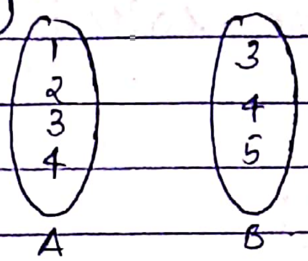
RELATIONS ⇒

Let A and B are two non-empty sets. Then the relation R from $A \to B$ will be a subset of cartisean product $A \times B$ ~~ua~~
$R \subseteq A \times B$ under some rules.

Eg (1) :



Let there be two sets A and B defined by the relation $(x, y) \to \{x < y\}$.

Then $R = \{(1,3)(1,4)(1,5)(2,3)(2,4)(2,5)(3,4)$
$(3,5)(4,5)\}$.

DOMAIN OF RELATION Domain/Dom(R) d(R)

Set of all first coordinate of relation
Here Dom (R) = $\{1, 2, 3, 4\}$

RANGE Ra(R), r(R).

Set of second coordinates of R
$r(R) = \{3, 4, 5\}$

RELATION ON A

If R is a relation from set A to itself, it is called relation on A
$A \times A = A^2$

NOTES:

- If A is a non-empty set then $\phi \in A \times A$ is a void or empty relation on A.
- ϕ is the smallest relation and $A \times B$ is the largest relation.
- Both ϕ and $A \times B$ are called trivial relations.

INVERSE RELATION:

If R is a relation from $A \to B$.
i.e $R = \{(a,b) : a \in A \text{ and } b \in B\}$.

then $R^{-1} = \{(b,a) : b \in B \text{ and } a \in A\}$.

If $R = \{(2,x), (3,y) (5,3)\}$

$R^{-1} = \{(x,2) (y,3) (3,5)\}$.

COMPLEMENT OF A RELATION: $(\overline{R})$

It is a set of all ordered pairs which do not belong to the relation.

i.e $\overline{R} = A \times B - R$

Eq ⇒ From eq ①
$\overline{R} = \{(3,3) (4,4) (4,3)\}$.

REPRESENTATION OF RELATIONS.

(i) ROASTER METHOD →

All the elements (ordered pairs) of the relation are enclosed within the brackets

Eg $R = \{(2,x)(3,y)(5,z)\}$.

2) MATRIX METHOD →

$A = \{a_1\ a_2 ------, a_m\}$

$B = \{b_1, b_2, -------, b_n\}$.

$R = [(a_i\ b_j)]_{m \times n}$

where $M_{ij} = 0$ if $(a_i\ b_j) \notin R$.

$= 1$ if $(a_i\ b_j) \in R$.

Eg: 2:

$A = \{1, 2, 3\}$

$B = \{x, y, z\}$

$R = \{(1,y)\ (1,z)\ (3,y)\}$

$$\begin{array}{c|ccc} & x & y & z \\ \hline 1 & 0 & 1 & 1 \\ 2 & 0 & 0 & 0 \\ 3 & 0 & 1 & 0 \end{array}$$

3) ADJACENCY MATRIX M_R

4) TABULAR FORM

	x	y	z
1		✓	✓
2			
3		✓	

Q. Define a relation for the adjacency matrix

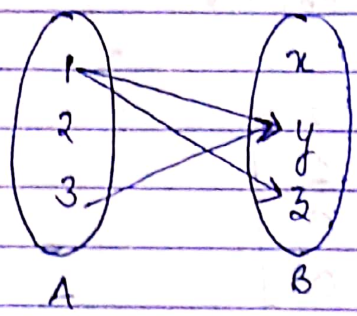
$$M_R = \begin{array}{c} \\ a \\ b \\ c \end{array}\begin{array}{c} \begin{array}{cccc} 6 & 7 & 8 & 9 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

$R = \{(a,6)\ (a,9)\ (b,7)\ (b,8)\ (c,6)\ (c,8)\}$.

1) ARROW DIAGRAM→

The elements of sets A and B are written into ~~djoint~~ disjoint plane figures (circles, triangles) and then arrows are drawn from x to y if $x \to y$

Eg: 2

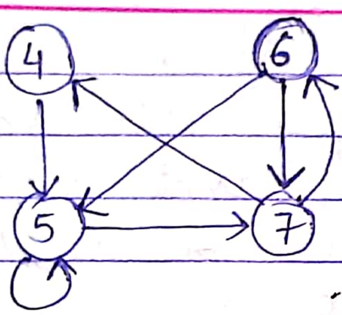


2) DIAGRAPH OF A RELATION ON SET

When a relation is from finite set A to itself.

$A = \{4,5,6,7\}$

$R = \{(4,5)\ (5,5)\ (5,7)\ (6,5)\ (6,7)\ (7,4)\ (7,6)\}$



(only when the elements are related to itself).