the following for Boolean Algebra :
- The zero and unit elements are unique
 - The complement of an element is unique.
- (b) Prove that :
- $a + (\bar{a}.b) = a + b$ and
 $a.(\bar{a} + b) = a.b$
 - $(a + b).(\bar{b} + c) + b.(\bar{a} + \bar{c}) =$
 $a.\bar{b} + a.c + b$
7. (a) Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.
(b) With the help of truth tables, prove that :
- $$p \vee \sim q = (p \vee q) \wedge \sim (p \wedge q)$$
- (c) Write a short note on gate circuits.

- (b) Use adjacency matrix to represent the graph shown in figure :



4. (a) Draw the graph represented by the incidence matrix :

$$\begin{matrix} a \\ b \\ c \\ d \\ e \end{matrix} \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 1 & 1 \end{bmatrix}$$

- (b) Describe an efficient algorithm for comparing distances in graphs.
- (c) Describe Infix, Prefix and Postfix form of an algebraic expression in trees.
5. (a) Define partially ordered sets. Consider $P(s)$ as the power set, show that the inclusion relation \subseteq is a partial ordering on the powerset $P(s)$.

- (b) Explain bounded lattice and Hasse diagram. Draw the Hasse diagram of $(P(A), \subseteq)$, where :
- $A = \{0, 1\}$
 - $A = \{0, 1, 2, 3\}$
6. (a) What do you mean by Boolean Algebra ?
Prove the following for Boolean Algebra :
- The zero and unit elements are unique
 - The complement of an element is unique.
- (b) Prove that :
- $a + (\bar{a}.b) = a + b$ and $a.(\bar{a} + b) = a.b$
 - $(a + b).(\bar{b} + c) + b.(\bar{a} + \bar{c}) = a.\bar{b} + a.c + b$
7. (a) Show that $(p \wedge q) \rightarrow (p \vee q)$ is a tautology.
(b) With the help of truth tables, prove that :
- $$p \vee \sim q = (p \vee q) \wedge \sim (p \wedge q)$$
- (c) Write a short note on gate circuits.

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8. (a) Explain an integral domain and a finite field.
- (b) Show that the set S of all matrices of the form $\begin{pmatrix} a & b \\ -b & a \end{pmatrix}$, where $a, b \in R$ is a field with respect to matrix addition and matrix multiplication.
- (c) Let $f(t) = t^4 - 3t^3 + 3t^2 + 3t - 20$. Find all the roots of $f(t)$ given that $t = (1 + 2i)$ is a root.

$$427.4 = \frac{5}{5}$$