Set

A **set** is a collection of distinct,symbols in ordered objects. Sets are typically collections of numbers, though a set may contain any type of data (including other sets).The objects in a set are called the members of the set or the elements of the set.

A set should satisfy the following:

1) The members of the set should be distinct.(not be repeated)

2) The members of the set should be well-defined.(well-explained)

Contents

Set notation

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Sets are notated using french braces {,,, ,,, ,,, } with delimited by commas. There are three ways to represent a set.

- Roster Form - A set may be described by listing all its members and then putting curly brackets or braces { }. This is called *roster or tabular form.*It Can be stated in two ways:-

1. Strict enumeration - each element in a set is explicitly stated (e.g.,).
2. Pattern enumeration - sets with elements following a clear pattern can be shortened from strict enumeration by only showing enough elements to describe the pattern and representing the rest with an ellipsis (e.g., $\{1, 2, 3...10\}$).

- Set former (or set builder)- A set may be described as {xlx has property *p*}. This is called *rule method or set builder form.* Elements in a set are defined as a function of one or more variables in a given domain that meets a condition. The presence of a condition is optional. Some syntaxes and variations for a set former are as follows:
  - $\{\text{function} : \text{variable domain} \mid \text{condition}\}$ For example, $\{x : 1 \leq x \leq 10 | x \text{ is an integer}\}$ defines the set of integers 1 through 10.
  - $\{f(x) | P(x)\}$, given a function f and predicate P, the set of all values $f(x)$ for which $P(x)$ is true.
  - $\{x \in S | P(x)\}$, given a set and predicate P, a subset of all x in for which $P(x)$ is true.

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Several properties and operations have been defined for sets. For the purpose of this section, sets are assumed to be collections of numbers. Set P is defined as the set $\{1, 2, 3...10\}$.

Properties

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- An object is an *element* of a set when it is contained in the set. For example, 1 is an element of P. This is written as $1 \in P$. Similarly, the fact that 11 is not an element of P is written as $11 \notin P$. The *universe* (usually represented as) is a set containing all possible elements, while the *empty set* or *null set* (represented as $\varnothing$ or $\{\}$) is a set containing no elements.
- The number of (different) elements in a set is called the Cardinal Number of the set.Thus the *cardinality* of a set is the number of elements in the set. The cardinality of P (written as $\#P$ or $|P|$) is 10.The Carrdinal Number of a Null Set is 0, for an Infinite Set it is not defined and for a Singleton Set, it is 1.
- Two sets are called *equal* (written as A B) if they have the same elements.Two finite sets are *equivalent* if they have same number of elements. Thus *"All equal sets are equivalent. But all equivalent sets are not equal"* i.e. A B if n(A) = n(B).
- The *complement* of a set is the set containing all elements of the universe which are not elements of the original set. For example, if the universe is defined as $\{x : 1 \leq x \leq 20 | x \text{ is an integer}\}$, then the complement of P with respect to (written as P^c) is $\{11, 12, 13...20\}$. The cardinalities of a set and its complement together equal the cardinality of the universe. Thus, the universe and the null set are complements of each other.
- A set is a *subset* of another set when all the elements in the first set are also a member of the second set. Given sets A and B, A is a subset of B, notated as $A \subseteq B$, if and only if for all x, $x \in A$ implies $x \in B$. All sets are subsets of the universe. By definition, all sets are subsets of themselves and by convention, the null set is a subset of all sets. For example, $\{1, 2, 3\} \subseteq P$. Any given set has $2^{|S|}$ subsets.
- Set A is called *subset* of B if every element of A is also an element of B. We write it as AB (read as "A is a subset of B" or "A is contained in B"). In such a case, we say BA ("B is a *superset* of A" or "B contains A").
- Two sets are equal if they are subsets of each other.
- Set A is called a *proper subset* of set B if every element of A is element of B but there exists at least one element of B which is not an element of A.
- A set's *proper subsets* are all subsets except the set itself. This relationship is notated by $A \subset B$

Operations

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- The *union* of two sets is the set containing all elements of either A or B, including elements of both A and B. This operation is written as $A \cup B$. For example, $\{1, 2, 3\} \cup \{2, 3, 4\} = \{1, 2, 3, 4\}$.
- The *union* of sets A and B, written as AB, is the set consisting of all elements which belong to either A or B or both..
- The *intersection* of two sets is the set containing all elements of both A and B. This is written as $A \cap B$. For example, $\{1, 2, 3\} \cap \{2, 3, 4\} = \{2, 3\}$. The sum of the cardinalities of the intersection and union of two sets is equal to the sum of the cardinalities of the two sets.
- The *intersection* of sets A and B, written as AB is the set consisting of all the elements which belong to both A and B.
- n(AB) = n(A) +n(B) -n(AB).
- If A and B are two sets, then *difference* of A and B is the set A -B consisting of all the elements which are elements of A but are not elements of B.
- *Complement* of a set A, written as A' or A^C is the set consisting of all the elements of which do not belong to A.
  Thus A' = {x I x and xA}.
- In *Venn diagrams*, sets are represented by closed figures like rectangle, circle, oval. Elements of the set are shown as points inside this figure. Usually the universal set

is denoted by rectangle and its subsets by closed curves (circles etc.) within this rectangle.

Other functions on sets

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- The Power set of , denoted $\mathcal{P}\left(S\right)$, is the set containing all subsets of .
- The Cartesian product of R and , denoted $R \times S$, is the set of ordered pairs $\left(r, s\right)$ where $r \in R$ and $s \in S$. That is, $R \times S = \{\left(r, s\right) | r \in R \text{ and } s \in S\}$.
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Types of Sets

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- An *infinite set* has unlimited number of elements.
- A *finite set* has finite, countable number of elements.
- An *empty set or null set or void set* has no elements. It is written as { }.
- The *equal sets-'* **two sets are equal if they have the same elements.**
- Two sets are called *disjoint* if they have no elements in common.
- Two sets are called *overlapping* if they have some elements in common.
- A set that contains all the elements under consideration in a given problem is called *universal set*. It is written as U.

See also

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- Relation
- Function
- Tuple
- Multiset

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