Lecture 14 :- $A = \{1,2\}$.

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

$|A| = n$. $|A \times A| = |A \times A| = n \times n = n^2$.

$|A \times A \times A| = |A| \times |A| \times |A| = n \times n \times n = n^3$.

Binary $R \subseteq A \times A$. Total Possible Relations $= 2^{n^2}$

Ternary $R \subseteq A \times A \times A$. $= 2^{n^3}$

4-Ary $R \subseteq A \times A \times A \times A$. $= 2^{n^4}$.

Ex 1 :- 469

$R \subseteq N \times N \times N$.

$R = \{(a,b,c) \mid a < b < c\}$.

$1 < 2 < 3$ ✓.

$(1,2,3) \in R$ ✓.

$a \; b \; c$.

$(2,4,3) \notin R$.

$a \; b \; c$.

Ex 2 :- 469

$R \subseteq Z \times Z \times Z$.

$R = \{(a,b,c) \mid b = a+k, \; c = a+2k\}$. $k \in Z$.

$(1,3,5) \in R$.

$a \; b \; c$.

$3 = 1+k$. $\quad k = 2$.

$5 = 1+2.2$.

$5 = 1+4$.

$5 = 5$ ✓.

$(2,5,9) \notin R$.

$a \; b \; c$.

$5 = 2+k$ $\quad k = 3$.

$9 = 2+2.3$.

$9 = 2+6$.

$9 \neq 8$.

Ex 3 :- 469

$R \subseteq Z \times Z \times Z^+$.

$R = \{(a,b,m) \mid a \equiv b \bmod m\}$.

$(8,2,3) \in R$ ✓.

$8 \equiv 2 \bmod 3$.

$(-1,9,5) \in R$

?

$3 \overline{)2}$ 0, ± 0, 2.

$3 \overline{)8}$ 2, ± 6, 2.

$(14,0,7) \in R$. ? HW $(7,2,3) \in R$ HW $(7,2,3) \in R$. ? HW. $(-2,-8,5) \in R$? HW.

Ex4:- R 5-Ary Relation. $A \times N \times S \times D \times T$.

(PIA, PK363, PW, KHI, 12:noon).

A = Set of Airlines.
N = Set of Flight Numbers.
S = Set of Starting Points.
D = Set of Destinations.
T = Set of Departure times.

REPRESENTING RELATIONS.

MATRICES [] Square brackets. Rows, Columns.

$A = \{a_1, a_2, a_3, \ldots, a_m\}$. $B = \{b_1, b_2, \ldots b_n\}$.

R $A \times B$.
R will have tuples of the form (a_i, b_j) $a_i \in A$, $b_j \in B$.

$M_R = [m_{ij}]$. Rows = $|A|$, Col = $|B|$.

$$m_{ij} = \begin{cases} 1 & \text{if } (a_i, b_j) \in R. \\ 0 & \text{if } (a_i, b_j) \notin R. \end{cases}$$

m_{12}.

Ex1 / 476 :- $A = \{1,2,3\}$. (a_1, a_2, a_3) $B = \{1,2\}$. (b_1, b_2).

R $A \times B$.
$R = \{(2,1), (3,1), (3,2)\}$. Represent Using Matrices.

$M_R = \begin{bmatrix} m_{11} & m_{12} \\ \cdots & \cdots \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ \cdots & \cdots \end{bmatrix}$

$$M_R = \begin{bmatrix} m_{11} & m_{12} \\ m_{21} & m_{22} \\ m_{31} & m_{32} \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ HW & HW \\ HW & HW \end{bmatrix}$$

Era :-

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$$= \begin{bmatrix} - & - \\ - & - \\ - & - \end{bmatrix}_{3\times 2}$$

|A| = 3 |B| = 2.

[ ] |x| .