

lecture 10:-

RELATIONS.

تعليقات

REVISION OF SET RELATED CONCEPTS.

Set $\rightarrow \{ \}$ \rightarrow Syntax.
 \rightarrow Collection of Distinct Objects. \rightarrow Semantics.

$\{ \text{Tomato, Potato, Okra, Mango} \}$.

$\{ \text{Tomato, Potato, Okra, Mango, } \underline{\text{Okra}} \}$ \rightarrow Semantics.

$[\text{Tomato, Potato, Okra}] \rightarrow$ Syntax.

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

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

CARDINALITY:- $|A| \rightarrow$ Syntax.
 Number of element in a Set.

$|A| = 3$ $|B| = 2$.

Subset:- \subseteq Syntax.

$A \subseteq B$ that every element of A should be in Set B.

$\{ a, b, c \} \not\subseteq \{ c, b, d \}$.

Power Set:- $\text{pow}(A) \rightarrow$ Syntax.
 All possible subsets of a Set.

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

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

$\text{pow}(A) = \{ \emptyset, \{ 1 \}, \{ 2 \}, \{ 3 \}, \{ 1, 2 \}, \{ 2, 3 \}, \{ 1, 3 \}, \{ 1, 2, 3 \} \}$.

$\text{pow}(B) = \{ \emptyset, \{ a \}, \{ b \}, \{ a, b \} \}$.

$$|\text{pow}(A)| = 2^{|A|} = 2^3 = 8.$$

MULTIPLICATION

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

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

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

$$|A \times B| = |A| \times |B|$$

CLASS 6 (MATHS).

$A = \emptyset = \{ \}$.

$$|\text{pow}(A)| = 2^{|A|} = 2^0 = 1.$$

$\text{pow}(A) = \{ \emptyset \}$.

CLASS 4 (MATHS).

$-15 \div 4 = ?$

$$|A \times B| = |A| \times |B| \\ = 3 \times 2 = 6.$$

CLASS 4 (MATHS) -
 $-15 \div 4 = ?$

$\text{Pow}(A) =$ Sets.
 $A \times B =$ tuples.
 $A =$ Singletons.

RELATIONS.

BINARY RELATIONS:- Two sets A & B .
 A binary relation from A to B
 is a subset of $A \times B$.
 $A = \{1, 2, 3\}$. $B = \{a, b\}$.

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

$$|\text{Pow}(A \times B)| = 2^{|A \times B|} = 2^{|A| \times |B|} = 2^{3 \times 2} = 2^6 = 64.$$

$$\text{Pow}(A \times B) = \{ \emptyset, \{(1, a)\}, \{(1, b)\}, \{(2, a)\}, \{(2, b)\}, \dots \\ \{(1, a), (1, b)\}, \{(1, a), (2, a)\}, \\ \vdots \\ \}.$$

Do it yourself.

$$|A| = 3$$

$$|B| = 2.$$

$$|A \times B| = 6.$$

$$|\text{Pow}(A \times B)| = 64.$$

$$|A| = 5$$

$$|B| = 4.$$

$$|A| = n$$

$$|B| = n.$$

$$P460 :- B \times 3.$$

$$A = \{0, 1, 2\}$$

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

$$\{(0, a), (0, b), (1, a), (2, b)\}.$$

$$P461 :- B \times 4.$$

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

$$R = \{(a, b) \mid a \text{ divides } b\}.$$

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

a divided by b .

$$\frac{a}{b}$$

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

a divided by b.

$$\frac{a}{b}$$

a divides b

$$\frac{b}{a}$$

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

1) Reflexive

2) Symmetric

3) Antisymmetric

4) Transitive

Reflexive: R defined on A.

$$\forall a \in A (a,a) \in R$$

$$\mathbb{Z} \times \mathbb{Z} - \text{UGA}$$

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

$$\begin{array}{c} \text{T} \\ \hline (1,1) \in R \wedge (2,2) \in R \\ \hline (3,3) \in R \wedge (4,4) \in R \\ \hline \text{T} \end{array}$$

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

$$R_2 = \emptyset$$

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

R3

!

R6

2

?

Do it at home...

W) & Lini