Sets

Set

A set is a group of an object. It is a collection of things usually numbers. It is also defined as the " well-defined collection of objects". It is related with many objects or things. It is a collection of object which is different in nature from something else of a similar type. The objects in the set are called its elements. Objects can be anything; numbers, people, words etc. A set which does not contain any element is called an empty set.

Examples of sets include:

Letters of English alphabet
Natural numbers less than 10
Five Places (Dharan, Biratnagar, Kathmandu, Butwal, Pokhara)

Notation

Notation	Definition
$\in$	Element of....
$\notin$	Not an element of....
$\subset$	Subset of....
$\not\subset$	Not a subset of....
$\subseteq$	A subset and equal to ...
$\cup$	Union (all together) 'OR'
$\cap$	Intersection (Overlap) 'AND'
A'	Not A
$\varnothing$	Empty set

Notation

Usually, Capital letter is used to denote set and the small letter is used to denote an element of sets. For example: set A ={p, q, r, s, t}. The symbol '$\in$' refers set membership and symbol '$\notin$' refers non-membership. For example:

In set: A = {a, b, c, d, e } and B= {f, g, h, i, j}, a $\in$ A and f $\notin$ A, it means, that the element 'a' belongs to set A but the element f does not belong to set A.

Specification

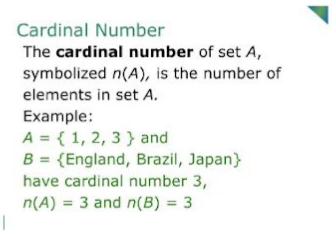
A set can be identified or membership of set can be point out in several ways. It is also the method to identify the sets and its elements.

Two common ways among them are:

1. **Listing or Tabulating Method**
   In this method elements of a set are listed, separated by commas and enclosed in braces.
   For example, V={a,e,i,o,u}

2. **Description or rule Method**
   In this method, a set is specified by enclosing in braces, descriptive phrases or a rule.
   For example, V = {letters of English alphabet} and N ={x:x is a natural number less than 10}, read as N is a set of all x such as x is a natural number less than 10.

Cardinal number of Set



Cardinal number of set

The number of elements in a set is called its cardinal number. For example: if a = {a,b, c, d, e} then, the cardinal number of A is 5 and we write n(A) = 5.

Finite and Infinite Set

A set having finite numbers of elements is called a finite set. For example: A = {1, 2, 3, 4} is a finite set. An infinite set is a set having infinite numbers of elements. For example: B = {1, 2, 3, 4............} is an infinite set.

Singleton Set

Some of the set have only one element, the set having only one element is called Singleton set. For example:

C= {x : x is president of America} is a single set.

Null Set

A set with no element is called the null set or empty set and is denoted by Φ (phi) or simply{ }. For example, the set of all prime numbers between 3 and 5 is a null set. The cardinal number of the null set is Zero.

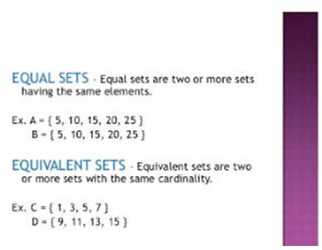
Intersecting Set

The two sets, having, at least, one element common is said to be intersecting sets. For example; {3, 4, 5} and {5, 6, 7} are intersecting sets as number 5 is common to both sets.

Disjoint Set

The two sets, having no common elements are said to be disjoint sets. For example: {a ,b, c} and {1 ,2, 3, 4} are disjoint sets as they have no common elements.

Equivalent Set



Example for equivalent sets and equal set

The two sets having a same number of elements are said to be equivalent sets. For example: if A = {p, q, r} and B = {1, 2, 3} then A and B are equivalent sets as n(A) = n (B).

Equal Set

Two sets are said to be equal if both the sets have same elements.

For example: If C = {2, 3, 4} and D= {2, 3, 4} then C = D.

Subset

A set which lies between another set (element of any set lies in another set).

For example;

P ={ 1, 2, 3} and Q = {1, 2, 3, 4, 5}

We say that P is the subset of Q since every element of P is in Q. This is denoted by $P \subset Q$. In this case $P \neq Q$. We say that P is a proper subset of Q.

Given: A = {1, 2, 3} and B = {2, 3, 4, 5, 6}, what is the relationship between these sets?

We can say A is not a subset of B since $A \not\subseteq B$.

The statement "A is not a subset of B" is denoted by $A \not\subset B$.

It helps to show the relationship between these sets.

Given,

P = {1, 2, 3, 4, 5} and Q = {3, 1, 2, 4, 5}, what is the relationship between P and Q?

Recall that the order in which the elements appear in a set is not important. Looking at the elements of these sets, it is clear that:

$P \subset Q$

$Q \subset P$

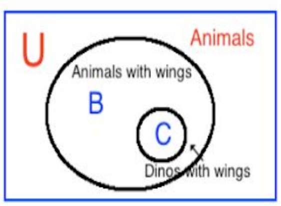
$\therefore P = Q$

Thus, for any set, if $P \subset Q$ and $Q \subset P$, then P = Q. In this case, we say that P is improper subset of Q and we write $P \subseteq Q$.

What are the differences between proper and improper sets?

Proper subsets contain some elements but not the elements of the original set. An improper subset contains every element of the original cost.

Universal Set



Example for universal sets

A un.iversal set is a set which contains all the sets under consideration as its subsets.

A universal set is denoted by U. For example, If A = {6, 7, 8}, B = {1, 2, 3, 5, 7} and C = {4, 6, 8, 10} then the universal set of these sets may be taken as {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

Note that the given sets, the choice of the universal set is not unique. For example, let A = {2, 4, 6, 7}, B = {3, 5, 7, 9} and C = {0, 4, 8, 12, 16} be the given sets. We can choose any of the following as a universal set:

$\{x : x \in W\ x \leq 16\}$

or, $\{x : x \in W\}$

or, {x : x is an integer} etc.