Relations: Basics

In our daily life we come across many patterns that characterises relations such as brother and sister, teacher and student, mother and daughter.
In mathematics also we come across many relations such as number X is less than number Y, line l is parallel to line m and a is equal to b . In all this we noticed that a relation involves pairs of objects in certain order.
All these pair of objects from two sets of objects introduces relations in mathematics. Some special relations in mathematics quality to be functions.

The concept of function is very important in mathematics since it captures the idea of a mathematically precise correspondence between one quantity with the other.

Cartesian product of sets

Suppose A is a set of two colours and B is a set of three objects

A = {pink, green}
B = {bag, coat, shirt}
How many pairs of coloured objects can be made from these two sets?

Proceeding in a very orderly manner we can see that there will be six distinct figures as given below

(pink, bag), (pink, coat), (pink, shirt),
(green, bag), (green, coat), (green, shirt)

And ordered pair of elements taken from any to set PNQ is a pair of elements written in small brackets and grouped together in a particular order
i.e; (p,q) , $p \in P$ and $q \in Q$

Definition:-

Given the non-empty sets P and Q. The Cartesian product P X Q is the set of all ordered pairs of elements from P and Q

$P \times Q = \{ (p,q) : p \in P \text{ and } q \in Q \}$

* if either P or Q is the Null said then P X Q will also be empty set
i.e; $P \times Q = \phi$

* consider to set $A = \{a_1, a_2, a_3, a_4\}$
$B = \{b_1, b_2, b_3, b_4\}$

Then A X B = {(a_1,b_1) , (a_1,b_2) ,(a_1,b_3) ,(a_1,b_4)
(a_2,b_1) ,(a_2,b_2), (a_2,b_3) ,(a_2,b_4) }

Rule :- if there are p elements in set A and q elements in set B then there are pq elements in
A X B.

Relations :- A relation R from a non-empty set A to a non-empty set B is a subset of the Cartesian product A X B.

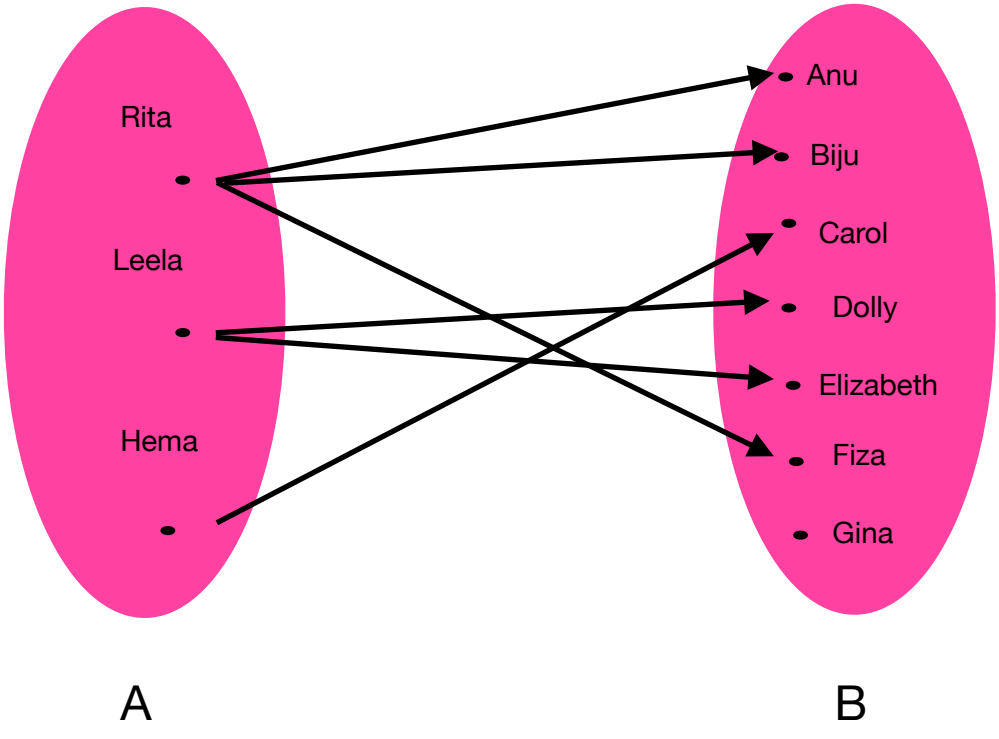
The subset is derived by describing a relationship between the first element and the second element of the ordered pairs in A X B. the second element is called the image of the first element.

Real life example of relations

Consider a set of mothers
A = {Rita , Leela , Hema}

And a set of children
B = {a,b,c,d,e,f,g}
A = Anu, b = Biju, c = Carol, d = Dolly, e = Elizabeth, f = Fiza, g = Gina

Anu, Biju and Fiza are children of Rita.
Karol is daughter of Hema.
Dolly and Elizabeth are daughters of Lila.
There relation can be depicted as such



Domain : The set of all first elements of the ordered pairs in a relation are from a set A to a set B is called the domain of the relation R.

Co - Domain and Range : The set of all second elements in a relation R from a set A to a set B is called the range of relation R.

The whole set B is called the Co - domain of the relation R. Note that range $\subseteq$ Co - domain .