

DISCRETE MATHEMATICS

Meeting 4

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Definition

A set is a collection of distinct objects. Objects in a set are called elements, or members.

Example: HMIF is an example of a set that contains members in the form of students. Each student is different from the other.

Example of a Set

- A set of letters (uppercase and lowercase)
- The set of the first four natural numbers: $A = \{1, 2, 3, 4\}$
- The set of the first five positive even numbers: $B = \{4, 6, 8, 10, 12\}$
- Set of integers: $Z = \{\dots, -2, -1, 0, 1, 2, \dots\}$

Notation to express membership:

- $x \in A$: x is a member of the set A
- $x \notin A$: x is not a member of the set A

Example:

- If $A = \{1, 2, 3, 4\}$, then $3 \in A$
- If $R = \{a, b, \{a, b, c\}, \{a, c\}\}$, then $\{a, b, c\} \in R$ and $c \notin R$

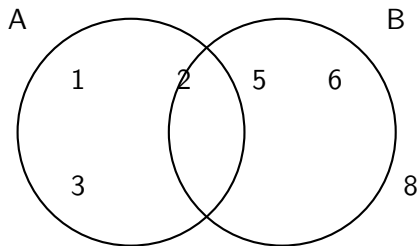
Standard Symbols

- P : The set of positive integers $\{1, 2, 3, \dots\}$
- N : The set of natural numbers $\{1, 2, \dots\}$
- Z : The set of integers $\{\dots, -2, -1, 0, 1, 2, \dots\}$
- Q : The set of rational numbers
- R : The set of real numbers
- C : The set of complex numbers
- U : The set of universals or universes

Example: Suppose $U = \{1, 2, 3, 4, 5\}$ and $A = \{1, 3, 5\}$, then $A \subseteq U$.

Venn diagram

Example: Suppose $U = \{1, 2, \dots, 8\}$, $A = \{1, 2, 3, 5\}$, and $B = \{2, 5, 6, 8\}$. Here is a Venn diagram depicting the relationship between A , B , and U :



Cardinality is the number of elements in a set. The cardinality notation of a set A is $n(A)$ or $|A|$. **Example:**

- $B = \{2, 3, 5, 7, 11, 13, 17, 19\}$, then $n(B) = 8$
- $T = \{\text{cat}, a, \text{Amir}, 10, \text{nail}\}$, then $n(T) = 5$
- $A = \{a, \{a\}, \{a\}\}$, then $n(A) = 3$

The empty set (null set) is the set that has no elements. Notation: \emptyset or $\{\}$.

Example:

- $E = \{x|x < x\}$, then $n(E) = 0$
- $P = \{\text{Indonesian people who have been to the moon}\}$, then $n(P) = 0$

A set A is said to be a subset of B if every element of A is an element of B . Notation: $A \subseteq B$.

Example: $A = \{1, 2, 3\}$ and $B = \{1, 2, 3, 4, 5\}$, then $A \subseteq B$.

Operations that can be performed on sets:

- Union (\cup): Combines two sets.
- Intersection (\cap): Finds the intersection of two sets.
- Difference ($-$): Subtracts a set from another set.
- Complement (\overline{A}): The set complement.

Also called properties of sets, or algebraic laws of sets:

- Commutative Law
- Associative Law
- Distributive Law
- Identity Law
- Law of Inversion