1- **Define sets. Explain different operations of sets with example?**

2- **Define : a) Equality b) Superset c) Cardinality of set d) The power set e) Cartesian product f) Null set.**

3- **Let A = {a, b, c, d, e} and B = {a, b, c, d, e, f, g, h}. Find**
   a) $A \cup B$. b) $A \cap B$. c) $A - B$. d) $B - A$.

4- **Draw a venn diagram for each of these combinations of the sets A, B, and C.**
   a) A □(B-C) b) (A □B) ∪ ((A □C) c) (A□$\overline{B}$) ∪ (A□$\overline{C}$)

5- **Let P (n) be the statement that $1^2 + 2^2 + \cdots + n^2 = n(n + 1)(2n + 1)/6$ for the positive integer n.**

6- **Let P (n) be the statement that $1^3 + 2^3 + \cdots + n^3 = (n(n + 1)/2)^2$ for the positive integer n.**

7- **Show that- $1^2 + 3^2 + 5^2 + \ldots\ldots\ldots\ldots\ldots\ldots + (2n-1)^2 = \frac{n(2n-1)(2n-1)}{3}$**

8- **What is strong induction and well ordering?**

9- **Define Functions and its types with suitable diagram?**

10- **List the ordered pairs in the relation R from A = {0, 1, 2, 3, 4} to B = {0, 1, 2, 3}, where (a, b) ∈ R if and only if**
   a) a = b. b) a + b = 4. c) a>b. d) a | b. e) gcd(a, b) = 1

11- **List all the ordered pairs in the relation R = {(a, b) | a divides b} on the set {1, 2, 3, 4, 5, 6}.**

12- **For each of these relations on the set {1, 2, 3, 4}, decide whether it is reflexive, whether it is symmetric, whether it is antisymmetric, and whether it is transitive.**
   a) {(2, 2), (2, 3), (2, 4), (3, 2), (3, 3), (3, 4)}
   b) {(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)}
   c) {(2, 4), (4, 2)}
   d) {(1, 2), (2, 3), (3, 4)}
   e) {(1, 1), (2, 2), (3, 3), (4, 4)}
   f) {(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)}

13- **Define Relations. Explain its types with suitable example?**

14- **Define Equivalence Relation and classes with example?**

15- **Use Warshall's algorithm to find the transitive closures of the relations R={1, 2, 3, 4}.**

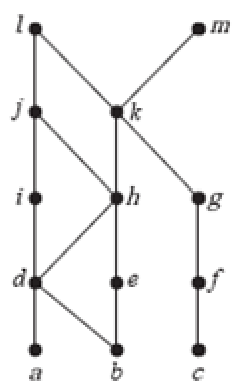
a) {(1, 2), (2,1), (2,3), (3,4), (4,1)}
b) {(2, 1), (2,3), (3,1), (3,4), (4,1), (4, 3)}
c) {(1, 2), (1,3), (1,4), (2,3), (2,4), (3, 4)}
d) {(1, 1), (1,4), (2,1), (2,3), (3,1), (3, 2), (3,4), (4, 2)}

16- Define Partial Order Relation with example. What is Hasse diagram or Poset?

17- Draw the Hasse diagram for the "less than or equal to" relation on
{0, 2, 5, 10, 11, 15}.

18- Draw the Hasse diagram for divisibility on the set
a) {1, 2, 3, 4, 5, 6, 7, 8}.
b) {1, 3, 9, 27, 81, 243}.

19- Answer these questions for the partial order represented by this Hasse diagram.



a) Find the maximal elements.
b) Find the minimal elements.
c) Is there a greatest element?
d) Is there a least element?
e) Find all upper bounds of {a, b, c}.
f) Find the least upper bound of {a, b, c}, if it exists.
g) Find all lower bounds of {f, g, h}.
h) Find the greatest lower bound of {f, g, h}, if it exists.

20- Answer these questions for the poset ({3, 5, 9, 15, 24, 45}, |).
a) Find the maximal elements.
b) Find the minimal elements.

c) Is there a greatest element?

d) Is there a least element?

e) Find all upper bounds of {3, 5}.

f) Find the least upper bound of {3, 5}, if it exists.

g) Find all lower bounds of {15, 45}.

h) Find the greatest lower bound of {15, 45}, if it exists.

21-Define a maximal and minimal element of a poset and the greatest and least element of a poset.

22- Define Lattice.