

- Note : 1) All Question are Compulsory
 2) All Questions Carry Equal Marks
 3) Figures to the Right side Indicate Marks.

Q1.A) Attempt any 3 (each of 5 marks) 15

1. Let $A = \{1,2,3,4\}$, Let $R = \{<1,2>, <1,3>, <1,4>, <2>3, <3,1>, <3,8>, <4,2>\}$ and $S = \{<1,3>, <2,2>, <3,2>, <4,2>\}$ find $RoRoR$
2. Find AxB, BxA, AxA & BxB if $A = \{1,2,3,5,6\}$ $B = \{2,3,4,5\}$.
3. If B is a Boolean algebra prove that $x+(x*y) = x$
4. If B is a Boolean algebra prove that $(x')' = X$
5. Prove that $1^2+2^2+ \dots + n^2 \geq \frac{n^3}{3}$ $n \in \mathbb{N}$.
6. State the dual of each of the following
 - i) $A \cup (B \cap A) = A$
 - ii) $A \cup (B \cap C \cup A) \cap B = C = U$

Q.2 Attempt any 3 (each of 5 marks) 15

1. If $f(x) = 9-2X$ and $g(x) = 5X - 4X^2 -3$, find the composite function defined by $(fog)(x)$ and $(Gof)(x)$.
2. Verify whether function $F: \mathbb{N} \rightarrow \mathbb{N}$ defined as $\delta(x) = 4X^2 + 1$ for all.
 - a. One to One
 - b. Onto
3. If X and Y are two sets such that $n(x) = 17$ $n(y) = 23$ and $N(X \cup Y) = 38$ find $n(X \cap Y)$.
4. Decide among the following sets, which sets are subsets of one and another
 $A = \{X: X \in \mathbb{R} \text{ and } X \text{ Satisfy } x^2 - 8x + 12 = 0\}$
 $B = \{2,4,6\}$ $C = \{2,4,6,8, \dots\}$ $D = \{6\}$.
5. Show that the function $\delta: \mathbb{R} \rightarrow \mathbb{R}$ given by $f(x) = 2X$, is one to one.
6. State whether the given function is on to or not.
 $F: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 1+x^2$

Q3. Attempt any 3 (each of 5 marks) 15M

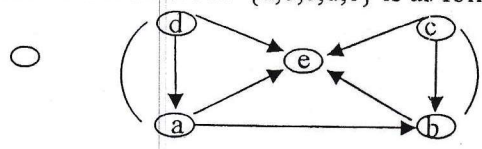
1. Find inverse for the function $f(x) = (3x+2) \cdot 1(x-1)$
2. Let $A = \{1,2,3,4\}$ and R be a partial order relation whose MR is given by

$$MR = \begin{pmatrix} 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 \end{pmatrix}$$
 Draw the Hasse Diagram of R .
3. Let $A = \{3,4,5,6,7,8\}$ and a relation R on A defined as $XRY \iff \frac{2}{(x-y)}$ Prove.
 A directed graph $O+R$
4. Let $A = \{a,b,c,d\}$ Let R be relation on A with adjacency matrix.

$$M(R) = \begin{pmatrix} 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 \end{pmatrix}$$

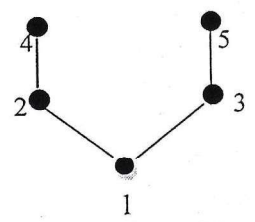
Find R as a subset of $A \times A$ Draw the diagram.

5. Draw the diagram of relation, $R = \{(1,2), (3,4), (3,2), (4,5) (5,3) (1,4)\}$
6. The diagram or relation R on set $A = \{a,b,c,d,e\}$ is as follow.



Q.4. Attempt any 3 (each of 5 marks)

1. Let set $A = \{1, 2, 3, 4, 5\}$ Define a Relation R on A by xRy if and only if $x+1 = y$. Find the relation R and write down its adjacency Matrix. Also draw diagram of R .
2. Let $A = \{1, 2, 3, 4, 5, 6\}$ let $R = \{(a, b) \mid a \equiv b \pmod{2}\}$ Is R an equivalence relation.
3. Let relation R on the set of integers defined as XRY if and only if $3x+4y$ is divisible by 7 $x, y \in \mathbb{Z}$ show that R is an equivalence relation.
4. Let $A = \{1, 2, 3, 4\}$ and $R = \{(1, 1), (1, 2), (2, 3), (3, 4), (4, 4), (9, 3)\}$ find R^* transitive closure and draw its graph.
5. Determine the partial order relation R and draw its hasse diagram is given as



6. Give an example of symmetric & Transitive but not reflexive.

Q5. Attempt any 3 (each of 5 marks)

1. Find matrix and diagram of relation $R = \{(x, y) \mid x - y = 1\}$ on set $A = \{1, 2, 3, 4, 5\}$.
2. Show that if any 14 integers are selected from the set $S = \{1, 2, 3, 4, \dots, 25\}$. There are at least two integers whose sum is 26.
3. Let relation R on set of integers defined as XRY if and only if $3x+4y$ is divisible by 7, $X, Y \in \mathbb{Z}$ show that R is an equivalence relation.
4. Find the matrix and diagram of relation $R = \{(x, y) \mid |x - y| = 2\}$ on set $A = \{1, 3, 5, 7\}$
5. Let $A = \{1, 2, 3, 4, 12\}$ Let R be a partial order relation defined on A as or B if a/b (a divides b). Draw the Hasse diagram of partial order relation?
6. Determine whether $\delta: R \rightarrow R$ are onto if $f(x) = x+z$

