SETS

- **Sets :** A well-defined and well distinguished collection of objects. Notation being,
  - **Set** → Capital alphabets
  - **Elements** (inside set) → Small alphabets

Important Signs

$\exists$	there exists	:	such that
|	such that	,	and
$\forall$	for every/ for all	$\in$	belongs to
$\notin$	doesn't belongs to	$\Rightarrow$	implies
$\subset$	Subset	iff	if and only if

Representation of sets

Roster form

- All elements separated by comma and enclosed in braces.
- Elements not repeated, Order of writing a set doesn't matter. **e.g.**

  "SCHOOL" $\Rightarrow$ {S, C, H, O, L} or {O, H, C, S, L}

Set Builder form

- Elements of a set possess a common property. **e.g.**

  A = {x: x is a natural number and $5 < x < 10$}

Cardinality/Cardinal Number/Order of a set

- Number of distinct elements in a set.
- Represented as n(A), O(A), |A| for a set A.

Special Sets

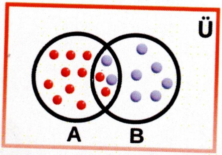
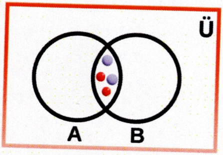
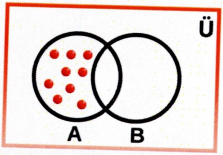
- **Empty/Null Set** : Set with no elements. Represented by { }, ϕ.
- **Singelton Set** : Set with only one element.
- **Finite Set** : Set with Finite no. of Elements.
- **Infinite Set** : Set with Infinite no. of Elements. e.g. **N, Z, Q, R, C.**
- **Universal Set (U) :** Containing all possible elements.
- **Equal Sets** : A=B, if every element of A is in B
- **Equivalent Sets** : finite sets, if n(A) = n(B)
- **Subset** : $A \subset B$: if and only if elements of A are in B.
- **Superset** : $A \subset B$: B is superset of A

1. Every set is a subset of itself,
2. ϕ is a subset of every set,
3. If n(A) = m, number of subsets : **2^m**, number of proper subsets : **2^{m-1}**

- **Power Set** : Set containing all the possible subsets of a particular set. If n(A)=m, then **$n(P(A))=2^m$**

$$\underbrace{n(P(P(P \ldots P(A)) \ldots))}_{y \text{ times}} = \underbrace{2^{2^{2^{\cdot^{\cdot 2^m}}}}}_{y \text{ times}}$$

Operation between two sets

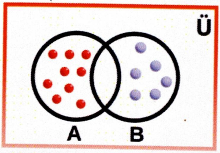
Venn Diagram	Properties
UNION : $A \cup B = \{x : x \in A \text{ or } x \in B\}$	
	• $A \cup B = B \cup A$ • $A \cup A = A$ • $A \cup (B \cup C) = (A \cup B) \cup C$ • $A \cup Ü = Ü$ • $A \cup \phi = A$ • $A \subset B \Rightarrow A \cup B = B$
INTERSECTION : $A \cap B = \{x : x \in A \text{ and } x \in B\}$	
	• $A \cap B = B \cap A$ • $A \cap A = A$ • $A \cap (B \cap C) = (A \cap B) \cap C$ • $A \cap Ü = A$ • $A \cap \phi = \phi$ • $A \subset B \Rightarrow A \cap B = A$
DIFFERENCE : $A - B = \{x : x \in A \text{ and } x \notin B\}$	
	• $A - A = \phi$ • $A - \phi = A$ • $A - Ü = \phi$ • $A - (B \cap C) = (A - B) \cup (A - C)$ • $A - (B \cup C) = (A - B) \cap (A - C)$ • $A - B \neq B - A$

Sets with no common element are called **Disjoint**

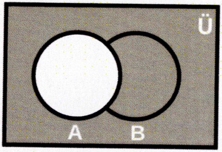
Operation between two sets

Venn Diagram	Properties

SYMMETRIC DIFFERENCE : $A \Delta B = (A-B) \cup (B-A)$



COMPLIMENT : $A^c = \{x : x \in Ü,\ x \notin A\}$



- $A \cup A^c = Ü$
- $A \cap A^c = \phi$
- $Ü^c = \phi$
- $\phi^c = Ü$

Representation: A^c or A' or $\bar{A}$

De-Morgan's Law

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

Laws of Sets

- $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
- $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C)$
- $n(A^c \cap B^c) = n(Ü) - n(A \cup B)$
- $n(A \cap B^c) = n(A) - n(A \cap B)$