



4.4.2.2 Sets

Sets

A set is:

- An unordered collection of values
- With no duplicates

Examples:

- $C = \{1, 2, 3, 4, 5\}$
- $D = \{x \mid x \in \mathbb{N} \wedge x \geq 10\} = \{10, 11, 12, 13, 14, 15, \dots\}$
- $E = \{0^n 1^n \mid n > 1\} = \{0011, 000111, 00001111, 0000011111, \dots\}$

Finite Set

A set whose elements can be counted off by natural numbers up to a particular number.

Infinite Set

A set whose elements cannot be counted off by natural numbers up to a particular number.

Countably Infinite Set

A set whose elements can be counted off by natural numbers (but does not stop at a particular number).

Cardinality

The number of elements in a set.

Cartesian product of sets

A set of ordered pairs made up of the elements of two other sets.

Example: $A \times B$

$$A = \{1, 2, 3\}$$

$$B = \{4, 5\}$$

$$A \times B = \{(1, 4), (1, 5), (2, 4), (2, 5), (3, 4), (3, 5)\}$$





Subset

A subset is a set where every element is also contained within another set.

Example:

If $A = \{1, 2, 3\}$,

The subsets of A are $\{\}, \{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}, \{1, 2, 3\}$

If a set B is a subset of set A we write:

$$B \subseteq A$$

Proper Subset

A proper subset is a set where every element is contained within another set but at least one element is not.

Example:

If $A = \{1, 2, 3\}$,

The proper subsets of A are $\{\}, \{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}$

If a set B is a proper subset of set A we write:

$$B \subset A$$

Countable set

A countable set is a set with the same cardinality (number of elements) as some subset of natural numbers.





Set Operations

Membership

$\in$ is the symbol for membership. Read it as “is an element of”

Example:

$x \in \mathbb{Z}$ means x is an element of the integers

Union

$\cup$ is the symbol for union.

$A \cup B$ means all the elements that are in A , or in B , or both.

Example:

$$A = \{1, 2, 3\}$$

$$B = \{3, 4, 5\}$$

$$A \cup B = \{1, 2, 3, 4, 5\}$$

Intersection

$\cap$ is the symbol for intersection.

$A \cap B$ means all the elements that are in both A and B .

Example:

$$A = \{1, 2, 3\}$$

$$B = \{3, 4, 5\}$$

$$A \cap B = \{3\}$$

Difference

$\setminus$ is the symbol for difference.

$A \setminus B$ means all the elements that are in A but not in B .

Example:

$$A = \{1, 2, 3\}$$

$$B = \{3, 4, 5\}$$

$$A \setminus B = \{1, 2\}$$

