MCA CET 2025

MATHS

SET RELATION FUNCTION

PART 2

H.W

① if $A = \{1, 2, 3, 4\}$ & $B = \{2, 3, 5\}$

identify the correct relation, among the following from A to B, given by xRy, if and only if $x < y$.

a) $R = \{(1,1), (1,3), (2,2), (2,3)\}$

b) $R = \{(3,2), (3,3), (3,4), (3,5)\}$

c) $R = \{(1,2), (1,3), (2,3), (2,5)\}$

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

(2) The relation $R = \{(1,1), (2,2), (3,3), (1,2), (2,3), (1,3)\}$ on set $A = \{1, 2, 3\}$ is ______

a) reflexive, transitive but not symmetric

b) reflexive, symmetric but not transitive

c) symmetric, transitive but not reflexive

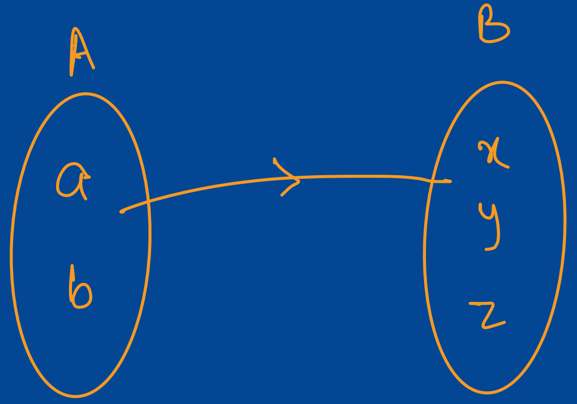
d) reflexive, but neither symmetric nor transitive

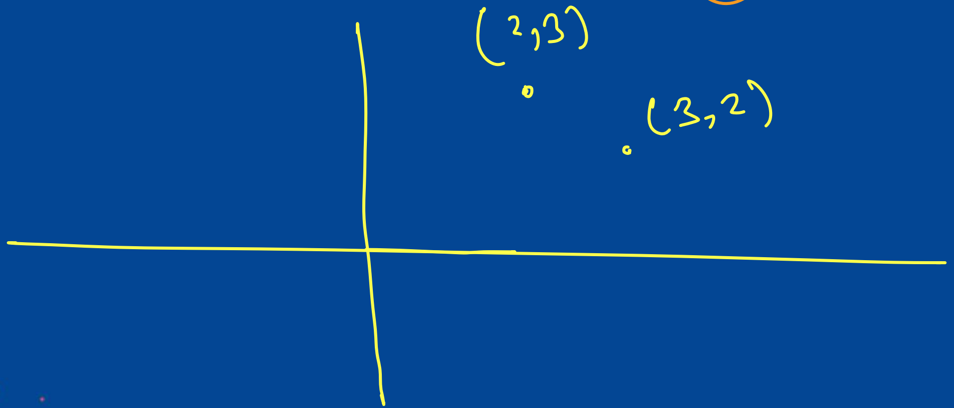
Relation

A relation from non empty set A to a non empty set B is a subset of cartesian product $A \times B$.

Ordered pair

(a,x) & (x,a)

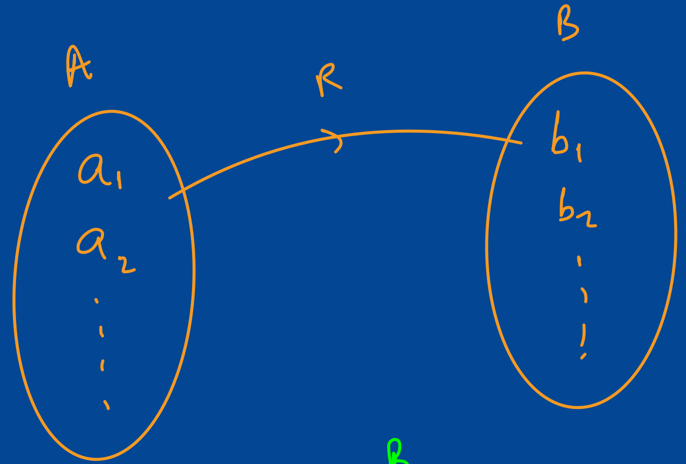




$A \times B = \{(a,x),(a,y),(a,z),(b,x),(b,y),(b,z)\}$

=

$\boxed{\text{Relation} = \text{connection}}$

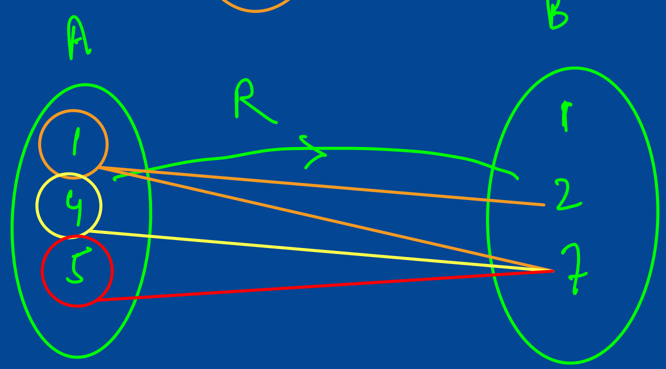


$\{(a_1, b_1), \; - - -$

image of a_1

R = set of ordered pair in which 1st element is less than the 2nd element.

eg:-



Soln $R = \{(1,2), (1,7), (4,7), (5,7)\}$

Roaster form

$(a,b) \longrightarrow aRb$

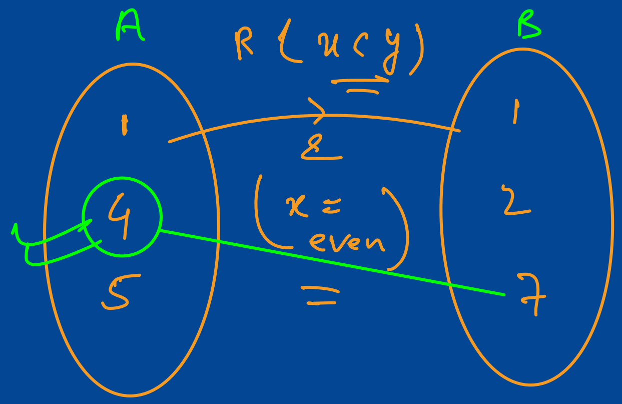
Set builder form

$R = \{(x,y) : x \in A, y \in B, x < y\}$

Domain of Relation

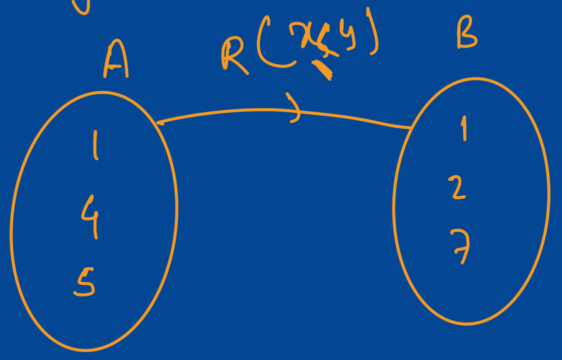
→ The set of all 1st element of the ordered pairs in a relation R from a set $A \to B$ is called domain of the Relation R.

→ Domain of Relation is either equal to or subset of set of 1st elements.



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

Range & Co-domain of Relation



$R = \{(1,2), (1,7), (4,7), (5,7)\}$

$R_1 \rightarrow x \leq y$

$= \{(1,1)\ (1,2)\ (1,7), (4,7), (5,7)\}$

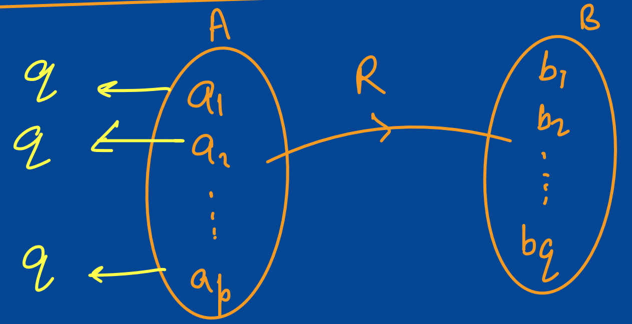
→ The set of all second elements in relation R from set A → B is called range of relation R.

→ The whole set B is called the co-domain of the relation R.

→ Range is either equal to or subset of set of second elements

* $\boxed{\text{Range} \subseteq \text{co-domain.}}$

Number of relations



$n(A) = p$

$n(B) = q$

total number of relation $= 2^{pq}$

$$A \times B = \{ \underline{q + q + q + \dots p \text{ times}} \}$$

$$= p \cdot q$$

$$n(A \times B) = p \cdot q$$

$$\begin{Bmatrix} (a_1, b_1), & (a_1, b_2), & (a_1, b_3) & \dots & (a_1, b_q), \\ (a_2, b_1), & (a_2, b_2), & (a_2, b_3) & \dots & (a_2, b_q), \\ \vdots & & & & \\ (a_p, b_1), & (a_p, b_2), & (a_p, b_3) & \dots & (a_p, b_q) \end{Bmatrix}$$

$\Rightarrow$ all elements have 2 options either to include or exclude in the subset.

$\therefore$ Total number of subset

$= 2 \times 2 \times 2 \times 2 \times \dots pq \text{ times}$

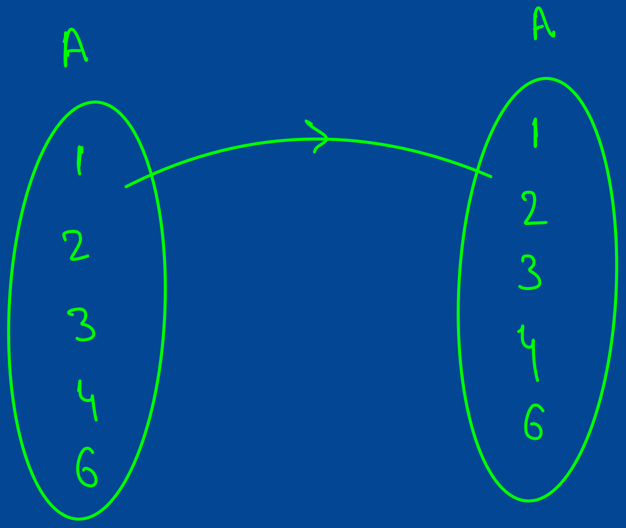
$= \underline{\underline{2^{pq}}}$

eg:- $A = \{1, 2, 3, 4, 6\}$

Let R be the relation on A defined by

$\{(a, b) : a, b \in A,\ a \text{ is exactly divisible by } b\}$

Sol^n



$R = \{(1,1), (2,1), (3,1), (4,1), (6,1), (2,2), (4,2), (6,2), (3,3), (6,3), (4,4), (6,6)\}$

$R_2 = (x, y) : x, y \in A$ and $x+y$ is divided by 1

$R_1 \Rightarrow \{(x, y) : x, y \in A,\ x+y \text{ divisible by } 13\}$

$1+1 = 2$ X

$6+6 = 12$ X

$R_1 = \{\ \} \Rightarrow$ empty set.

Types of Relation

① Empty Relation

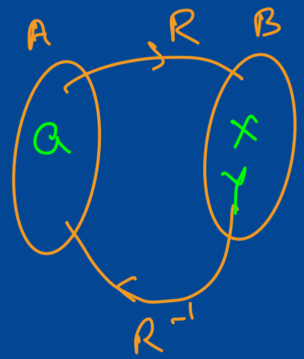
↳ if no element of A is related to any element of B. i.e $R = \phi$

$\phi \subset A \times B$.

② Universal Relation

↳ if each element of A is related to every element of B. i.e $R = A \times B$.

③ Inverse Relation (R^{-1})



↳ R be relation from $A \to B$ then inverse of R (R^{-1}) is a relation from $B \to A$.

④ Identity Relation (I_A)

↳ If every element of A is related to itself only.

$$I_A = \{(a,a) : a \in A\}$$

eg:- $A = \{1, 2, 3\}$

$I_A = \{(1,1), (2,2), (3,3)\}$

$I_1 = \{(1,1), (2,2)\}$ $\quad$ $I_3 = \{1,1\}$ → Identity Relation ✗

$I_2 = \{(2,2), (3,3)\}$

5 Reflexive relation

↳ if $(a,a) \in R$, $\forall\ a \in A$.

eg :- $A = \{1, 2, 3\}$

$R_1 = \{(1,1), (2,2), (3,3)\ (1,3)\ (1,2), (2,1)\}$ ✓ Reflexive

$R_2 = \{(1,1)\ (1,3)\ (1,2)\} \longrightarrow$ Reflexive ✗

** I_A is always reflexive

6 Symmetric Relation

↳ if $(a_1, a_2) \in R$ then (a_2, a_1) also belongs to R

$\forall \; a_1, a_2 \in A$.

eg:- A = set of Natural Number.

$R_1 = (x, y) : x, y \in A \;\&\; x + y = 5$

$R_1 = \{(1,4), (2,3), (3,2), (4,1)\}$ → Symmetric Relation

$R_2 = \{(x,y) : x, y \in A \;\&\; x \text{ is divisor of } y\}$

$= \{(1,1), (1,2), (1,3) \ldots$
$(2,2)\ (2,4)\ (2,6) \ldots$
$(3,3)\ (3,6)\ (3,9) \ldots\}$

Symmetric ✗

7 Transitive Relation

↳ if $(a_1, a_2) \in R$ and $(a_2, a_3) \in R$ then (a_1, a_3) also belongs to R $\forall$ $a_1, a_2, a_3 \in A$.

eg:— A = Set of Natural Number.

$R = (x, y) : x, y \in A$ & $x < y$.

$\{ (1, 2), (2, 5), (1, 5) \} \longrightarrow$ Transitive.

(8) Equivalence Relation

↳ If relation R is reflexive, symmetric & transitive then relation R is equivalence relation.

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