



- **KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

Answer ALL Questions
(10 X 10 = 100 Marks)

1. (i) Without using a truth table show that [5]
 $\neg(p \wedge q) \rightarrow (\neg p \vee (\neg p \vee q)) \equiv (\neg p \vee q)$

(ii) Without using the truth table find the principle disjunctive normal form (PDFN) and deduce the Principle Conjunctive normal form (PCNF) of $(P \wedge Q) \vee (\neg P \wedge Q \wedge R)$. [5]

2. Show that the premises "A student in this class has not read the book," and "Everyone in this class passed the first exam" imply the conclusion "Someone who passed the first exam has not read the book"? [10]

3. (i) Prove that for any commutative monoid $(M, *)$, the set of all idempotent elements of M forms a submonoid. [6]

(ii) Find the left cosets of $\{[0], [3]\}$ in the addition modular group (Z_6, \oplus_6) . [4]

4. Let $e: B^2 \rightarrow B^6$ is an (2,6) encoding function defined as [10]

$$e(00) = 000000, e(01) = 011101, e(10) = 001110 \text{ and } e(11) = 111111.$$

(i) Find minimum distance?

(ii) How many errors can detect?

(iii) How many errors can correct?

5. Solve the following recurrence relation using generating function [10]
 $a_{n+2} - 8a_{n+1} + 15a_n = 0$, given that $a_0 = 2$, $a_1 = 8$.

6.a) (i) Let $D_{60} = \{1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60\}$ and the divisibility ($/$) be a relation on a poset on D_{60} . (a) Draw the hasse diagram for D_{60} . (b) Find the greatest lower bound and least upper bound of 10 and 20. [5]

(ii) Obtain the sum of products and product of sums canonical forms in three variables of the Boolean expression $x_1 \oplus (x_2 * x_3)$. [5]

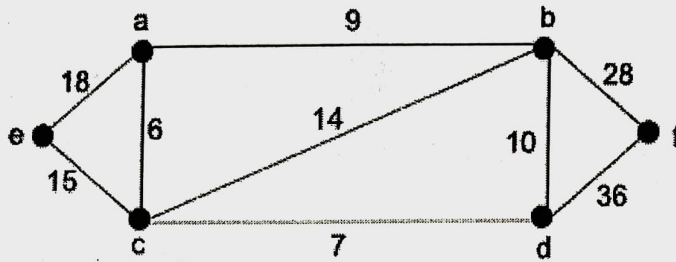
OR

6.b) (i) Let (L, \leq) be a lattice in which $*$ (meet) and \oplus (join) denote the operations. [6]
 Prove that for any $a, b \in L$, $a \leq b \Leftrightarrow a * b = a \Leftrightarrow a \oplus b = b$.

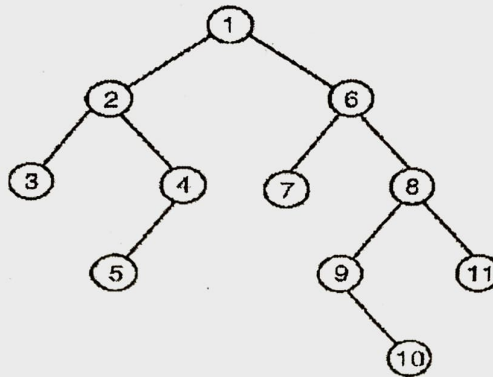
(ii) Obtain the product of sums canonical form in three variables of the Boolean expression $x_1 * x_2$. [4]

7. Prove that the maximum number of edges in a simple disconnected graph G with n vertices and k components is $\frac{(n-k)(n-k+1)}{2}$. [10]

8. Explain Dijkstra's algorithm. Using Dijkstra's algorithm to find the shortest path from e to f [10]

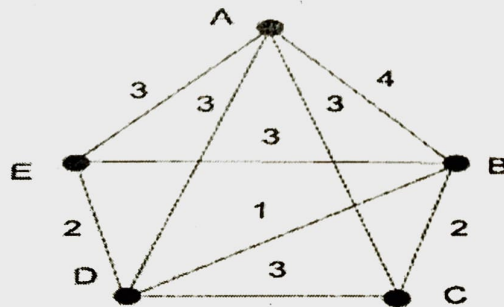


9.a) Explain the Pre-order, in-order, and post-order traversals. Determine the pre-order, post-order, and in-order traversal of the following binary tree. [10]



OR

9.b) Explain Prim's algorithm. Find the minimum spanning tree of the following graph by using prim's algorithm.



10. Prove that an n -vertex graph is a tree if and only if its chromatic polynomial $P_n(\lambda) = \lambda(\lambda-1)^{n-1}$. [10]

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