

## Unit-2

### Relation $\rightarrow$

Set  $\rightarrow$  well defined collection of element

$$N = \{1, 2, 3, 4, 5, \dots\}$$

$$A = \{a, e, i, o, u\}$$

favourite cricketers / movie / singer / player  
 $\rightarrow$  not well defined

Cartesian product of sets  $\rightarrow$  let A and B be two sets.

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

$\downarrow$  ordered pairs

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

$$n(A) = 3$$

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

$$n(B) = 3$$

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

$$n(A \times B) = 9$$

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

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

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$$A \times B \neq B \times A$$

$$(a, 1) \neq (1, a)$$

### Relation $\rightarrow$

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

$$B = \{1, 4, 9\}$$

$$R \rightarrow x^2$$

$$1 \xrightarrow{x^2} 1$$

$$2 \xrightarrow{x^2} 4$$

$$3 \xrightarrow{x^2} 9$$

$$1R1, 2R4, 3R9$$

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

$$\begin{array}{ccc} 2 & x & 4 \\ 3 & x^2 & 9 \end{array}$$

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

$$\underline{A \times B} = \{(1,1), (1,4), (1,9), (2,1), (2,4), (2,9), (3,1), (3,4), (3,9)\}$$

Relation is a subset of the Cartesian product  $A \times B$ .

$\phi$  is a subset of  $A \times B$

The no. of relations from a set  $A = \{1, 2\}$  to  $B = \{4, 5\}$

- (a) 2      (b) 4      (c) 16      (d) None of these.

No. of Relation from  $A$  to  $B$  = No. of subsets in  $A \times B$

$$n(A \times B) = n(A) \cdot n(B) \\ = 2 \cdot 2 = 4$$

$$\text{No. of subsets} = 2^n = 2^4 = \underline{16}$$

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

$$B = \{4, 5\}$$

$$R_1 = \phi \checkmark$$

$$R_2 = \{(1,4)\} \checkmark$$

$$R_3 = \{(1,5)\} \checkmark$$

$$R_4 = \{(2,4)\} \checkmark$$

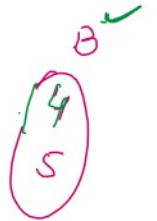
$$R_5 = \{(2,5)\} \checkmark$$

$$R_6 = \{(1,4), (2,4)\}$$

$$R_7 = \{(1,5), (2,5)\}$$

$$R_8 = \{(1,4), (2,5)\}$$

$$R_9 = \{(1,5), (2,4)\}$$



$$\underline{A \times B} = \left\{ \begin{array}{c} (1,4) \\ \downarrow \\ a \end{array} \right\} \left\{ \begin{array}{c} (1,5) \\ \downarrow \\ b \end{array} \right\} \left\{ \begin{array}{c} (2,4) \\ \downarrow \\ c \end{array} \right\} \left\{ \begin{array}{c} (2,5) \\ \downarrow \\ d \end{array} \right\}$$

③  $A = \{a, b, c, d\}$

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①  $A = \{a, b\}$

$$\textcircled{3} \quad A = \{a, b, c, d\}$$

Subsets  $\phi, A$

$\{a\}, \{b\}, \{c\}, \{d\}$

$\{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{b, d\}, \{c, d\}$

$\{a, b, c\}, \{b, c, d\}, \{c, d, a\}, \{d, a, b\}$

$$\textcircled{1} \quad A = \{a, b\}$$

Subsets  $\rightarrow \phi, A, \{a\}, \{b\}$

$$\textcircled{2} \quad A = \{a, b, c\}$$

Subsets

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

How many relations are there on a set with 3 elements?

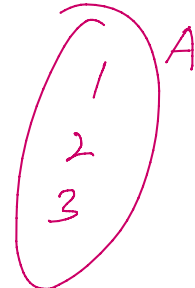


512

$$R: A \rightarrow A.$$

$$R: 3 \rightarrow 3$$

$A \rightarrow$  Contains 3 elements



Relation  $\rightarrow$  Subset of  $A \times B$

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

$$= \frac{n(A \times B)}{2} = \frac{n(A) \cdot n(B)}{2} = \frac{3 \cdot 3}{2} =$$

$$= 2^9 = \underline{\underline{512}}$$