

RUNNING NOTES

Sets & relations

Teacher's handwritten notes, typed

IN THESE NOTES

Cartesian product of two Sets

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Cartesian product of two Sets

let $A = \{1, 2, 3\}$, $B = \{a, b\}$

Consider $\{(1, a), (1, b), (2, a), (2, b), (3, a), (3, b)\}$

This set is called the cartesian product of given A, B. It is denoted by $A \times B$ (Read it as A cross B)

Def : If A, B are two sets then the set of all order pairs (a, b) such that

$a \in A$, $b \in B$ is called the cartesian product of A, B. It is denoted by $A \times B$

$$\therefore A \times B = \{(a, b) : a \in A, b \in B\}$$

Ex : $A = \{x, y, z\}$, $B = \{a, b\}$

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

Note If $n(A) = m$, $n(B) = n$

then $n(A \times B) = mn$

→ No. of elements in $A \times B$.

■ Def : Relation from A to B

let $A = \{1, 2, 3\}$, $B = \{x, y\}$

then $A \times B = \{(1, x), (1, y), (2, x), (2, y), (3, x), (3, y)\}$

Consider $R_1 = \{(1, x), (2, x), (3, y)\}$ is a relation from A to B

$R_2 = \{(1, x), (3, x)\}$ is also a relation from A to B

Def : If A, B are two nonempty sets then every subset of $A \times B$ is a relation from A to B.

Note : If $n(A) = m$, $n(B) = n$ then

$$n(A \times B) = mn$$

Now number relations from A to B

$$= \text{No. of possible subsets of } A \times B$$

$$= 2^{mn}$$

Note : If $(a, b) \in R$ then it can be written aRb

■ Def : void relation (or) Null relation

$\varnothing \subseteq A \times B$, so $\varnothing$ is also a relation from A to B. This relation $\varnothing$ is called null relation (or) void relation.

■ Def : Universal relation :

$A \times B \subseteq A \times B$, so $A \times B$ is also a relation from A to B and it is called universal relation.

■ Domain and Range of a relation

If R is a relation from A to B then

(i) Domain of $R = \{a \in A : aRb \text{ exists for } b \in B\}$

(ii) Range of $R = \{b \in B : aRb \text{ exists for } a \in A\}$

Ex $A = \{1, 2, 3\}$, $B = \{a, b\}$

$A \times B = \{(1, a), (1, b), (2, a), (2, b), (3, a), (3, b)\}$

Let $R_1 = \{(1, a), (2, a)\}$

Domain of $R_1 = \{1, 2\}$, Range of $R_1 = \{a\}$

■ Inverse relation :

let $A = \{1, 2, 3\}$, $B = \{a, b\}$

and $R_1 = \{(1, b), (3, b)\}$

then inverse relation of $R_1 = R_1^{-1}$

$= \{(b, 1), (b, 3)\}$