CHAPTER-10

SETS

STUDY NOTES

What is a Set?

- A set is a well-defined collection of distinct objects.

  Example: A = {1, 2, 3, 4, 5}

What is an element of a Set?

- The objects in a set are called its elements.
  - So in case of the above Set A, the elements would be 1, 2, 3, 4, and 5. We can say, $1 \in A$, $2 \in A$ etc.
- Usually we denote Sets by CAPITAL LETTERs like A, B, C, etc. while theirelements are denoted in small letters like *x, y, z* etc.
- If *x* is an element of A, then we say *x* belongs to A and we represent it as $x \in A$

- If x is not an element of A, then we say that x does not belong to A and werepresent it as

  $x \notin A$

How to describe a Set?

- Roaster Method or Tabular Form
  - In this form, we just list the elements.
  - Example A = {1, 2, 3, 4} or B = {*a, b, c, d, e*}
- Set- Builder Form or Rule Method or Description Method
  - In this method, we list the properties satisfied by all elements of the set
  - Example $A = \{x : x \in N, x < 5\}$

Some examples of Roster Form vs Set-builder Form

1	{1, 2, 3, 4, 5}	$\{x \mid x \in . \square N, x < 6\}$
2	{2, 4, 6, 8, 10}	$\{x \mid x = 2n, n \in . \square N, 1 \le n \le 5\}$
3	{1, 4, 9, 16, 25, 36}	$\{x \mid x = n^2, n \in . \square N, 1 \le n \le 6\}$

Sets of Numbers

1. Natural Numbers (N)
   - N = {1, 2, 3,4 ,5 6, 7, …}
2. Integers (Z)
   - Z = {…, -3, -2, -1, 0, 1, 2, 3, 4, …}
3. Whole Numbers (W)
   - W = {0, 1, 2, 3, 4, 5, 6…}
4. Rational Numbers (Q)
   - $Q=\{\frac{p}{q} : p \in . \square Z, q \in . Z, q \neq 0\}$

Finite Sets & Infinite Sets

- Finite Set: A set where the process of counting the elements of theset would surely come to an end is called finite set
  - Example: All natural numbers less than 50
  - All factors of the number 36
- Infinite Set: A set that consists of uncountable number of distinctelements is called infinite set.
  - Example: Set containing all natural numbers
  - $\{x \mid x \in N, x > 100\}$

Cardinal number of Finite Set

- The number of distinct elements contained in a finite set A is calledthe cardinalnumber of A and is denoted by $n(A)$
- Example $A = \{1, 2, 3, 4\}$ then $n(A) = 4$
  - $A = \{x \mid x \text{ is a letter in the word 'APPLE'}\}$. Therefore $A = \{A, P, L, E\}$and $n(A) = 4$
  - $A = \{x \mid x \text{ is the factor of } 36\}$, Therefore $A = \{1, 2, 3, 4, 6, 9, 12, 18, 36\}$and $n(A) = 9$

Empty Set

- A set containing no elements at all is called an empty set or a null set or avoid set.
- It is denoted by φ (phai)
- In roster form you write φ = { }
- Also n (φ) = 0
  - Examples: $\{x \mid x \in . ?N, 3 < x < 4\} = \varphi$
  - $\{x \mid x$ is an even prime number, $x > 5\} = \varphi$

Non Empty Set

- A set which has at least one element is called a non-empty set
  - Example: A = {1, 2, 3} or B = {1}

Singleton Set

- A set containing exactly one element is called a singleton set
    - Example: A = {*a*} or B = {1}

Equal Sets

Two set A and B are said to be equal sets and written as A = B if everyelement of A is in B and every element of B is in A.

- Example A = {1, 2, 3, 4} and B = {4, 2, 3, 1}
- It is not about the number of elements. It is the elements themselves.
- If the sets are not equal, then we write as A ≠ B

Equivalent Sets

- Two finite sets A and B are said to be equivalent, writtenas A ↔ B,if n(A) = n(B), that is they have the same number of elements.
    - Example: A = {a, e, i, o, u} and B = {1, 2, 3, 4, 5}, Therefore n(A) =5 and n(B) = 5 therefore A ↔ B

- Note: Two equal sets are always equivalent but two equivalent setsneed not be equal.

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