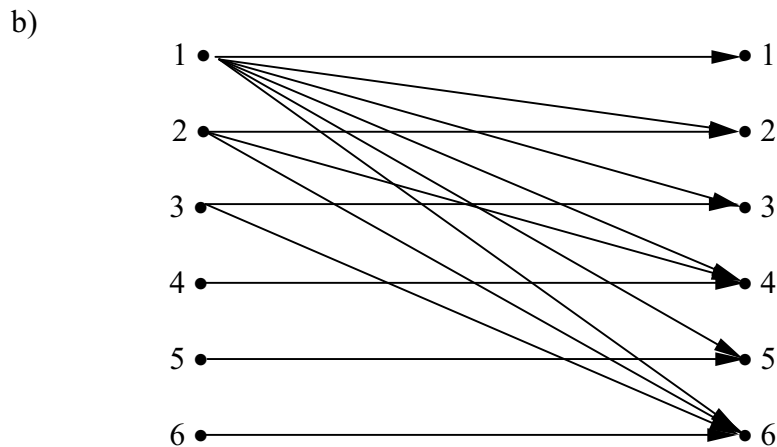# Tutorial Sheet 10
(Answers)

1.   a)   (1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 2), (2, 4), (2, 6), (3, 3), (3, 6), (4, 4), (5, 5), (6, 6).

    b)

    c)

R	1	2	3	4	5	6
1	X	X	X	X	X	X
2		X		X		X
3			X			X
4				X		
5					X	
6						X

2.   a) $\{(1, 1), (1, 2), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3), (3, 4)\} = R_2$
    b) $\{(1, 2), (2, 3), (3, 4)\} = R_2$
    c) $\varnothing$
    d) $\{(1, 1), (2, 1), (2, 2), (3, 1), (3, 2), (3, 3)\}$

3.   a) $\begin{pmatrix} 1 & 1 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$ b) $\begin{pmatrix} 0 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ c) $\begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}$ d) $\begin{pmatrix} 0 & 0 & 1 \\ 0 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix}$

4.   a)   Since the $(1, 1)^{th}$ entry is a 1, (1, 1) is in the relation. Since $(1, 2)^{th}$ entry is 0, (1, 2) is not in the relation. Continuing in this manner, we see that the relation contains (1, 1), (1, 3), (2, 2), (3, 1), and (3, 3).
    b)   (1, 2), (2, 2), and (3, 2).
    c)   (1, 1), (1, 2), (1, 3), (2, 1), (2, 3), (3, 1), (3, 2), and (3, 3).