

0	0	1	0	0	1	0	0	0	1
0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	1	0	0	0
1	1	0	0	0	0	1	1	0	0

1	0	0	0	0	1	0	0	0	0
0	1	0	0	0	0	1	0	0	0
0	0	1	0	0	0	0	1	0	0
1	1	0	0	0	0	0	1	0	0

0	0	1	0	0	0	0	0	0	1
0	0	1	0	0	0	0	1	0	0
0	0	0	1	0	0	0	0	1	0
1	1	0	0	0	0	1	0	0	0

1	0	0	0	0	0	1	0	0	0
0	1	0	0	0	0	0	1	0	0
0	0	1	0	0	0	0	0	1	0
1	1	0	0	0	0	0	1	0	0

0	0	1	0	0	0	0	0	0	1
0	1	0	0	0	0	0	0	1	0
0	0	1	0	0	0	0	1	0	0
1	0	0	0	0	0	1	0	0	0

1	0	0	0	0	0	0	1	0	0
0	1	0	0	0	0	0	1	0	0
0	0	1	0	0	0	0	0	1	0
1	1	0	0	0	0	1	0	0	0

0	0	1	0	0	0	0	0	0	1
0	0	1	0	0	0	0	1	0	0
0	0	0	1	0	0	0	0	1	0
1	0	0	0	0	0	1	0	0	0

BIJECTIVE

- IS THERE ANY  $f: A \rightarrow B | R \subseteq f$ ?  $M(f) \leq M(R)$

$$M(f) = \begin{vmatrix} 0 & 0 & 0 & 0 \\ 0 & * & 0 & 0 \\ 0 & 0 & 0 & 0 \\ * & 0 & 0 & 0 \end{vmatrix}$$

2<sup>ND</sup> AND 4<sup>TH</sup> ROW DO NOT  
PERMIT IT TO BE  
A FUNCTION

c)  $A = \{1, 2, 3\}$   $B = \{1, 2, 3, 4\}$   $R: A \rightarrow B$

$$M(R) = \begin{vmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 \end{vmatrix}$$

- R IS NOT A FUNCTION. 1<sup>ST</sup> AND 3<sup>RD</sup> ROW HAVE 2 "1"s

- IS THERE ANY  $f: A \rightarrow B | R \subseteq f$ ?  $M(R) \leq M(f)$

$$M(f) := \begin{vmatrix} 1 & * & 1 & * \\ * & 1 & * & * \\ * & 1 & * & 1 \end{vmatrix}$$

IT CAN'T BE A FUNCTION  
BECAUSE OF 1<sup>ST</sup> AND  
3<sup>RD</sup> ROW

- IS THERE ANY  $f: A \rightarrow B | R \subseteq f$ ?  $M(f) \leq M(R)$

$$M(f) := \begin{vmatrix} * & 0 & * & 0 \\ 0 & * & 0 & 0 \\ 0 & * & 0 & * \end{vmatrix} =$$

$$\begin{vmatrix} * & 0 & * & 0 \\ 0 & 1 & 0 & 0 \\ 0 & * & 0 & * \end{vmatrix}.$$

THERE ARE 4  
DIFFERENT  $f \subseteq R$ :

$$\left| \begin{array}{cccc} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{array} \right| . \left| \begin{array}{cccc} 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{array} \right| ,$$

$$\left| \begin{array}{cccc} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{array} \right| . \left| \begin{array}{cccc} 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{array} \right|$$

WE CAN CLASSIFY THEM:

- 1) NEITHER INJECTIVE NOR SURJECTIVE
- 2) NEITHER INJECTIVE NOR SURJECTIVE
- 3) INJECTIVE, NOT SURJECTIVE
- 4) SURJECTIVE, NOT INJECTIVE