Set Language and Notation

Set Language and its notation

A set is a collection of well-defined and distinct objects such as letters, numbers, people,etc

Greatest and Least Values of Subsets

Since the letter ‘a’ is an element of S = {a, e, i, o, u}, we write a ∈ S.
Since the letter ‘b’ is not an element of S, we write b ∉ S.
Since there are 5 elements in S, we write n(S) = 5
∈ denotes ‘ is an element of ’ and ∉ denotes ‘ is not an element of ’.
n(A) denotes the number of elements in set A

A set can be defined by

(a) listing its elements within braces, e.g. A = {1, 2, 3, 4},
(b) stating its characteristic in words, e.g. B = { : is a prime number},
In set-builder notation:

It says “the set of all ’s, such that is greater than zero”.

With the use of braces “{ }” which stand for the words “the set of”, the elements of a set may be specified in a few ways.
For example, the set of prime numbers less than 10 can be presented as
i. A = {2, 3, 5, 7}
or ii. B = { : is a prime number less than 10}
We use upper case letters to denote a set. Elements of a set may consist of upper case or lower case letters. We may also use lower case letters for variables representing elements of a set.

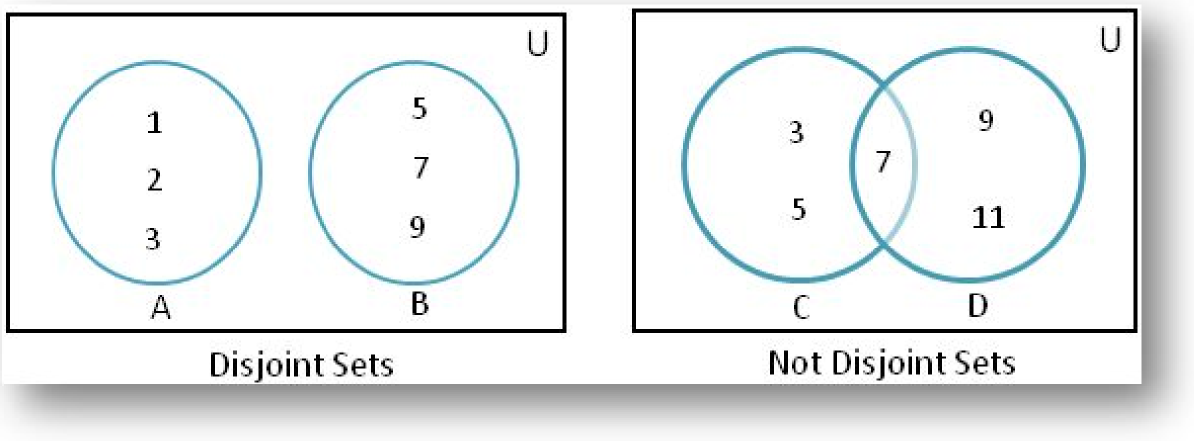
Some Definitions

A finite set is a set which contains a countable number of elements.
e.g. A = {months in the year with 31 days}
• An infinite set is a set which contains an uncountable number of elements.
e.g. B = {even numbers}
• The universal set ε is a set which contains all the available elements.
• The empty set or null set { } is a set which contains no elements.
e.g. C = { : is a real number and 2+ 1 = 0}

Equal sets

If two sets contain the exact same elements, we say that the two sets are equal sets.
E.g. Consider 3 sets, A = {1, 2, 3}, B = {3, 2, 1} and C = {a, b, c}.
A and B are equal sets but A and C are not equal sets.

Disjoint sets are sets with no common elements at all



A **Venn Diagram** is a diagrammatic representation of sets. It is commonly used to illustrate relationships among sets.

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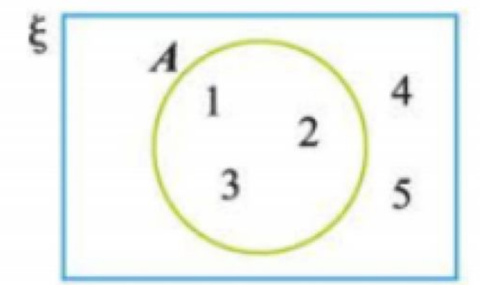


The rectangle represents the set of all the elements that are under consideration for this particular situation, i.e. {1, 2, 3, 4, 5}. This is called the **universal set** and is denoted by the symbol ξ (pronounced 'xi'), i.e. ξ = (1, 2, 3, 4, 5).

In the diagram, A = {1, 2, 3}.

Complement of a set contains elements belonging to the universal set but not belonging to another given set.

The complement of a set A is denoted by A'. That is: $A' = \{ x : x \in \xi$ and $x \notin A\}$

A rectangle is used to denote a universal set and circles or ovals to represent its subsets.

Subsets and Proper Subsets

P is a subset of Q if each element of P is also an element of Q.

If every element of B is also an element of A, B is said to be a subset of A.

- In symbols, we use the notation $B \subseteq A$.
- However, not every element in B can be found in C, thus $B \subseteq/ C$.
- By definition of subset, we find that $B \subseteq D$ and $D \subseteq B$.
- When this happens, the two sets are equal sets, or, B = D.
- In general, any set is a subset of itself.
- By definition, the empty set is a subset of any set.
- Therefore, $\subseteq A$, $\subseteq B$, $\subseteq C$ and $\subseteq D$.

Each element of B is also an element of A but A has at least one element not found in B.

We can be more specific and say that:

B is a proper subset of A, denoted by $B \subset A$, or $A \supset B$.

Notation	Examples
$\in$ means " is an element of "	$2 \in \{1,2,3,4\}$
$\notin$ means " is not an element of "	$2 \notin \{1,3,5\}$
$\cup$ means "union of set"	$\{1,2,3\} \cup \{3,4,8\} = \{1,2,3,4,8\}$
$\cap$ means "intersection of set"	$\{1,2,3\} \cap \{3,4,8\} = \{3\}$
$\subset$ means "subset of set"	$\{1,2,3\} \subset \{1,2,3,4,8\}$
$\supset$ means "superset of set"	$\{1,2,3,4,8\} \supset \{1,2,3\}$
$\not\subset$ means "not a subset of set"	$\{10,20,30\} \not\subset \{1,2,4,8\}$
$\varnothing$ or $\{\}$ denotes the empty set	

Intersection of Sets

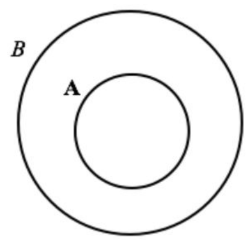
The intersection of sets A and B, is the set of elements which are common to both A and B. It is denoted by A∩B.

Union of Sets

The union of sets A and B is the set of elements which are in set A, or set B, or both set A and set B. It is denoted by A∪B.

Venn Diagrams

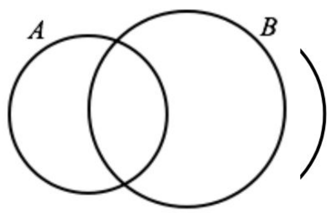
Using Venn diagrams to show relationships between sets



$A \subset B$
or
$A \cap B = A$
$n(A \cap B) = n(A)$

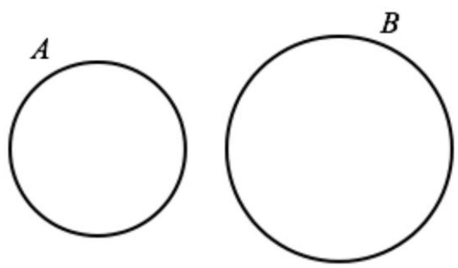
or

$A \cup B = B$
$n(A \cup B) = n(B)$



$A \cap B \neq \phi$

$n(A \cap B) > 0$



$A \subset B'$
$B \subset A'$

or

$A' \cap B = B$
$B' \cap A = A$

or

$A \cap B = \phi$
$n(A \cap B) = 0$

If it is given that B ⊆ A but the elements are not known, it is usual to represent the relation as B ⊂ A in the Venn diagram.