A = $\{a_1, a_2, a_3\}$ - number of rows = $|A|$

B = $\{b_1, b_2, b_3, b_4, b_5\}$ - number of columns = $|B|$

R = ?

	b_1	b_2	b_3	b_4	b_5
a_1	0	1	0	0	0
a_2	1	0	1	1	0
a_3	1	0	1	0	1

1. R = ?
2. Which are reflexive, symmetric, antisymmetric?

Reflexive relations have all 1's on the diagonal
Symmetric relation R iff $\forall i \forall j \; m_{ij} = m_{ji}$
Antisymmetric relation R iff $\forall i \forall j \; i \neq j \wedge m_{ij} \neq m_{ji}$

A	b_1	b_2	b_3
a_1	1	0	0
a_2	0	1	0
a_3	0	0	1

B	b_1	b_2	b_3
a_1	0	1	1
a_2	1	0	1
a_3	1	1	0

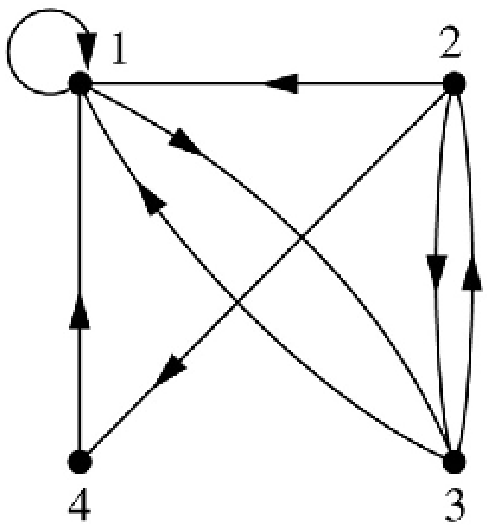
C	b_1	b_2	b_3
a_1	1	0	0
a_2	1	1	0
a_3	1	1	1

3. $M_S \odot M_R$

M_S	1	2	3
1	1	0	1
2	0	0	0

M_R	1	2
1	1	0
2	0	1
3	0	0

4. E?



5. Is 1,3,1,1,2 a path? Explain.

6. Give the graph of
   R={(1,2),(2,3),(3,4),(4,1),(3,1)}

7. Give R^{-1} and the symmetric closure of the relation.

A = {1,2,3,4}

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

	1	2	3	4
1	0	0	1	1
2	1	0	0	0
3	0	1	0	0
4	0	0	0	0

8. Find the zero-one matrix of the transitive closure of the relation R

M_R	1	2	3
1	1	0	0
2	0	1	0
3	1	1	0

$M_{R^*} = M_R \vee M^{[2]}_R \vee M^{[3]}_R$

$A = \{a_1, a_2, a_3\}$ - number of rows = $|A|$

$B = \{b_1, b_2, b_3, b_4, b_5\}$ - number of columns = $|B|$

R = ?

	b_1	b_2	b_3	b_4	b_5
a_1	0	1	0	0	0
a_2	1	0	1	1	0
a_3	1	0	1	0	1

1. $R = \{(a_1,b_2),(a_2,b_1),(a_2,b_3),(a_2,b_4), (a_3,b_1), (a_3,b_3), (a_3,b_5)\}$
2. Which are reflexive, symmetric, antisymmetric?

Reflexive relations have all 1's on the diagonal
Symmetric relation R iff $\forall i \forall j \; m_{ij} = m_{ji}$
Antisymmetric relation R iff $\forall i \forall j \; i \neq j \wedge m_{ij} \neq m_{ji}$

Reflexive A,C
Symmetric A,B
Antisym. A, C

A	b_1	b_2	b_3
a_1	1	0	0
a_2	0	1	0
a_3	0	0	1

B	b_1	b_2	b_3
a_1	0	1	1
a_2	1	0	1
a_3	1	1	0

C	b_1	b_2	b_3
a_1	1	0	0
a_2	1	1	0
a_3	1	1	1

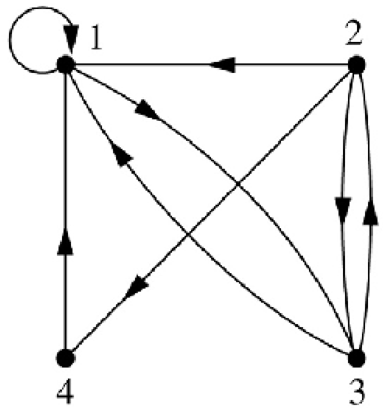
3. $M_S \odot M_R$

M_S	1	2	3
1	1	0	1
2	0	0	0

M_R	1	2
1	1	0
2	0	1
3	0	0

	1	2
1	1	0
2	0	0

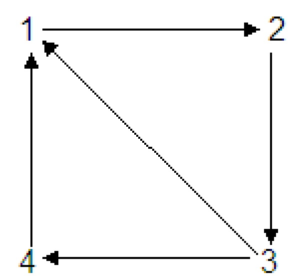
4. E?



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

5. Is 1,3,1,1,2 a path? No. Explain. No 1,2 path

6. Give the graph of
R={(1,2),(2,3),(3,4),(4,1),(3,1)}



7. Give R^{-1} and the symmetric closure of the relation.

A = {1,2,3,4}

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

R^{-1} = {(3,1),(4,1),(1,2),(2,3)}

	1	2	3	4
1	0	**1**	1	1
2	1	0	**1**	0
3	**1**	1	0	0
4	**1**	0	0	0

8. Find the zero-one matrix of the transitive closure for R

M_R^* =

M_R^*	1	2	3
1	1	0	0
2	0	1	0
3	1	1	0

=

M_R	1	2	3
1	1	0	0
2	0	1	0
3	1	1	0

V

$M^{[2]}_R$	1	2	3
1	1	0	0
2	0	1	0
3	1	1	0

V

$M^{[3]}_R$	1	2	3
1	1	0	0
2	0	1	0
3	1	1	0