ASSIGNMENT 5

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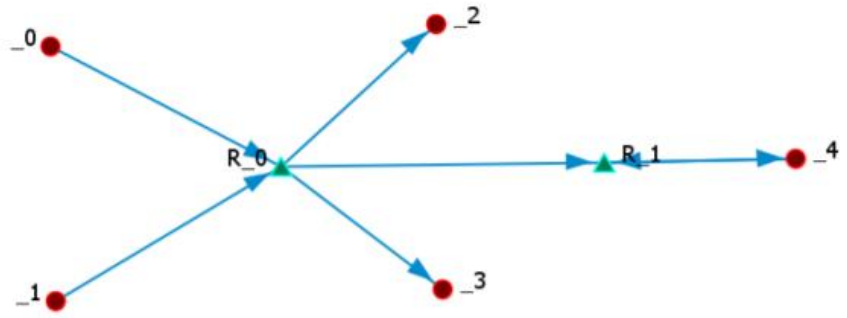
Use the following meta-network for problems 1-6. The red circles are agents and the blue triangles are resources.



1. Write the adjacency matrices for each of the following networks:
    a. **X** = Agent x Resource
    b. **Y** = Resource x Agent
    c. **Z** = Resource x Resource
2. Use matrix algebra to calculate the following values by hand:
    a. $\mathbf{XX}^T$
    b. **XY**
    c. $\mathbf{Y}^T\mathbf{X}^T$
    d. $\mathbf{Y}^T\mathbf{Y}$
3. How many agent x agent links emerge in each of the four calculations in number 2 above?
4. Determine what relational algebra is necessary to connect agent "_0" with agent "_4". HINT: You must use the **Z** matrix. Carry out the operation and show your work.
5. What relational algebra is required to connect agent "_0" to agents "_1" and "_3"? Which other agents become connected as well, as a result of the required relational algebra?
6. What relational algebra is required to connect agents "_2" and "_3"?

Extract a structured data set from a social media of your choice. For example, you might have user_ID associated with forum_ID. Use relational algebra to extract a social network (or forum network) from your structured data. Create a visualization of your extracted network. What observations do you have in regards to the network structure of your data?

1a

X=

	R_0	R_1
_0	1	0
_1	1	0
_2	0	0
_3	0	0
_4	0	1

1b

Y=

	_0	_1	_2	_3	_4
R_0	0	0	1	1	0
R_1	0	0	0	0	1

1c

Z=

	R_0	R_1
R_0	0	1
R_1	0	0

2a

X

1	0
1	0
0	0
0	0
0	1

X^T

1	1	0	0	0
0	0	0	0	1

XX^T

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

2b

X

1	0
1	0
0	0
0	0
0	1

Y=

0	0	1	1	0
0	0	0	0	1

XY

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

2c

Y^T

0	0
0	0
1	0
1	0
0	1

X^T

1	1	0	0	0
0	0	0	0	1

$Y^T X^T$

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

2d

Y^T

0	0
0	0
1	0
1	0
0	1

Y=

0	0	1	1	0
0	0	0	0	1

$Y^T Y$

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

3.

Five links

4.

To connect agent_0 to agent _4, we need XZY as below

X

1	0
1	0
0	0
0	0
0	1

Z

0	1
0	0

Y

0	0	1	1	0
0	0	0	0	1

XZY

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

5.

To connect agent_0 to agent _1, we need XX^T, no other agent becomes connected.

To connect agent_0 to agent _3, we need XY, agent 2 also becomes connected as well

6.

To connect agent_2 to agent_3, we need $Y^T Y$

Visualization of Facebook network

Observation: Lattice Network with mostly high school and university friends all connected to each other.