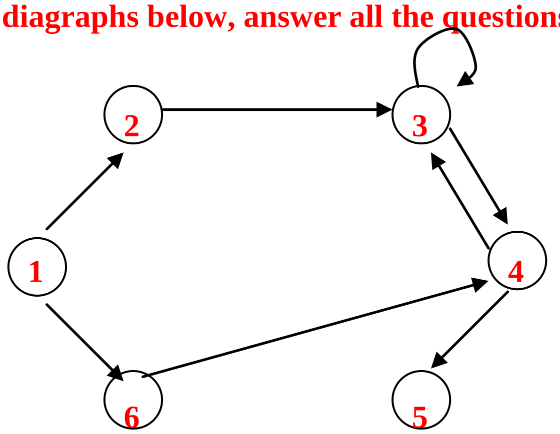
TUTORIAL8: RELATIONS

1. Change the matrices on set A below into set and diagraph. Then read the in-degree and out-degree.

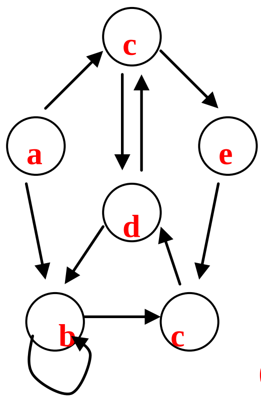
a) A = {1, 2, 3, 4} and $M_R = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

b) A = {a, b, c, d, e} and $M_R = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$

2. From the diagraphs below, answer all the questions.



(a)



(b)

a) **Change diagraph (a) into set.**
b) **Change diagraph (b) into matrix.**
c) **Draw the digraph of R^2 for (a).**
d) **Find $M_R{}^2$ for (b).**

3. **Consider relations on set A = {1, 2, 3, 4}. Determine either the relation is reflexive, irreflexive, symmetric, asymmetric, antisymmetric and/or transitive?**

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

R_2 = {(1, 1), (1, 2), (2, 1)}

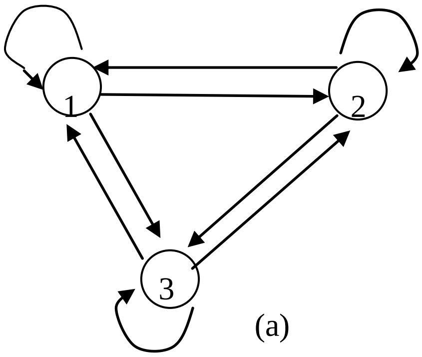
R_3 = {(1, 1), (1, 2), (1, 4), (2, 1), (2, 2), (3, 3), (4, 1), (4, 4)}

R_4 = {(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)}

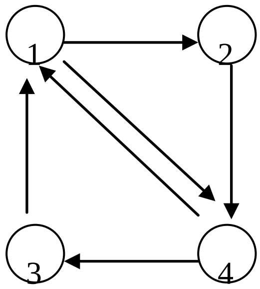
R_5 = {(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)}

R_6 = {(3, 4)}

4. From the diagraphs below, determine either the relation is reflexive, irreflexive, symmetric, asymmetric, antisymmetric and/or transitive?



(a)



(b)

5. From the matrices below, determine either the relation is reflexive, irreflexive, symmetric, asymmetric, antisymmetric and/or transitive?.

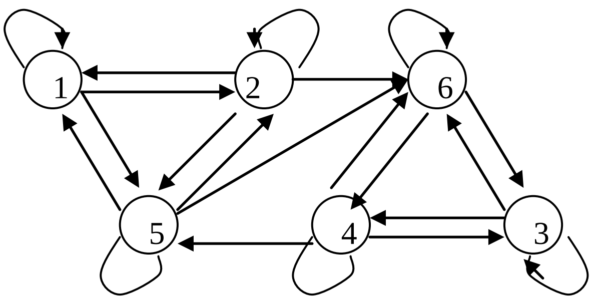
a) $\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$ b) $\begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

6. Given A = {a, b, c}. Determine either R is an equivalence relation or not.

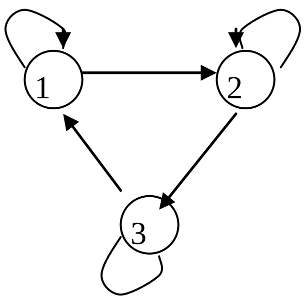
a) $M_R = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$ b) $M_R = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

7. In diagraphs below, determine either R is an equivalence relation or not.

a)



b)



8. In relations on sets A = B = {1, 2, 3} below, find:

a) $R \cap S$ b) $R \cup S$ c) S^{-1}

d) R^{-1} e) $\overline{R}$ f) $\overline{S}$

g) $S \circ R$ h) $R \circ S$ i) $R \circ R$

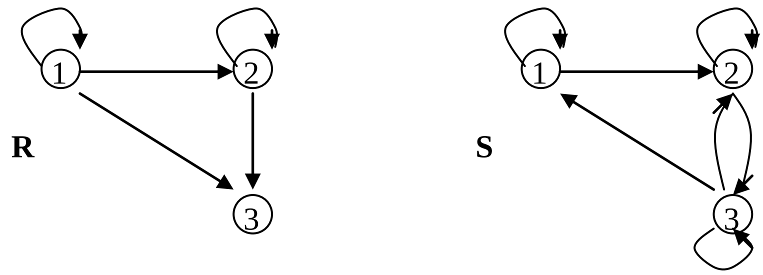
i) **R** = {(1, 1), (1, 2), (2, 3), (3, 1)}; **S** = {(1, 2), (2, 1), (3, 1), (3, 2), (3, 3)}.

ii) **R** = {(1, 1), (2, 1), (3, 2), (3, 3)}; **S** = {(1, 1), (1, 2), (2, 1), (2, 2)}

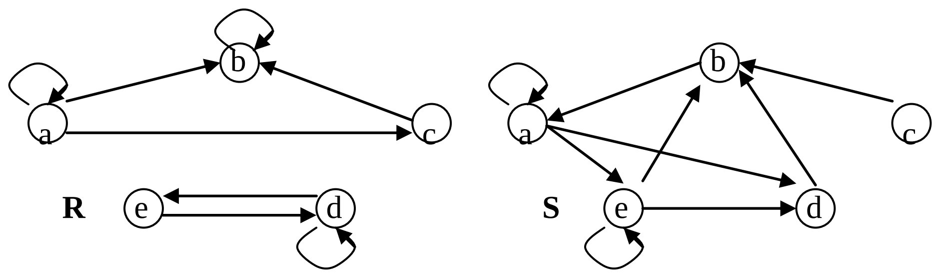
iii) A = B = {1, 2, 3, 4}

$$M_R = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \qquad M_S = \begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

iv)



v) A = B = {a, b, c, d, e}



9. Let A = {1, 2, 3, 4}. R is given by matrices R and S below. Find the transitive closure by using Warshall Algorithm.

a) $M_R = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix}$ b) $M_R = \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 \end{bmatrix}$