Set Theory

1. Defining Sets:

Sets are typically defined in two ways:

- **Listing method:** Elements are enclosed in curly braces { } and separated by commas.
    - Example: A set of primary colors {red, green, blue}.
- **Descriptive method:** A property that all elements share is described within curly braces.
    - Example: The set of even numbers greater than 4 = {x | x is even and x > 4}. The symbol "|" here means "such that".

2. Relationships between Sets:

- **Equality:** Two sets are considered equal if they have exactly the same elements, regardless of order.
    - Example: {1, 2, 3} is equal to {3, 1, 2}.
- **Subset:** A set A is a subset of another set B (written as $A \subseteq B$) if all elements in A are also elements in B. B is called the superset of A.
    - Example: {1, 2} is a subset of {1, 2, 3}.
- **Proper Subset:** A proper subset (written as $A \subset B$) is when A is a subset of B, but A is not equal to B (A has fewer elements than B).
    - Example: {1, 2} is a proper subset of {1, 2, 3}.
- **Disjoint Sets:** Two sets are disjoint if they have no elements in common (their intersection is empty).
    - Example: {1, 2, 3} and {red, green, blue} are disjoint sets.

3. Set Operations:

Set theory defines operations to combine or manipulate sets:

- **Union (U):** The union of two sets A and B (written as A U B) includes all elements that are in either A or B, or both.
  - Example: {1, 2, 3} U {2, 4, 5} = {1, 2, 3, 4, 5}.
- **Intersection (∩):** The intersection of two sets A and B (written as A ∩ B) includes only the elements that are in both A and B.
  - Example: {1, 2, 3} ∩ {2, 4, 5} = {2}.
- **Difference (-):** The difference of two sets A and B (written as A - B) includes all elements that are in A but not in B.
  - Example: {1, 2, 3} - {2, 4, 5} = {1, 3}.

4. Special Sets:

- **Empty Set (Ø):** A set with no elements.
- **Universal Set (U):** A set that contains all elements under consideration in a specific context.