Term: symmetric difference, n. (sets). The symmetric difference of sets A and B is the set of all elements of A or B which are not in both A and B. Symbolically,

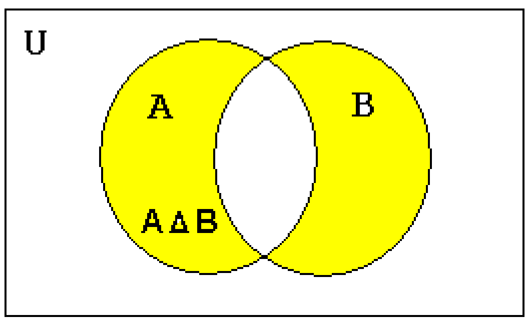
$$A \Delta B = \{x | (x \in A \wedge x \notin B) \vee (x \notin A \wedge x \in B)\}$$

Symbol: Δ (sets) symmetric difference

Notation: symmetric difference

The symmetric difference of two sets A and B i s denoted by Δ, e.g., {a, b} Δ {b, c} = {a, c}

Venn diagram:



Closure: symmetric difference_=`The set of sets is closed under symmetric difference. That is, the symmetric difference of two sets is a set.

Associativity: symmetric difference

Difference of sets **is** associative: that is, for all sets A, B, and C, (A Δ B) Δ C = A Δ (B Δ C)

Commutativity: symmetric difference

Symmetric difference of sets **is** commutative: that is, for all sets A and B, A Δ B = B Δ A

Identities: symmetric difference

The empty set, ∅, is a right identity for set difference. That is, for any set A, A Δ &empty = A

The empty set, ∅, is a left identity for set difference. That is, for any set A, & empty Δ A = A

Idempotency: symmetric difference

Sets are **not** idempotent under symmetric difference: that is, in general, for set A, $A \Delta A = \emptyset \neq A$

Notation: symmetric difference

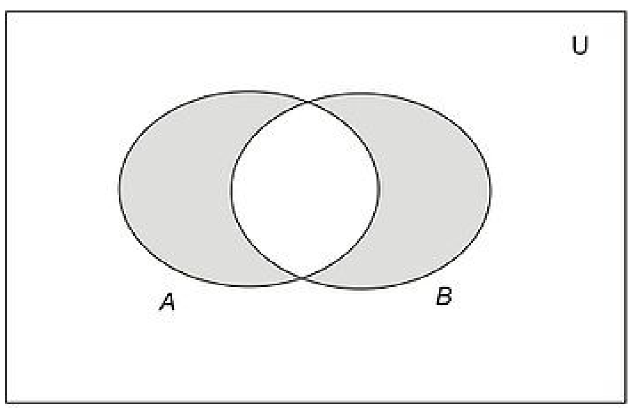
The symmetric difference of two sets A and B i s denoted by Δ, $\{a, b\} \Delta \{b, c\} = \{a, c\}$

Remarks:

- Symmetric difference is a binary operation.
- The symmetric difference is conceptually similar to the exclusive or operation.

Symmetric Difference of Sets:

The **symmetric difference of two sets** is the set of elements which are in one of the sets, but not in both. If **A** and **B** are two sets; the **symmetric difference of the sets A** and **B** is denoted by **A Δ B**



A Δ B

In the above figure the shaded region gives the **symmetric difference of the sets A** and **B.**

In set builder form the **symmetric difference of the sets A** and **B** is given by

$\{x / x \in A \cup B$ and $x \notin A \cap B\}$

For example consider two sets **A** and **B** where **A= {1, 2, 3, 4}** and **B = {2, 3, 6}** Here the elements **'2'** and **'3'** are present in both the sets, so the **symmetric difference of the sets A** and **B** is **{1, 4, 6}.**

The formula for **symmetric difference of two sets A** and **B** is,

$$A \Delta B = (A-B) \cup (B-A) \text{ OR } A \Delta B = (A \cup B) - (A \cap B)$$

<u>Properties of Symmetric Difference:</u>

a). Symmetric difference of the sets is commutative $A \Delta B = B \Delta A$

b). Symmetric difference of the sets is associative $(A \Delta B) \Delta C = A \Delta (B \Delta C)$

<u>Solved Example:</u>

1) **A= {1, 3, 5, 6, 7, 8}** and **B = {2, 3, 4, 6}**.Find the **symmetric difference of the sets A** and **B**.

A-B = **{1, 5, 7, 8}** and **B-A = {2, 4}**

$$A \Delta B = (A-B) \cup (B-A) = \{1, 5, 7, 8\} \cup \{2, 4\} = \{1, 2, 4, 5, 7, 8\}$$

<u>OR</u>

A∪ B = {1, 2, 3, 4, 5, 6, 7, 8} and **A∩ B = {3,6}**

AΔ B = (A∪ B) - (A∩ B) ={1,2,3,4,5,6,7,8} - {3,6} ={1,2,4,5,7,8}

Problems:

Q.1 A = {0, 1, 2, 3, 4} and B = {0, 2, 4, 6}. Find the symmetric difference of A and B.

Q.2 X = {a, b, c, d, e, f} and Y = {a, d, h}. Find the symmetric difference of X and Y.

Q.3 P = {1, 3, 5, 7}; Q = {2, 4, 6, 8} and R = {0, 1, 4}.Find A U (B Δ C).