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1 Chapter 02 - Basic Structures

1.1 Sets

\in : belong to, is in

1.1.1 Definition 2

Two sets are equal if and only if they have the same elements. Therefore, if A and B are sets, then A and B are equal if and only if $\forall x (x \in A \iff x \in B)$. We write $A = B$ if A and B are equal sets.

1.1.2 Definition 3

The set A is also a subset of B , and B is a superset of A , if and only if every element of A is also an element of B . We use the notation $A \subseteq B$ to indicate that A is a subset of the set B . If, instead, we want to stress that B is a superset of A , we use the equivalent notation $B \supseteq A$. (So, $A \subseteq B$ and $B \supseteq A$ are equivalent statements.)

1.1.3 Definition 4

Let S be a set. If there are exactly n distinct elements in S where n is a nonnegative integer, we say that S is a finite set and that n is the cardinality of S . The cardinality of S is denoted by $|S|$.

1.1.4 Countable and Uncountable Sets

- Countable
 - \mathbb{N}

- \mathbb{Z}
- \mathbb{Q}
- Uncountable
 - \mathbb{R}
 - \mathbb{C}

Let $S_0 = \{x\}$, and $S_1 = \{\{x\}\}$.

$$S_0 \neq S_1 \tag{1}$$

1.1.5 Example

1. List the members of these sets.

a) $\{x \mid x \text{ is a real number such that } x^2 = 1\}$

$$S = \{x \in \mathbb{R} \mid x^2 = 1\}$$

b) $\{x \mid x \text{ is a positive integer less than } 12\}$

$$S = \{x \in \mathbb{R} \mid 0 \leq x < 12\}$$

1.1.6 Definition 6

Given a set S , the power set of S is the set of all subsets of the set S . The power set of S is denoted by $\mathcal{P}(S)$.

1.2 Set Operations

1.3 Functions

1.4 Sequences and Summations

1.5 Cardinality of Sets

1.6 Matrices