1. Basic Definitions

1. Sets

A set is a collection of well defined distinct objects. Each element of the set is called its member or element. Each set is given a name, usually capital letter of English alphabets. All the elements are put inside the curly brackets separated by a comma.

For example $A = \{Sparrow, Crow, Parrot\}$ is a set of few birds

$B = \{Ram, Hari, Sheela, Shyama\}$ is a set of few students of a class.

$X = \{1, 2, 4, 96, 132\}$ is a set of few positive integers.

2. Symbols for Elements of a Set

When an element belongs to a set we say <element> $\in$ <set>

When an element does not belong to a set we say <element> $\notin$ <set>

The symbol $\in$ is pronounced as 'belongs to' and symbol $\notin$ is pronounced as 'does not belong to'

For example for a set $A = \{2, 5, 8, 100\}$, we say $2 \in A$ but $7 \notin A$

3. Characteristics of a Set

- The name of the set is usually a capital letter of English alphabets.
- The names of elements are small letters of English alphabets.
- Repetitions of elements are not counted separately. Hence sets {1, 2, 2, 3, 1, 3} is identical to set {1, 2, 3}.
- The order in which elements appear in a set is not important. Hence sets $\{a,b,c\},\{b,a,c\},\{a,c,b\}$ are same sets.

2. Representation of Sets

1. Listing Method

In this method, all the elements are enclosed in braces { } separated by commas.

For example $A = \{1, 3, 6, 10\}$ is a set written in listing method.

Illustration 1:

Write first ten natural numbers in listing method.

Solution:

$A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

Illustration 2:

Write first five prime numbers in listing method.

Solution:

$B = \{2, 3, 5, 7, 11\}$

2. Property Method

In this method, instead of giving numerical value of each element, we give out their description or properties.

For example $A = \{x : 1 \leq x \leq 8 , x \text{ is a natural number}\}$ will give us first 8 natural numbers.

Illustration 3:

Write first ten even natural numbers using property method.

Solution:

$A = \{x : x = 2n, n \text{ is a natural number}, 1 \leq n \leq 10 \}$

Illustration 4:

Write first ten prime numbers using property method.

Solution:

$B = \{x : x \text{ is a prime number less than } 30\}$

3. Some Standard Sets

- N : Set of all natural numbers {1, 2, 3, 4 and so on}
- W : Set of all complex numbers. {0, 1, 2, 3, 4, 5 and so on}
- R : Set of all real numbers, rational or irrational. {1, 2.4, 5.4, --3.2 and so on}
- Z : Set of all integers. {-4, -3, -2, -1, 0, 1, 2, 3 and so on}
- Q Set of all rational numbers. $\{\frac{2}{5}$, 0.3, 0.12, $\frac{1}{7}$ and so on}

4. Types of Sets

1. Null Set, Empty Set or Void Set

A set having no element is called a null set. It is denoted by ϕ.

For example A = {} is a null set.

2. Singleton Set or Unit Set

A set having only one element is called singleton set.

For example B = {2} is a singleton set.

3. Pair Set or Doubleton

A set having two elements is called doubleton set.

For example A = {2, -5} is a doubleton set.

4. Finite Set

A set in which there are finite number of elements is called a finite set.

For example D = {1, 5, 9, 14} is a finite set.

5. Infinite Set

A set in which there are infinite number of elements is called an infinite set.

For example X = {1, 2, 3, 4 and so on} is an infinite set.

6. Universal Set

A set which contains elements of all the sets under consideration is called a universal set. It is denoted by U .

7. Equal Sets

Two sets A and B are equal set if every element of one is an element of the other.

For example A = {2, 1, 3} and B = {1, 2, 3} are equal sets.

C = {1, 2} and D = {2, 1, 3} are not equal sets.

8. Equivalence Sets

If the number of elements in two sets is same, the sets are called equivalence sets.

For example A = {2, 4} and B = {-3, -6} are equivalence sets because they both have 2 elements each.

5. Subsets

1. Subsets

- If every element of a set A is also an element of set B , then A is called the subset of B and we write $A \subseteq B$.
- Every set is a subset of itself.
- Empty set is a subset of every set.
- If A is a subset of B , then we write $A \subset B$.
- If C is a not subset of B , then we write $C \not\subset B$.

2. Number of Subsets

If a set A has n elements, then total numbers of subsets are 2^n .

Illustration 5:

Write all the subsets of $A = \{2, 6\}$

Solution:

Subsets of A are ϕ, {2}, {6}, {2, 6}

6. Union & Intersection

1. Union of Two Sets

The union of two sets A and B is the set of all those elements which are present either in A or in B or in both. The union of two sets is denoted by $A \cup B$. Hence $A \cup B = \{x : x \in A \text{ or } x \in B\}$.

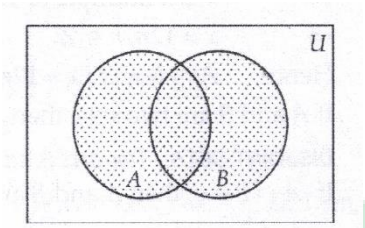

Illustration 6:

Find the union of two sets $A = \{1, 7, 3, 0, 12\}$ and $B = \{4, 7, 1, 12, 16\}$

Solution:

$A \cup B = \{0, 1, 3, 4, 7, 12, 16\}$

2. Intersection of Two Sets

The intersection of two sets A and B is the set of all those elements which are present in both sets. The intersection of two sets is denoted by $A \cap B$. Hence $A \cap B = \{x : x \in A \text{ and } x \in B\}$.

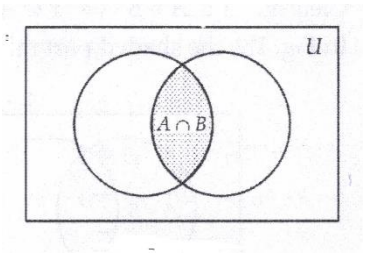

Illustration 7:

Find the intersection of two sets $A = \{1, 7, 3, 0, 12\}$ and $B = \{4, 7, 1, 12, 16\}$

Solution:

$A \cap B = \{1, 7, 12\}$

7. Venn's Diagram