Set Theory and Relation

THEORY

Standard Notations

1) V/U ⇒ OR
2) ^ ⇒ and
3) ⇒ ⇒ Implies
4) $\in$ ⇒ belongs to
5) $\notin$ ⇒ does not belong to
6) $\forall x$ ⇒ for all x
7) : ⇒ such that
8) / ⇒ such that
9) $\subseteq$ ⇒ (subset)
11) $\not\subset$ ⇒ (not a proper subset)
12) $\supset$ ⇒ (Superset)
13) ~ ⇒ (Difference)
14) $\varnothing$ ⇒ (nullset)
15) U or S ⇒ (Universal set)

2. SET THEORY (Concepts)

1. A set is a collection of well-defined and distinct object. The objects are called the elements of the set.
2. Sets are denoted by A, B, C, D etc and the elements are kept within brackets.
   e.g A = (a, b, c, d)
   A = (1, 2, 3, 4)
3. Method of designating a set
   i. ROSTER METHOD / TABULAR METHOD / ENUMERATION METH-OD
   ii. PROPERTY METHOD / SELECTOR METHOD / RULE METHOD/SET BUILDER NOTATION.

1) Under Roster or Enumeration method the set is defined by listing all the elements.
   e.g A = {a, e, i, o, u}
2) Under Property Method the sets are indicated by their common characteristics which an object must possess in order to its elements.
   e.g. A = { x : x is a vowel}

TYPES OF SETS

1) A set is said to be finite when the elements can be exhausted by counting.
   A = {4}
2) A set is said to be infinite when its elements can not be exhausted by counting.
   Eg. A = {1, 2, 3……}
3) <u>SINGLETON SET</u> : A set which has only 1 element is called Singleton set
   e.g A = {2}

3. A FEW STANDARD INFINITE SETS

i. R = Set of real nos
ii. I = Set of Integers
   = {0, ±1, ±2, ±3…..}
iii. W = Set of whole nos.
   = {0, 1, 2……}
iv. Q = Sets of Rational nos.
v. I^+ = Sets of Positive integers
   = { 1, 2, 3……}
vi. I^- = Sets of Negative integers
   = { -1, -2, -3……}
v. NULL SET / EMPTY SET / VOID SET

It is a set having no element in it. It is denoted by i or { }

A = {x : x is a real no. whose square is –ve}

4. EQUAL SETS

Two sets are said to be equal if and all the elements of A belong to B

A = { S, T, R, A, N, D}

B = { S, T, A, N, D, A, R, D}

Note : Order of arrangement or repetition of elements does not affect the property of equality.

5. EQUIVALENT SETS

If the total no. of elements of one set is equal to the total no. of elements of another set, then the two sets are said to be equivalent. The elements may or may not be same always.

A = {1, 2, 3, 4}

B = {b, l, u, e}

$A \equiv B$

6. SUB SET

If each element of set A is an element of set B, then A is said to be a subset of B or A is contained in B.

Symbolically, $A \subseteq B$

If a set has n elements than the number of subset are 2^n .

e.g. If A = {1, 2, 3}

then the subsets of A are {1}, {2}, {3}, {1,2}, {1,3}, {2,3}, {1,2,3} ∅

Therefore the total number of subsets are $2^3 = 8$

Note 1. : If a set has n elements then

i. TOTAL NUMBER OF SUBSETS $= 2^n$

ii. TOTAL NUMBER OF NON- EMPTY SUBSETS $= 2^n - 1$

iii. TOTAL NUMBER OF PROPER SUBSETS $= 2^n - 1$

iv. TOTAL NUMBER OF NON- EMPTY PROPER SUBSETS $= 2^n - 2$

Note 2. : i. Every set is a subset of itself

ii. Φ is a subset of every set

iii. In subset element may be equal

iv. If $A \subseteq B$ and $B \subseteq A \Rightarrow A = B$

7. PROPER SUB SET

If each element of set A is an element of set B but there is atleast 1 element in B which is not in A, in such a case A is said to be proper subset of B and is symbolically denoted by:

$A \subset B$

To the above e. g. the proper subsets of A are {1}, {2}, {3}, {1,2}, {1,3}, {2,3} ∅

{1,2,3} is the improper subset because all the element are equal.

8. UNIVERSAL SET (U \ S)

Universal set or the universe is the set which contains all the elements of all subsets under investigation in a particular content.

Eg. U = {1, 2, 3, 4, 5}

A = {2, 3}

B = {1, 3, 5}

C = {4, 5}, etc

Here A, B, C are all subsets of U.

9. POWER SET

It is defined as the set of all possible subsets in a particular investigations. If a set contains n elements, its power set will contain 2^n elements.

A = {2, 3, 4} Total elements in the Power set will be $2^3 = 8$

[there are 3 elements in set A]

P(A) = (i, {2}, {3}, {4}, {2,3}, {2, 4}, {3, 4}, {2,3,4})

e.g The power set of A contains 128 elements. Find the no. of elements in set A Let there be n elements in Set A

$\therefore 2^n = 128$

Or $2^n = 2^7$

Or n = 7 $\therefore$ Set A has 7 elements

10. CARDINAL NO. IN A SET: n(A)

If a set A contains "X" no. of elements, then the cardinal no. in set A will be given by :

n(A) = x.

e.g. A {2, 3, 4, 5}

n(A) = 4

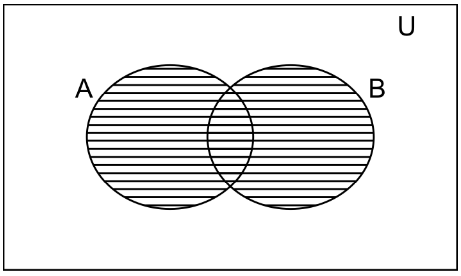
SET OPERATIONS

1. UNION OR JOIN OF 2 SETS

If A & B are 2 sets then the Union or Join of 2 sets is defined as the set of all elements which belong either to A or to B or to both A & B.

Symbolically $A \cup B = \{ x : x \in A \text{ or } x \in B \}$

NOTE : Here 'or' $\Rightarrow$ and/or

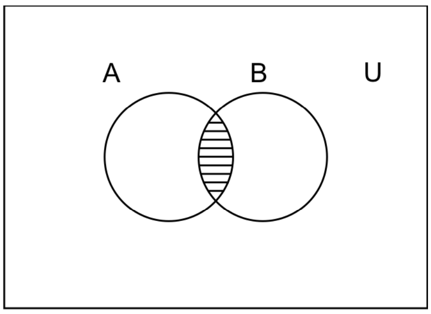


e.g

A = { 1, 2, 3, 4, 5} B = {2, 3, 5, 6, 7}'

$A \cup B$ = {1,2,3,4,5,6,7}

2. **INTERSECTION OF 2 SETS**



If A & B are 2 sets, then the intersection of the sets A & B is the set of those elements which belong to both A & B and is denoted by $A \cap B$.

Symbolically,

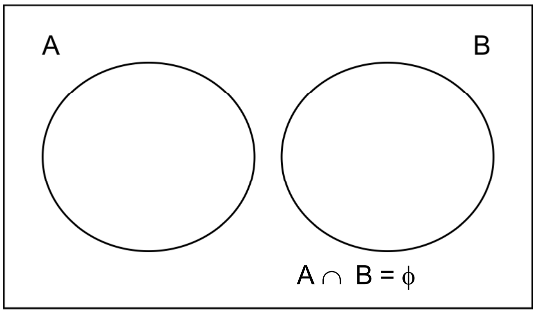
$A \cap B = \{ x : x \in A \text{ and } x \in B\}$

A = { 1, 2, 3, 4} B = (3, 4, 5}

$A \cap B$ = { 3, 4}

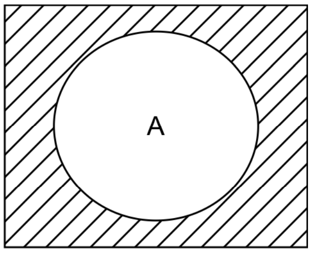
3. DISJOINT SETS

2 Sets are said to be disjoint when they have no elements in common i.e. their intersection is a Null Set.



e.g. If A = {1, 3, 5,} B = {2, 4} then $A \cap B = \phi$ therefore A & B are disjoints sets.

4. COMPLEMENT OR NEGATION SET



If U be the universal set and A be its subset, then the complement of set A in relation to U is the set whose element belong to U and not to A. This is denoted by :

$\hat{A}$ or A' or A^c = (U – A)

therefore Ac = $\{x : x \in U \text{ and } x \notin A\}$

e.g.

U = { 1, 2, 3, 4, ……10}

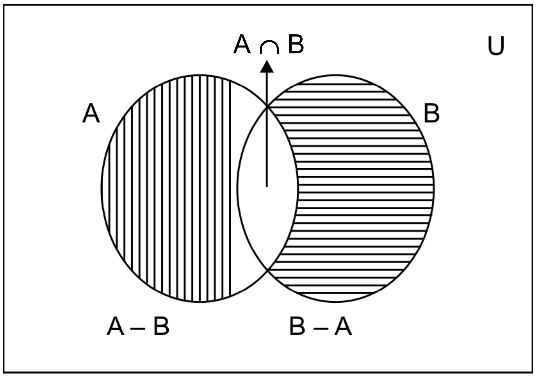
A = {2, 3, 5, 7}

B = {1, 2, 9, 10}

A^c = { 1, 4, 6, 8, 9, 10}

B^c = (4, 3, 5, 7, 6, 8}

5. DIFFERENCE OF 2 SET



(a) $A - B = \{x : x \in A$ and x õ $B\}$

Or

$A \sim B$

$B - A = \{x : x \in B$ and $x \in A\}$

Or

$B \sim A$

$A = \{1, 2, 3, 4, 5\}$

$B = \{3, 5, 6, 7\}$

$A - B = \{1, 2, 4\}$ and $B - A = \{6, 7\}$

6. CARTESIAN PRODUCT OF 2 SETS

If A and B are 2 sets, then the set of all ordered pairs {x, y} such that $x \in A$ and $y \in B$ is called Cartesian Product of A & B and it is denoted by A x B (read an A "cross" B)

Symbolically, $A \times B = \{(x, y) : x \in A$ and $y \in B\}$

$A = \{1,2\}$ $B = (3, 4, 7\}$

$A \times B = \{(1, 3), (1, 4), (1, 7), (2,3), (2, 4), (2, 7)\}$

$B \times A = \{(3, 1), (3, 2), (4, 1), (4,2), (7, 1), (7, 2)\}$

$A \times B \neq B \times A$ but $A \times B \equiv B \times A$ since $n(A \times B) = n(B \times A)$

Note :1. If $n(A) = m$ and $n(B) = n$ then the total number of elements in $A \times B = m \times n$

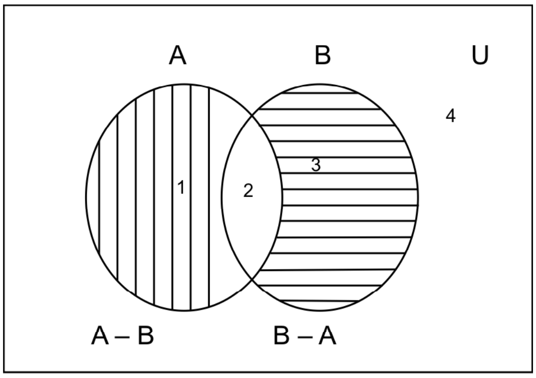
2. The total number of subsets of $A \times B = 2^{mn}$

Notes :

1. ϕ' = U
2. U' = ϕ
3. $(A^c)^c$ = A
4. $A \cup A'$ = U
5. $A \cap A'$ then = ϕ
6. $A \subset B$ then $B' \subset A'$ = ϕ
7. $A \cup \phi$ = A
8. $A \cap \phi$ = ϕ
9. $A \cup U$ = U
10. $A \cap U$ = A

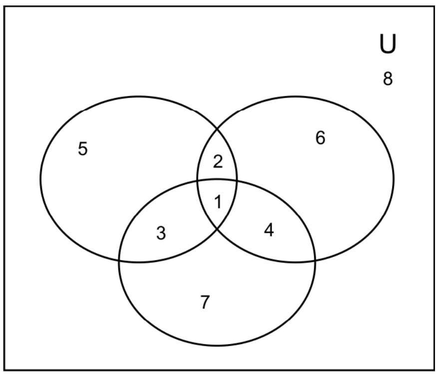
PARTITIONING OF SETS

Case 1



1. A-B or $A \cap B^c$ or A but not B = $n(A) - n(A \cap B)$
2. $(A \cap B)$ or (A and B)
3. B-A or $A^c \cap B$ or B but not A = $n(B) - n(A \cap B)$
4. $A^c \cap B^c$ or neither A nor B or $n(A \cup B)^c$ or $n(U) - n(A \cup B)$
5. $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

Case 2



1. $(A \cap B \cap C)$
2. $n(A \cap B \cap C^c) = n(A \cap B) - n(A \cap B \cap C)$
3. $n(A \cap B^c \cap C) = n(A \cap C) - n(A \cap B \cap C)$
4. $n(A^c \cap B \cap C) = n(B \cap C) - n(A \cap B \cap C)$
5. $n(A \cap B^c \cap C^c) = n(A) - n(A \cap B) - n(A \cap C) + n(A \cap B \cap C)$
6. $n(A^c \cap B \cap C^c) = n(B) - n(A \cap B) - n(B \cap C) + n(A \cap B \cap C)$
7. $n(A^c \cap B^c \cap C^c) = n(C) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C)$
8. $n(A^c \cap B^c \cap C^c) = n(A \cup B \cup C)^c = n(U) - n(A \cup B \cup C)$
9. $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$

Notes :

a) (2), (3), (4) are cases where only 2 items of the 3 are taken at a time.

b) (5), (6), (7) are cases where only 1 item of the 3 is taken at a time

c) (8) is the case where no item of the 3 are taken.

d) (1) is the case where all the items are taken i.e. the common part to all the 3.

LAWS

ASSOCIATIVE LAW

(a) $A \cup (B \cup C) = (A \cup B) \cup C$

(b) $A \cap (B \cap C) = (A \cap B) \cap C$

DISTRIBUTIVE LAW

(a) $A \cap (B$ È $C) = (A \cap B) \cup (A \cap C)$

(b) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

DEMORGAN'S LAW

(a) $(A \cup B)^c = A^c \cap B^c$

(b) $(A \cap B)^c = A^c \cup B^c$

DEMORGAN'S LAW ON DIFFERENCE OF SETS

(a) $A - (B \cup C) = (A-B) \cap (A-C)$

(b) $A - (B \cap C) = (A-B) \cup (A-C)$

CARTESIAN PRODUCT

(a) $A \times (B \cup C) = (A \times B) \cup (A \times C)$

(b) $A \times (B - C) = (A \times B) - (A \times C)$

RELATIONS

1. If A and B are two non empty sets, then any sub-set of A x B is called a relation from A to B. if R is a relation, then, $R \in A \times B$.
2. $A = \{1, 2, 3, 5\}$ $B = \{2, 4\}$
   Then, $A \times B = \{(1, 2), (1, 4), (2, 2), (2, 4), (3, 4), (3, 2), (5, 2), (5, 4)\}$
3. If we consider the relation 'is less than' then the set of all ordered pairs R in A x B, where
   (i) $R = \{(1,2), (1, 4), (2, 4), (3, 4)\}$
   $= \{(x, y) : x \in A, Y \in B, X R Y\}$
   (ii) Let A = (1, 2, 3, 4............... 32) R be the relation "one fourth of A"
   $R = \{(1, 4), (2,8), (3, 12), (4, 16), (5, 20), (6, 24), (7, 28), (8, 32)\}$

4. **Number of Relation**
   If A and B are 2 sets containing m and n items respectively, then A x B will have mn ordered pairs, Total number of subsets of mn ordered pairs = 2^{mn}

   Since each relation is subset of A x B.
   $\therefore$ Total Relation = 2^{mn}
   e.g. if n(A) = 4, n(B) = 2
   Total relations = $2^8 = 256$.

5. **Domain and Range of Relation**
   If A and B are 2 non-empty sets and R be the relation, then the set of first element in the ordered pair (x, y) is called the Domain of the relation and the set of second component in the ordered pair is called the Range of the relation.
   e.g. : $A = \{1, 3, 4, 5, 7\}$
   $B = (2, 4, 6, 8)$

And R is the relation 'is one less than' from A to B, then
R = {(1, 2), (3, 4), (5, 6), (7, 8)}
Domain of R = { 1, 3, 5, 7}
Range of R = (2, 4, 6, 8}
Co-domain of R = (2, 4, 6, 8}
Range $\subseteq$ Co-domain

TYPES OF RELATIONS

1. **Note** : A relation R in set A is a subset of A x A
2. A relation R in set A is said to be **"Reflexive"**, if (a, a) $\in$ R for all a $\in$ A where 'a' is the element of set A
   e.g. : A = {(2, 4, 7)} then the relation R = {(2, 2), (4, 4), (7, 7)} is reflexive.
3. A relation R in set A is called **"Symmetric"** if (a, b) $\in$ R, then (b, a) $\in$ R.
   A = [2, 4, 7]
   R = {(2,4), (4, 2), (2, 7), (7, 2)} is a symmetric relation.
4. A relative R in Set A is called **"Transitive"** relation if (a, b), (b, c) $\in$ R, then (a, c) $\in$ R
   e.g. : R = {(2, 4), (4, 7), (2, 7)} is transitive
5. A relation which is reflexive, symmetric and transitive is called an **"Equivalence"** relation.

Note :

1. Inverse of **Equivalence** relation is also an **Equivalence** relation.
2. Intersection of two **Equivalence** relation is also **Equivalence** relation.

Inverse Relation

Let, R be the relation from set A to B, then the inverse relation of R is denoted by R^{-1} is a relation from B to A.

$\therefore$ If R is a subset of A x B.

R^{-1} is a subset of B x A which consists of all the ordered pairs which when reversed belongs to R.

A = (2, 3, 5, 7), B = (4, 6, 7, 10, 11) and R be the relation "is a divisior of" from A to B then,
R = {(2, 4), (2, 6), (2, 10), (3, 6), (3, 9), (5, 10)}
$\therefore$ R^{-1} is a relation from B to A will be given by;
R^{-1} = {(4,2), (6, 2), (10, 2), (6, 3), (9, 3), (10, 5)}
$\therefore$ R^{-1} in this relation "is divisible by"
Domain of R^{-1} = {4, 6, 10, 9} = Range of R
Range of R^{-1} ={2, 3, 5) = Domain of R

Note : D(R^{-1}) = R (R)
R(R^{-1}) = D(R)

FUNCTIONS

1. If A and B are 2 non-empty sets then, function is a rule or correspondence which associates every element **'X'** of A to a unique element of **'Y'** in B.
2. Symbolically we express it as $f : A \rightarrow B$

Note :

1. Set from which it is defined is called domain i.e. Set A
2. Set to which it is defined is called co-domain
3. The set of images are the ranges of the function,
   Range $\subseteq$ Co-domain

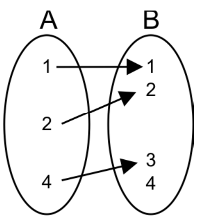
<u>Types of Functions</u>

Types of Function

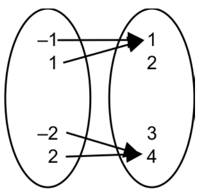
One – One (Injective)

Many – One

One – Many (does not exist)

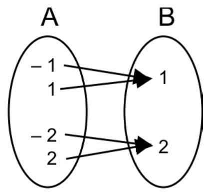


Each Element in A has only one image in B and each element in B has one pre-image in A

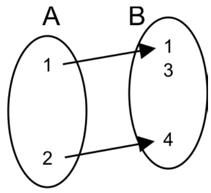


At least two elements in A has the same image in B and at least one element in B, has more than one pre-image in A

Onto Function
(Surjective Function)
Range = co-domain

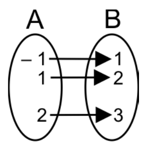


Into Function
Range $\subseteq$ co-domain

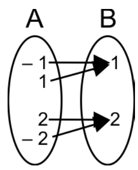


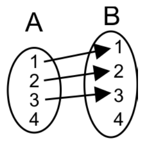
There should be at least one element in Set B which has no pre-image in A

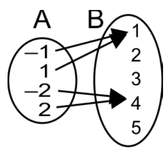
One – one Into (Bijective Function)



Many one-onto







Domain : {-1, 1, -2, 2}
Co-Domain : {1, 2, 3, 4, 5}
Range : {1, 4)

Set Theory and Relation

(For Q. No. 1 to 6)

If A = { a, b, c, d, e}; B = { a, e, i, o, u} and C = {m, n, o, p, q, r, s, t, u}

1. $A \cup B$ has how many elements?
   a) 8
   b) 7
   c) 9
   d) 11

2. $B \cup C$ is equal to:
   a) {a, e, i, o, u, m, n, p, q, r, s, t}
   b) {a, e, i, r, s, t}
   c) {o, u, p, q, r, s}
   d) None of the above

3. $A \cup C$ is equal to:
   a) {d, e, f, p, q, r}
   b) {(a, b, c, d, e, m, n, o, p, q, r, s, t, u}
   c) (a, b, c, s, t, u}
   d) None of the above

4. $B \cap C$ is equal to:
   a) {a, e}
   b) {o, u}
   c) {o, p}
   d) None of the above

5. $A \cap B$ is equal to:
   a) {a, e}
   b) {o, u}
   c) {o, p}
   d) None of the above

6. A - B is equal to:

a) {a, e, o}

b) {m, n, p, q}

c) {b, c, d}

d) None of the above

7. The set of cubes of the natural numbers is:

a) A finite set

b) An infinite set

c) A null set

d) None of the above

8. If A and B are two sets containing 4 and 7 distinct elements respectively, find the minimum possible number and maximum possible number of elements $A \cup B$.

a) 5, 10

b) 4, 12

c) 7, 11

d) 8, 13

9. Set X and Y had 6 and 12 elements respectively, what can be the minimum number of elements in $X \cup Y$?

a) 14

b) 16

c) 12

d) 18

10. If A, B, C are three sets in which $n(A \cap B \cap C) = 8$, $n(A \cap B) = 15$, $n(A) = 22$, $n(B \cap C) = 11$, $n(B) = 19 = n(C)$, $n(A \cap C) = 10$, then what is $n(A \cup B \cup C)$?

a) 31

b) 33

c) 35

d) 32

11. K_1 & K_2 are two sets such that $n(K_1) = 17$, $n(K_2) = 23$, $n(K_1 \cup K_2) = 38$, then $(K_1 \cap K_2) = ?$

a) 12

b) 2

c) 7

d) 9

12. If A = { 1, 2, 3}, B = {3, 4}, and C = {4, 5, 6} then $(A \times B) \cap (B \times C)$ is equal to :

a) { }

b) {(3, 4)}

c) {(2, 3), (3, 2), (3, 4)}

d) None of the above

13. Let A : {O, R, A, N, G, E} and B = { 0, 1, 2, 3, 4, 5}. The above two sets are:

a) Equal

b) Equivalent

c) Disjoint

d) Both b) and c) above

14. The number of elements in the power of set of a set containing ‘p‘ elements is:

a) 2^{p-1}

b) 2^{p}

c) 2^{p+1}

d) $2^{p} + 1$

15. The number of non - empty subsets of the set {8, 9, 10, 11, 15} is :

a) 32

b) 31

c) 30

d) 33

16. If the set A has M elements and set B has N elements then the number of elements in A x B is:
    a) m + n
    b) mn
    c) m – n
    d) m^n

17. Set A and B has 3 and 6 elements respectively, what is the minimum number of elements in $A \cup B$?
    a) 18
    b) 9
    c) 6
    d) 3

18. Two finite sets have p and q number of elements. The total number of subsets of the first set is eight times the total number of subsets of the second set. Find the value of p – q.
    a) 2
    b) 3
    c) 4
    d) None of the above

19. For A and B two given non-empty sets consisting of m and n elements respectively, the total number of subsets of A X B are:
    a) 2^m
    b) 2^{mn}
    c) $2^m + 2^n$
    d) None of the above

20. If A = { 1, 2,}, B = {3, 4}, and C = {4, 5} then $(A \times B) \cap (B \times C)$ is equal to :
    a) { }
    b) {(3, 4)}
    c) {(2, 3), (3, 2), (3, 4)}
    d) None of the above

21. In a class of 65 students, 35 students have taken Mathematics, 40 have taken Statistics. Find the no. of students who have taken both. Find the no. of students who have taken Mathematics but not Statistics. (Assume that every student has to take atleast one of the two subjects.)

(a) 10, 25 (b) 10, 10 (c) 10, 20 (d) 10, 30

22. In a class of 50 students, 20 students play football and 16 students play hockey. It is found that 10 students play both the games. Use algebra of sets to find out the number of students who play neither.

(a) 26 (b) 25 (c) 24 (d) 20

23. In a class test of 45 students, 23 students passed in paper first, 15 passed in paper first but did not pass in paper second. Using set theory, find the no. of students who passed in both the papers and who passed in paper second but did not pass in paper first. (Assume that each student passed at least one of the two paper.

(a) 8, 22 (b) 8, 20 (c) 10, 8 (d) None

24. In a statistical investigation of 1003 of Calcutta it was found that 63 families had neither a radio nor a T.V. 794 families had a radio and 187 a television. How many families in that group had both a radio and a T.V.

(a) 41 (b) 42 (c) 40 (d) None

25. In a town 60% read magazines A, 25% do not read magazine A but read magazine B. Calculate the percentage of those who do not read any magazine. Also find the highest and lowest possible figure of those who read magazine B.

(a) 15, 85, 25 (b) 15, 75, 25 (c) 25, 75, 20 (d) None

26. In a City there are three daily newspaper published X, Y, Z. 65% of the people of the city read X, 54% read Y, 45% read Z, 38% read X and Y, 32% read Y and Z, 28% read X and Z. 12% do not read any of the three papers. If 10,00,000 person live in the city. Find the number of persons who read all the three newspaper.

(a) 220000 (b) 230000 (c) 120000 (d) 200000

(For Q No.27-Q30)

Out of 1600 students in a college, 390 played Kho-Kho, 450 played Kabaddi, and 500 played cricket; 90 played both Kho-Kho and Kabaddi; 125 played Kabaddi and Cricket, and 155 played Kho-Kho and Cricket; 50 played all the three games.

27. How many students did not play any game?

a) 400

b) 500

c) 450

d) None of the above

28. How many played only Kho-Kho?

a) 295

b) 195

c) 95

d) 1000

29. How many played only one game?

a) 1030

b) 930

c) 750

d) 730

30. How many played only two games?

a) 220

b) 320

c) 120

d) None of the above

Refer to the data below and answer the questions that follow.

Kimaya colony has a population of 2800 members.

Number of member listening only English music = 650

Number of member listening only Hindi music = 550

Number of member listening only Bengali music = 450

Number of member listening all three types of music = 100

Number of member listening Hindi as well as English music = 200

Number of member listening Hindi as well as Bengali music = 400

Number of member listening Bengali as well as English music = 300

31. Find the number of members listening Bengali music?

a) 950

b) 1050

c) 650

d) 550

32. Find number of members listening none of the music?

a) 450

b) 2650

c) 2550

d) 550

33. Find the number of members listening only one type of music

a) 450

b) 1100

c) 1600

d) 1650

34. Find number of members listening to at least two types of music

a) 600

b) 400

c) 700

d) 500

35. The ratio of members listening Hindi to that of Bengali music is :

a) 2 : 1

b) 1 : 1

c) 1 : 2

d) 3 : 2

36. A shop has only red, green and blue carpets. 60% of the carpets have red colour, 30% have green colour and 50% have blue colour. If no carpet has all the three colours, what percentage of the carpets have only one colour?

a) 40%

b) 60%

c) 70%

d) None of the above

37. A company studied the product preferences of 300 consumers it is found that 226 like product A, 51 like product B, 54 it is found C, 21 like product A and B, 54 like product A and C, 39 like product B and C and 9 like all three product. Prove that the study results are not correct. (Assume that each consumer like at least one of the three product.

38. It is known that in a group of people, each of whom speaks at least one of the languages English, Hindi and Bengali, 31 speaks English, 36 speaks Hindi and 27 speaks Bengali. 10 speaks both English and Hindi, 9 both English and Bengali, 11 both Hindi and Bengali, prove that the group contains at least 64 people and not more than 73 people.

39. For two non-empty sets A and B containing m and n elements respectively, the total number of relations from A to B will be :

a) 2^{m+n}

b) 2^{m}

c) 2^{mn}

d) $2^{m} + 2^{n}$

40. If A = {a, b, c, d} and B= {p, q, r, s} then which of the following are relations from A to B?

a) R_1 = {(a, p), (b, r),(c, s)}

b) R_2 = {(q, b), (c, s),(d, r)}

c) R_3 = {(a, p), (b, r),(c, r)(s, q),(d)}

d) R_3 = {(a, p), (b, s),(s, b)(q, a)}

41. If A = {1, 3, 5, 7} and B = {2, 4, 6, 8, 10} and R = {(1, 8), (3, 6), (5, 2), (1, 4)} be a relation from A to B, then Dom(R) = ?

a) {1, 5}

b) { 1, 3, 5}

c) (3, 5}

d) None of the above

42. In the above question, what is the Range (R)?

a) {1, 3, 5}

b) { 8, 6, 2, 4}

c) (2, 4, 6}

d) None of the above

43. If A = {1, 2, 3} and B= {4, 5, 6} then which of the following are relations from A to B?

a) R_1 = {(1, 4), (1, 5),(1, 6)}

b) R_2 = {(1, 5), (2, 4),(3, 6)}

c) R_3 = {(1, 4), (1, 5),(3, 6), (2, 6), (3, 4)}

d) All of the above

44. Let A = {1, 2} and B = {3, 4}. The total number of relations from A into B is:

a) 8

b) 16

c) 32

d) 4

45. Let A = {x, y}. The number of all relations on A are:

a) 4

b) 8

c) 16

d) 32

46. Let A = {c, d, e} and B = {a, b}. The total number of relations from A into B is:

a) 64

b) 8

c) 16

d) 32

47. What can be said about the relation R ={(a, b),(b, c), (c, a)} defined on set A = {a, b, c}?

a) Reflexive, Symmetric, Transitive

b) Non Reflexive, Symmetric, Transitive

c) Non-Reflexive, Non-Symmetric, Non Transitive

d) None of the above

48. What can be said about the relation R = {(a, a), (a, b), (a, c),(b, b), (b, c), (c, a), (c, b), (c, c)} defined on Set A = {a, b, c}?

a) Reflexive, Symmetric, Transitive

b) Non Reflexive, Symmetric, Transitive

c) Reflexive, Symmetric, Non Transitive

d) Reflexive, Non-Symmetric, Non Transitive

49. What can be said about the relation R = {(a, b), (b, a),(a, c), (c, a),} defined on Set A = {a, b, c}?

a) Reflexive, Symmetric, Transitive

b) Non Reflexive, Symmetric, Non-Transitive

c) Reflexive, Symmetric, Non Transitive

d) Reflexive, Non-Symmetric, Non Transitive

50. Let A = {1, 2, 3} and R = {(1, 2), (1, 1,), (2, 3)} be a relation on A. What minimum number of ordered pairs may be added to R so that it may become a transitive relation on A.

a) {3, 1}

b) {1, 3}

c) {2, 2}

d) None of the above

51. The domain of the relation R where R = {(-3, 1),(-1, 1),(1, 0), (3, 0)} is:

a) {1, 0}

b) {1, 3, 2, -1, -2, -3}

c) (1, 3, -1, -3}

d) None of the above

52. The Range of the relation R where R = {(x, x + 5) : x {0, 1, 2, 3, 4, 5} is:

a) {0, 1, 2, 3, 4, 5}

b) {1, 5, 6, 7, 8}

c) {5, 6, 7, 8, 9}

d) {5, 6, 7, 8, 9, 10}

53. A = { 1, 2, 3) R = {(1, 2), (2, 2,), (3, 1), (3, 4)} Find

a) D(R)

b) R(R)

c) R^{-1}

d) $D(R^{-1})$

e) $R(R^{-1})$

54. Find in each case the type of relation:

A = (1, 2, 3)

R_1 = {(1,1), (2,2), (3,3,), (1, 2)}

R_2 = {(1,1), (2,2), (1,2,), (2, 1)}

R_3 = {(1,1), (2,2), (3,3,), (1, 2), (2,1), (2, 3)(3,2)}

R_4 = {(1,1), (2,3), (3,2,)}

55 Find in each case the Type of Relation.

i. “Is smaller than” over the set of eggs in a box is

(a) T (b) S (c) R (d) E

ii. “Is equal to “ over the set of all rational numbers is

(a) T (b) S (c) R (d) E

iii. “Is perpendicular to” over the set of straight lines in a given plane is

(a) R (b) S (c) T (d) E

iv. “Is the reciprocal of” … over the set of non-zero real numbers is

(a) S (b) R (c) T (d) none of these

v. “is the square of “ over a set of real numbers is

(a) R (b) S (c) T (d) none of these