lecture 12:- Properties of Relation Inside Matrices.

R $\quad A \times B$ $\quad A = \{a_1, a_2, a_3 \ldots a_m\}$.

$B = \{b_1, b_2, b_3, \ldots b_n\}$.

M_R

Rows = $|A|$

Col = $|B|$

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

1) Reflexive: $\forall a_i \in A \quad (a_i, a_i) \in R$

$\forall i \quad m_{ii} = 1$.

$[\ ]$ ✓ $\quad [1]$ ✓ $\quad [0]$ X. $\qquad A = \{1, 2\}$.

$A \times A = \{ \quad \}$.

X $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ X $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ X $\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ X $\begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$ X $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$

X $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$ X $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$ ✓ $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ X $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ X $\begin{bmatrix} 0 & 1 \\ 0 & 1 \end{bmatrix}$ X $\begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$

X $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$ ✓ $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ ✓ $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ X $\begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$ ✓ $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

Symmetric $\quad \forall a_i, b_j \in A \quad$ if $(a_i, b_j) \in R \rightarrow (b_j, a_i) \in R$.

$\forall i, j \quad$ if $m_{ij} = 1 \rightarrow m_{ji} = 1$.

$[\ ]$ ✓ $\quad [0]$ ✓ $\quad [1]$ ✓

✓ $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ ✓ $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ X $\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ X $\begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$ ✓ $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$.

- - - - Hw.

$M_R^T = M_R$ Symmetric Property.

Anti Symmetric $\forall a_i, b_j \in A$ if $(a_i, b_j) \in R \wedge (b_j, a_i) \in R \rightarrow \underset{i=j}{a=b}$

$\forall i j$ if $m_{ij} = 1 \wedge m_{ji} = 1 \rightarrow i = j$

$[\;]$ ✓ $[0]$ ✓ $[1]$ ✓

$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ ✓ $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ ✓ $\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$ ✓

$\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ - - - - -

$\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ X

Transitive. (Leave for Now).

$\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$

```
AS = T;
M(n,m) = zeros(0).
for i=1: i<=n : ++i {
    for j=1: j<=m : ++j
    {
        if (i≠j) {
```

if $M(i,j) = 1$ && $M(j,i) = 1$
{ AS = False
Break; }

}

3.

Ex4 Taking Union & Intersection.
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$$M_{R_1} = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \qquad M_{R_2} = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \end{bmatrix}$$

$$M_{R_1 \cap R_2} = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Quiz # 5

Let $A = \{2, 6, 15, 4, 20\}$.

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

a). Determine R.

b). Tell us if R is

b.1). Reflexive.

b.2) Symmetric.

b.3) Antisymmetric.