NAKUL PANDIT
PGT (MATHS)

RELATIONS

INTRODUCTION:

Consider the sets

$A = \{\text{Kolkata, Ranchi, Chandigarh}\}$

$B = \{\text{Punjab, Jharkhand, Haryana, Bihar, WB.}\}$

Clearly, the elements of the set A are cities and the elements of set B are states of India.
Now,

$$A \times B = \begin{Bmatrix} (\text{Kolkata, Punjab}), (\text{Kolkata, Jharkhand}), \ldots (\text{Ranchi, Punjab}), (\text{Ranchi, Jharkhand}), \ldots \\ (\text{Chandigarh, Punjab}), (\text{Chandigarh, jharkhand}), \ldots \end{Bmatrix}$$

If we write **R** to denote the relation "is the capital of ", then the relationship between the elements of A and B can be written as follows:

Kolkata **R** WB , Ranchi **R** Jharkhand, Chandigarh **R** Punjab, Chandigarh **R** Haryana.

Now, if we omit the letter **R** and express the above facts as ordered pair, then we get

$R = \{(\text{Kolkata, WB}), (\text{Ranchi , Jharkhand}), (\text{Chandigarh, Punjab}), (\text{Chandigarh, Haryana})\}$

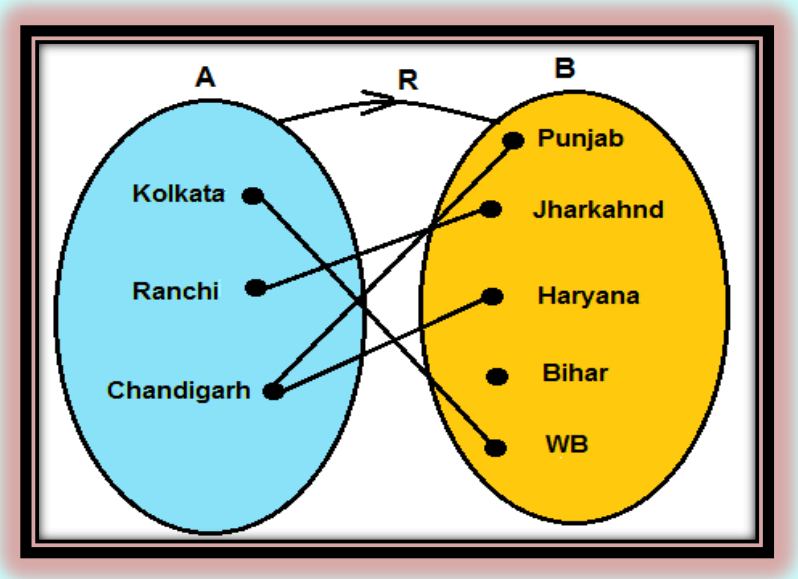
Clearly, $R \subset A \times B$

Thus we see that the relation "is the capital of " from the set A to set B gives rise to a sub set **R** of $A \times B$ such that

$R = \{(a, b): a \in A, b \in B \text{ and } a \ \mathbf{R} \ b\}$

Where **R** means "is the capital of "

Arrow Diagram:



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RELATION

Definition: "A *relation R from a set A to the set B is a sub set of* $A \times B$."

In other words

$R \text{ is a relation from set } A \text{ to } B \iff R \subset A \times B.$

Note:

(i) Every subset of A × B is a relation from set A to set B.

(ii) If $(a, b) \in$ R , then we write $a\mathrm{R}b$. Which is read as "*a is related to b by the relation* ***R***"

DOMAIN, CODOMAIN AND RANGE OF A RELATION

Let R be a relation from set A to the set B. Then

The set of all first components or coordinates of the ordered pairs belonging to R is called the **domain** of R and the set of second components or coordinates of ordered pairs in R is called the **range** of R.

Thus,

$\text{Domain(R)} = \{a: (a, b) \in \text{R}\}$

$\text{Range(R)} = \{b: (a, b) \in \text{R}\}$

$\text{Codomain(R)} = \text{Set B}$

In the earlier example,

$\text{Domain(R)} = \{\text{Kolkata, Ranchi, Chandigarh}\}$

$\text{Range(R)} = \{\text{Punjab, Jharkhand, Haryana, WB}\}$

$\text{Codomain(R)} = \{\text{Punjab, Jharkhand, Haryana, Bihar, WB.}\}$