

## ❖ Intersection of Sets :

→ The **intersection** of two or more sets contains all the elements that are in all sets.

→ For sets  $A$ ,  $B$ , their **intersection**  $A \cap B$  is the set containing all elements that are simultaneously in  $A$  and (“ $\wedge$ ”) in  $B$ .

→ Formally,  $\forall A, B: A \cap B = \{x \mid x \in A \wedge x \in B\}$ .

→ **Note** that  $A \cap B$  is a subset of  $A$  and it is a subset of  $B$ :  
 $\forall A, B: (A \cap B \subseteq A) \wedge (A \cap B \subseteq B)$ .

→ Formal definition for the intersection of two sets:  
 $A \cap B = \{x \mid x \in A \text{ and } x \in B\}$ .

### → Further Examples

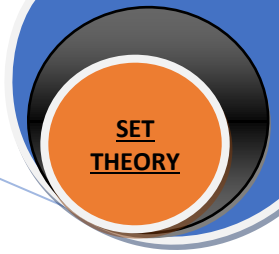
➤  $\{1, 2, 3\} \cap \{3, 4, 5\} = \{3\}$ .

➤  $\{\text{New York, Washington}\} \cap \{3, 4\} = \emptyset$ .  
No elements in common

➤  $\{1, 2\} \cap \emptyset = \emptyset$   
Any set intersection with the empty set yields the empty set

### • Properties of the intersection operation

- |   |                 |
|---|-----------------|
| ▪ $A \cap U = A$                          | Identity law    |
| ▪ $A \cap \emptyset = \emptyset$          | Domination law  |
| ▪ $A \cap A = A$                          | Idempotent law  |
| ▪ $A \cap B = B \cap A$                   | Commutative law |
| ▪ $A \cap (B \cap C) = (A \cap B) \cap C$ | Associative law |



## ❖ Disjoint of Sets:

- ➔ Two sets are disjoint if they have **NO** elements in common
- ➔ Formally, two sets are disjoint if their intersection is the empty set
- ➔ **Formal definition for disjoint sets:**  
Two sets are disjoint if their intersection is the Empty set.
- ➔ **Further Examples**
  - {1, 2, 3} and {3, 4, 5} are not disjoint
  - {New York, Washington} and {3, 4} are disjoint
  - {1, 2} and  $\emptyset$  are disjoint
- ➔ Their intersection is the empty set  $\emptyset$  **and**  $\emptyset$  are disjoint!  
Their intersection is the empty set
- ➔ Two sets **A, B** are called **disjoint** (*i.e.*, enjoined)  
if their intersection is empty. ( $A \cap B = \emptyset$ )
- ➔ Example: the set of even integers is disjoint with the set of odd integers.