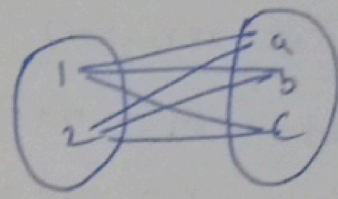
part-1

Relation

Relations are derived from Cartesian product.

A = {1, 2}

B = {a, b, c}.



A×B = { (1,a), (1,b), (1,c),
(2,a), (2,b), (2,c) }

Definition
Let. A & B are two nonempty set, then relation 'R' from A to B is a subset of (A×B)

$\boxed{R \subseteq A\times B}$

Example of relation

→ Exp → A = {1, 2}
B = {1, 2, 3}

R_1 = {(1,1), (1,3), (2,1), (2,2)}

← 'R_1' is a relation for A & B or not ?

Find out all subset & check whether all the values of 'R_1' is ~~Rxxs~~ present or not.

→ all subset → { (1,1), (1,2), (1,3)
(2,1), (2,2), (2,3) }

* So we can called 'R_1' is relation for A & B

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→ $R_{max} = A \times B$

→ $R_{min} = \{\phi\}$, (empty set)

$$\boxed{\text{Total no of relation} = 2^{m \cdot n}}$$

when $m =$ no of element of set 'A'

$n =$ no of element of set 'B'.

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

$B = \{2, 3, 4\}$

The Max^m no of relations => $2^{2 \cdot 3} = 2^6 = \cancel{32}\ 64$.

Types of relations < Reflexive / Irreflexive.

① Reflexive.

Let 'R' be a Relation in set 'A'. Then 'R' is called Reflexive relation if $(a, a) \in R$ for all $a \in A$

↳ where $a =$ elements of set 'A'.

Exp $A = \{1, 2, 3, 4, 5\}$

$a = 1, = 2, = 3, = 4, = 5$

Let say I have 2 sets

(not reflexive) but not (5,5) ((2,2))

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

$R_2 = \{(1,1), (1,2), (2,2), (3,3), (4,4), (5,5)\}$

↳ Reflexive

$R_3 = \{\phi\}$ ✗ (no)

$R_4 = \{A \times A\}$ (reflexive)

↳ all elements are inside of.

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(ii) Irreflexive Relation

Relation 'R' on a set is said to be irreflexive if

$a \in A$, $\not\exists$ $(a,a) \in R$.

-> It can also called as antireflexive relation.

$A = \{1,2,3,4\}$

R_1

$\{(1,2),(1,3)$
$(2,2),(2,4)\}$
X

as one (a,a) type value is here.
So it can not be irreflexive Relation.

R_2

no (a,a)

$\{(3,4),(3,2),(2,1),(1,2)\}$

So it is a irreflexive relation

* For this above example if any value like (a,a) is present i.e $\{(1,1),(2,2),(3,3),(4,4)\}$ then it is not called irreflexive Relation.

$R_1 = \{\phi\}$ ✓ irreflexive relation.

$R_2 = \{A \times A\}$ X not an irreflexive relation

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Part-4

(a) Symmetric relation:

Let 'R' be a relation on set 'A'.

Then 'R' is said to be symmetric relation.

If $(a,b) \in R \Rightarrow (b,a) \in R$.

$xRy = yRx$

Exp $A = \{1,2,3,4\}$

$R_1 = \{(1,2),(2,1),(3,4),(4,3)\}$ ← symmetric

$R_2 = \{(1,3),(3,1),(3,4),(4,4)\}$ ← (x)

→ $(A \times A)$ is a symmetric relation.

$A \times A$ →

$(1,2,3)\ (1,2,3)$

$\{(1,1),(1,2),(1,3)$
$(2,1),(2,2),(2,3)$
$(3,1)(3,2),(3,3)$

$R_3 = \{(1,1),(2,2),(3,3),(4,4)\}$

(symmetric)

Antisymmetric

A relation 'R' on a set 'A' is said to be anti-symmetric

If $(a,b) \in R$ & $(b,a) \in R$, then $a=b$,

Exp $A = \{1,2,3,4\}$

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

a b

$a=b$

3) Can a relation be symmetric & anti symmetric both?

YES

$A = \{a, b, c\}$

$R_1 = \{(a,a), (b,b), (c,c)\}$

If $(a,b) \in R$, $(b,a) \in R$ So symmetric.

If $(a,b) \in R_1$, $(b,a) \in R_1$ then $a = b$ So also anti'symmetric.

ⓒ Asymmetric Relation

A relation R on a set 'A' is said to be Asymmetric relation

If $(a,b) \in R \Rightarrow (b,a) \notin R$

$A = \{1, 2, 3, 4\}$

$R_1 = \{(1,2), (2,3), (3,1), (4,3)\}$ ← Asymmetric.

$R_2 = \{(1,2), (2,1), (2,3), (4,3)\}$

× → not an asymmetric.

Exp

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

a b

So it is not an asymmetric.

$a, b \in R$

$b, a \in R$

Exp

$R = A \times A$ ← no Asymmetric.

$R = \phi$ (Empty set). ← it is an Asymmetric.