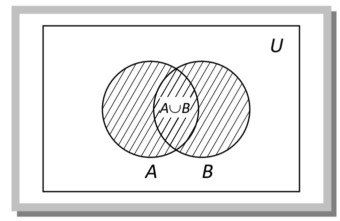
1. Operations on Sets.

(1) **Union of sets:**Let A and B be two sets. The union of A and B is the set of all elements which are in set A or in B. We denote the union of A and B by $A \cup B$



Which is usually read as "A union B".

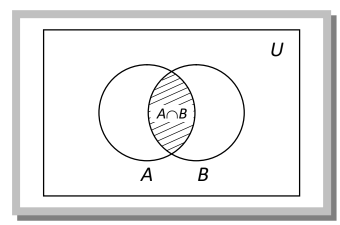
Symbolically, $A \cup B = \{x : x \in A \text{ or } x \in B\}$.

It should be noted here that we take standard mathematical usage of "or". When we say that x ∈ A or x ∈B we do not exclude the possibility that x is a member of both A and B.

Note: If $A_1, A_2, \ldots\ldots, A_n$ is a finite family of sets, then their union is denoted by $\bigcup_{i=1}^{n} A_i$ or

$A_1 \cup A_2 \cup A_3 \ldots\ldots \cup A_n$.

(2) **Intersection of sets:**Let A and B be two sets. The intersection of A and B is the set of all those elements that belong to both A and B.



The intersection of A and B is denoted by A ∩ B (read as "A intersection B")

Thus, A ∩ B = {x : x ∈ A and x ∈ B}.

Clearly, x ∈ A ∩ B ⇔ x ∈ A and x ∈ B.

In fig. the shaded region represents A ∩ B. Evidently A ∩ B ⊆ A, A ∩ B ⊆ B.

Note: If $A_1, A_2, A_3 \ldots\ldots, A_n$ is a finite family of sets, then their intersection is denoted by $\bigcap_{i=1}^{n} A_i$ or

$$A_1 \cap A_2 \cap A_3 \cap \ldots\ldots \cap A_n.$$

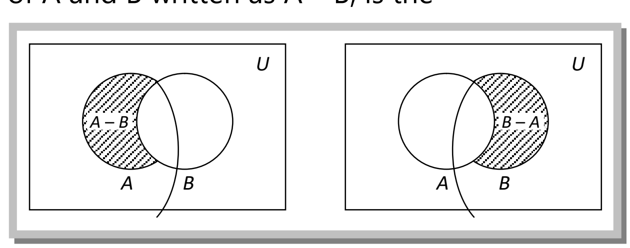
(3) **Disjoint sets:** Two sets A and B are said to be disjoint, if A ∩ B =ϕ. If A ∩ B ≠ϕ, then A and B are said to be non-intersecting or non-overlapping sets.

In other words, if A and B have no element in common, then A and B are called disjoint sets.

Example: Sets {1, 2}; {3, 4} are disjoint sets.

(4) **Difference of sets:**Let A and B be two sets. The difference of A and B written as A – B, is the set of all those elements of A which do not belong to B.

Thus, A – B = {x: x ∈ A and x ∉ B}



or $A - B = \{x \in A: x \notin B\}$

Clearly, $x \in A - B \Leftrightarrow x \in A$ and $x \notin B$. In fig. the shaded part represents A – B.

Similarly, the difference $B - A$ is the set of all those elements of B that do not belong to A i.e.

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

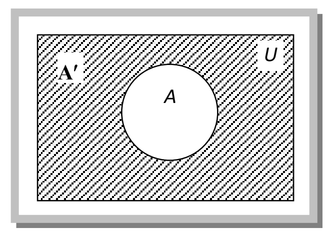
Example: Consider the sets $A = \{1, 2, 3\}$ and $B = \{3, 4, 5\}$, then $A - B = \{1, 2\}; B - A = \{4, 5\}$

As another example, $R - Q$ is the set of all irrational numbers.

(5) **Symmetric difference of two sets:** Let A and B be two sets. The symmetric difference of sets A and B is the set $(A - B) \cup (B - A)$ and is denoted by $A \Delta B$. Thus, $A \Delta B$ =

$(A - B) \cup (B - A) = \{x : x \notin A \cap B\}$

(6) **Complement of a set:** Let U be the universal set and let A be a set such that $A \subset U$. Then, the complement of A with respect to U is denoted by A′ or A^c or $C(A)$ or U – A and is defined the set of all those elements of U which are not in A.



Thus, $A' = \{x \in U: x \notin A\}$.

Clearly, $x \in A' \Leftrightarrow x \notin A$

Example: Consider $U = \{1, 2, ..., 10\}$ and $A = \{1, 3, 5, 7, 9\}$.

Then $A' = \{2, 4, 6, 8, 10\}$