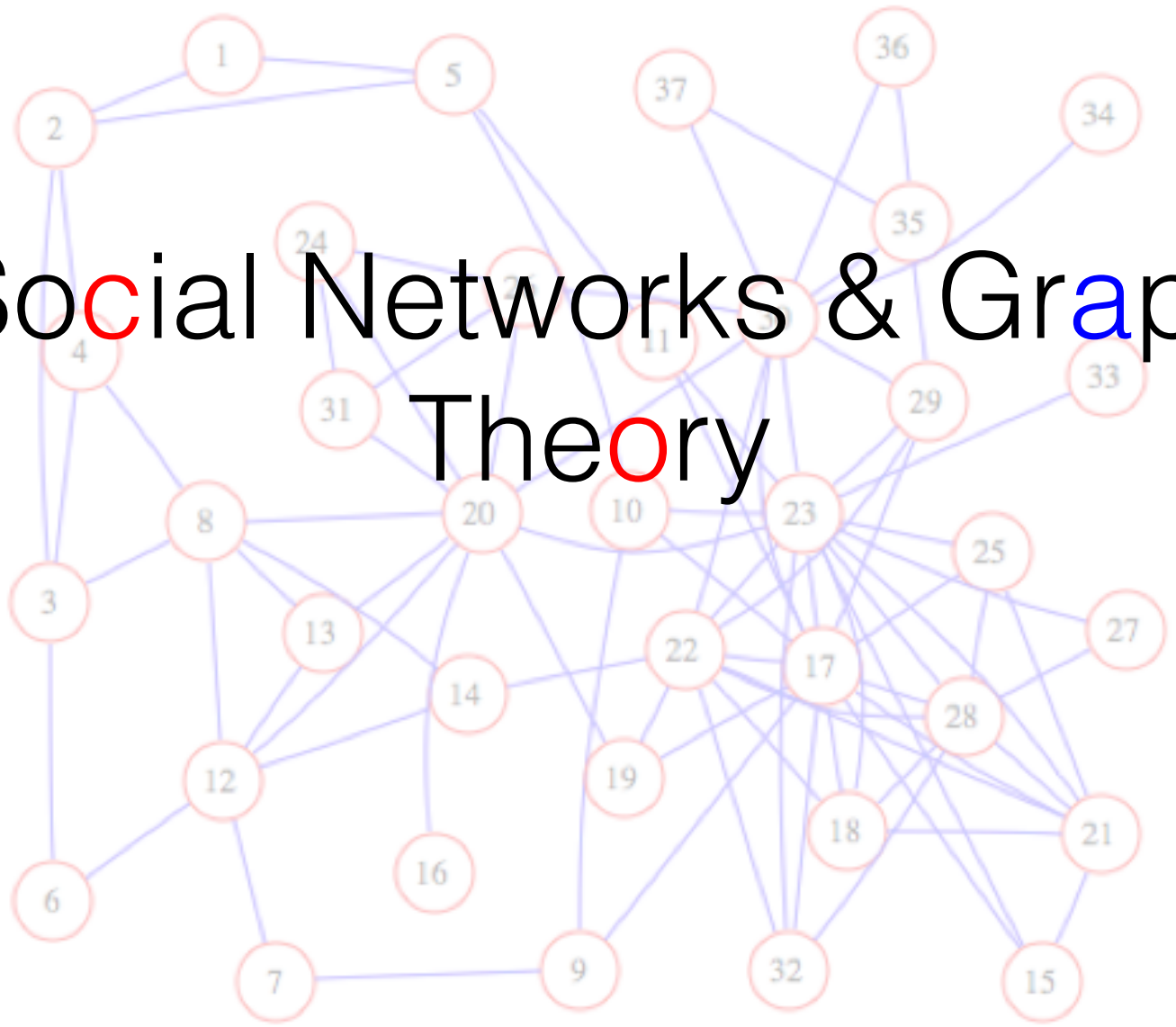
Social Networks & Graph Theory



Tasks

1. Use adjacency matrix to visualize graph

2. Solve Minimum Dominating Set problem

3. Visualize your Minimum Dominating Set

   [Write a short paragraph about your method]

All of this *can* be done in a single script, socialdrive.m (no subfunctions)

What information are we given about the graph?

911- graph

1	2
1	9
2	9
2	15
3	9
3	15
4	5
4	6
4	12
5	12
…	…

1. What does this information represent?
2. How do we get this information into socialdrive?

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1	9
2	9
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5	12
…	…

1. What does this information represent?

2. How do we get this information into socialdrive?

   -hard code (but this limits applicability to arbitrary graphs)

   -use MATLAB's textread `A=textread('911-graph-mod.txt');`

3. Once this information is in MATLAB, what do we need to use it to find out about the graph?

   (i)
   (ii)

What information are we given about the graph?

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1. What does this information represent?

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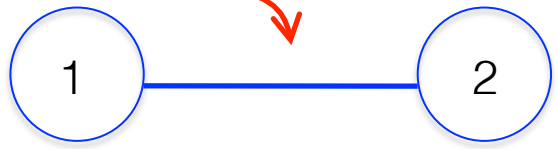
   -hard code (but this limits applicability to arbitrary graphs)

   -use MATLAB's textread `A=textread('911-graph-mod.txt');`

3. Once this information is in MATLAB, what do we need to use it to find out about the graph?
   (i) Adjacency matrix
   (ii) "Watered down" adjacency matrix for biograph

Building the Adjacency Matrices

1	2
1	9
2	9
2	15
3	9
3	15
4	5
4	6
4	12
5	12
6	14
7	9
7	13
7	15
8	12
9	10
9	17
…	…



A	Node 1	Node 2	…	Node n
Node 1	1	1		
Node 2	1	1		
.				
.				
.				
Node n				

How many entries do we get from a single row?

Using biograph

- Biograph doesn't need A, it needs something a little simpler
  - Only upper triangular
  - Self-connections are assumed

```
>>ga=zeros(7);
>> A=[0 1 1 0 1 1; 0 0 1 1 1 0; 0 0 0 1 0 1;  ...
0 0 0 0 1 1; 0 0 0 0 0 1; 0 0 0 0 0 0];
>>ga(1:6,1:6)= A;
>>for i=1:6
 ids{i}=num2str(i);
 end
>> ids{7} = 'Example Graph';
>>g=biograph(ga, ids);
>>g.set('ShowArrows', 'off');
>>view(g);
```

What is 6, in terms of our graph?

So, what do we want instead of 7?

This A is already in upper triangular form. How do we put ours in upper triangular form?

Tasks

1. Use adjacency matrix to visualize graph

   Need: biograph and simple A

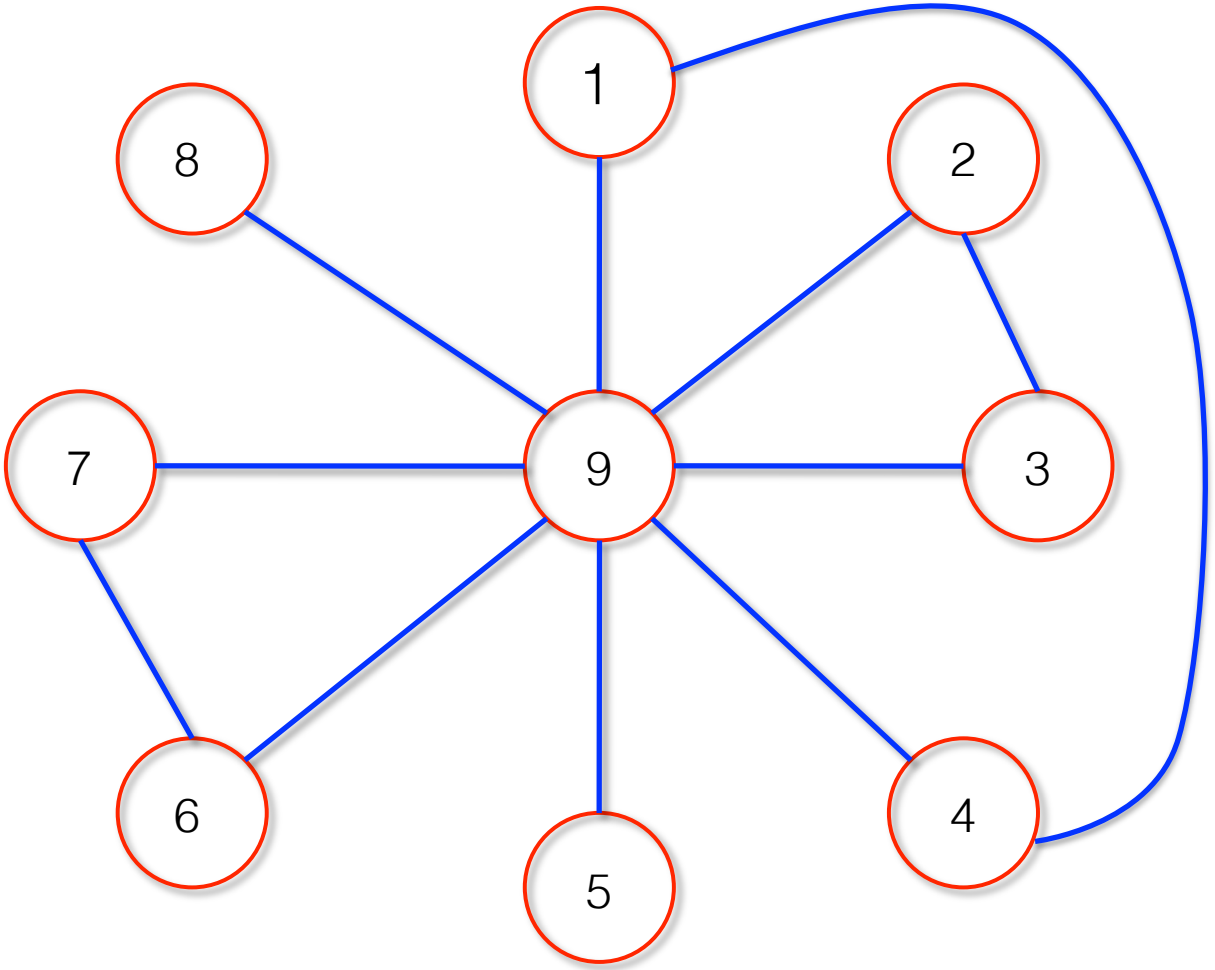
2. Solve Minimum Dominating Set Problem

3. Visualize your Minimum Dominating Set

4. Write a paragraph about your method

Minimum Dominating Set

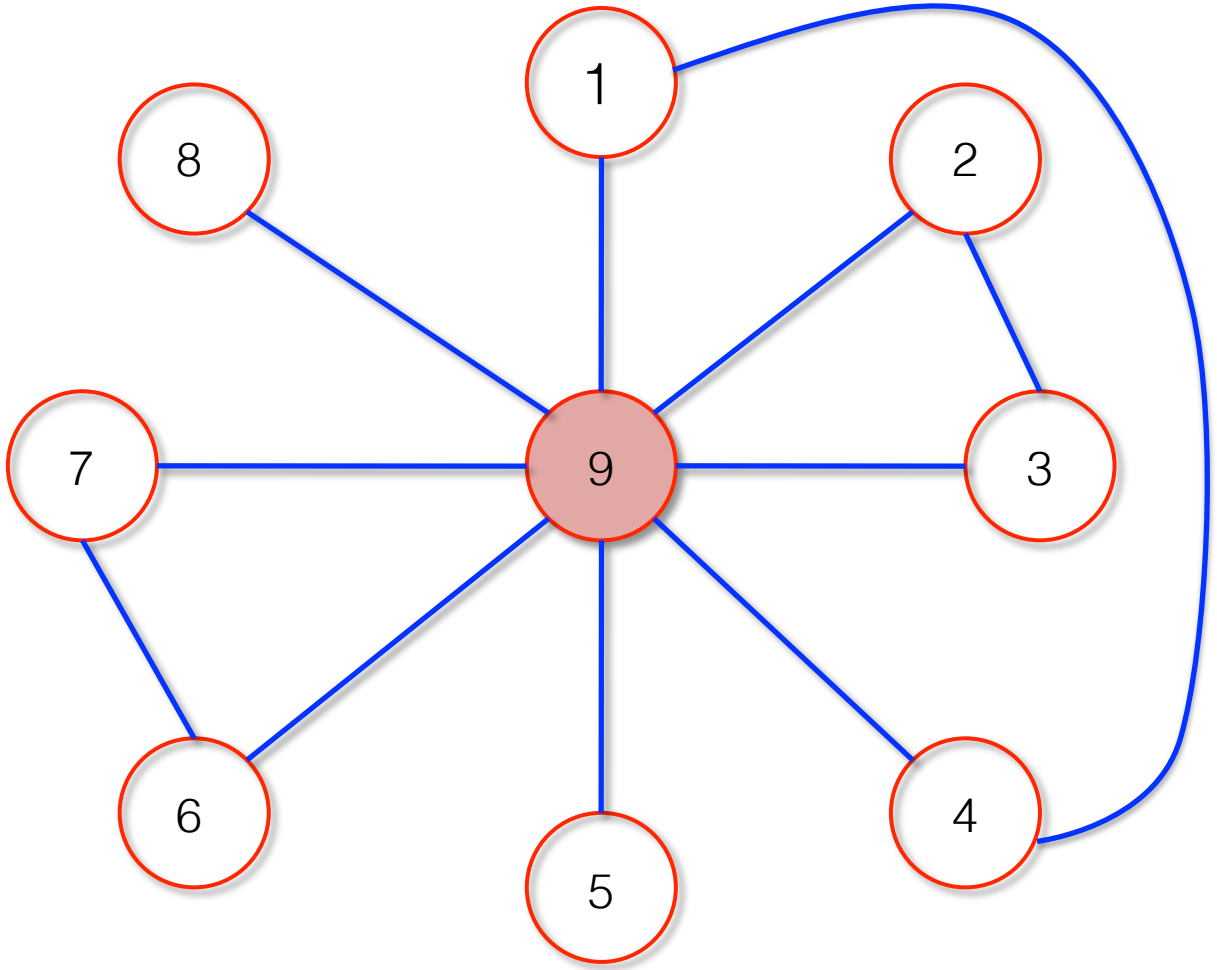
Subgraph of *smallest size* such that everyone is in it or connected to someone in it.



What is the Minimum Dominating Set here?

Minimum Dominating Set

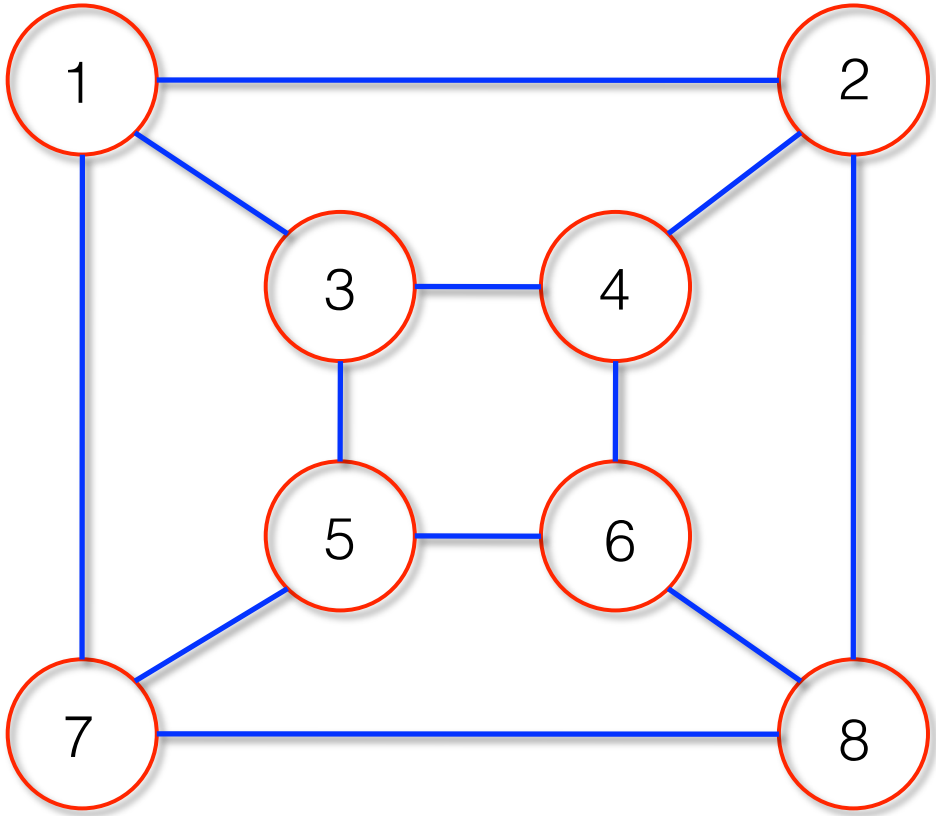
Subgraph of *smallest size* such that everyone is in it or connected to someone in it.



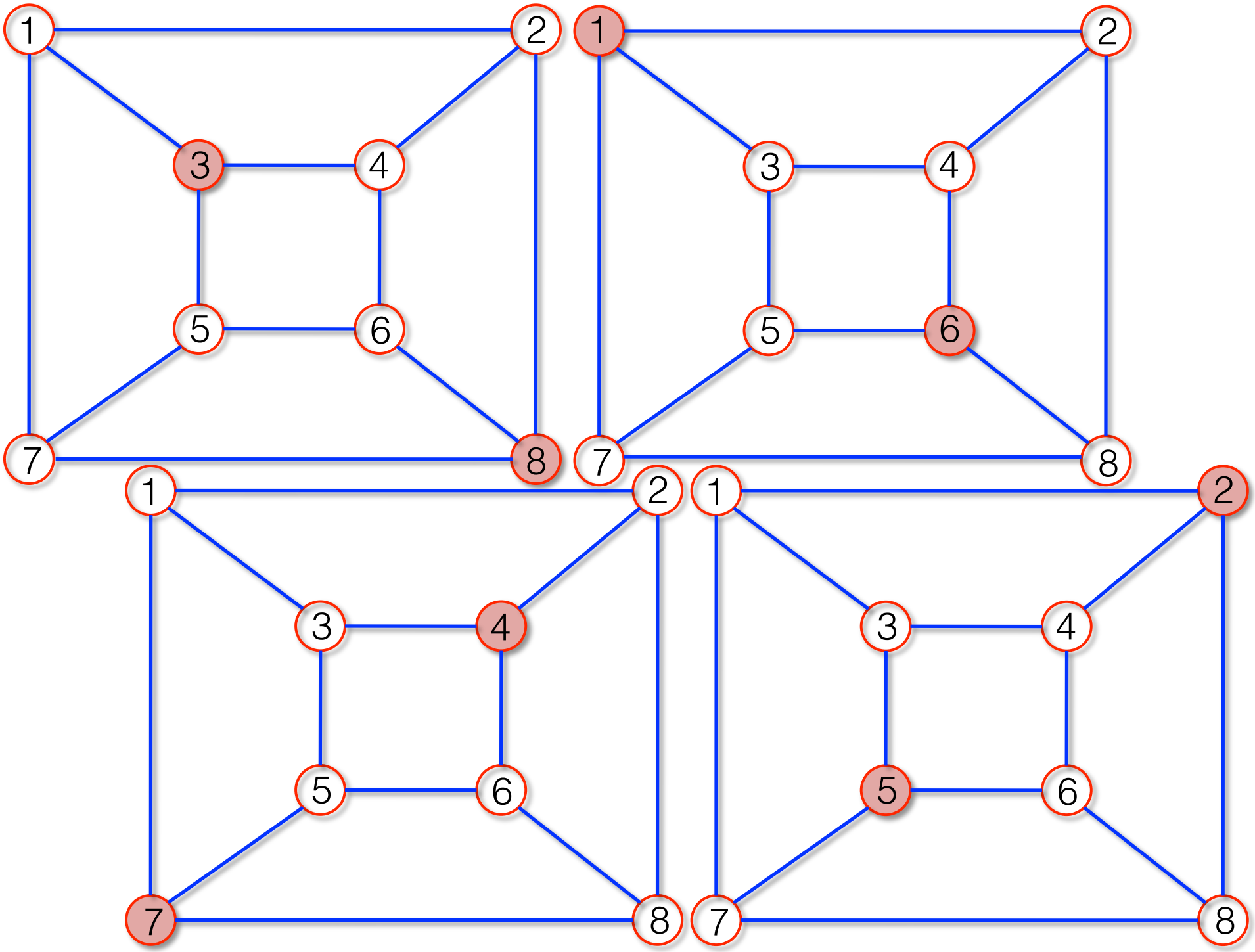
What is the Minimum Dominating Set here?

Minimum Dominating Set

Subgraph of *smallest size* such that everyone is in it or connected to someone in it.



How about here?


1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
8
1
2
3
4
5
6
7
8

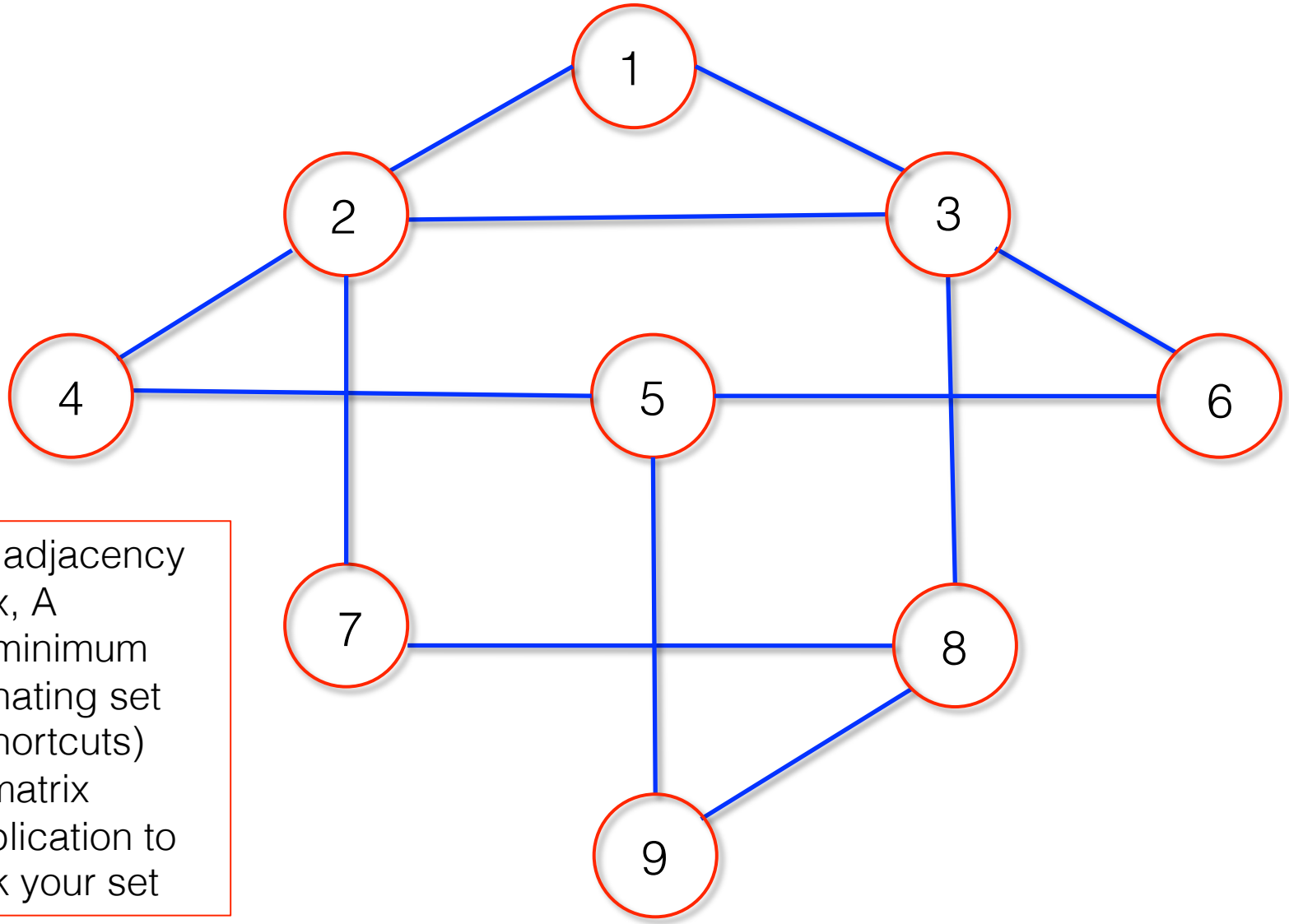
Your Algorithm

- One simple possibility: brute force
- If you come up with something quicker/more clever, and it works, use it! Just explain what you did in your paragraph.
- Start from smallest possible (reasonable) set, compute all possible minimum dominating sets using combnk
- Check if each set is *actually* a minimum dominating set

  c = Ax (A is the adjacency matrix, x has a 1 in the j^{th} position if node *j* is being considered for the set)

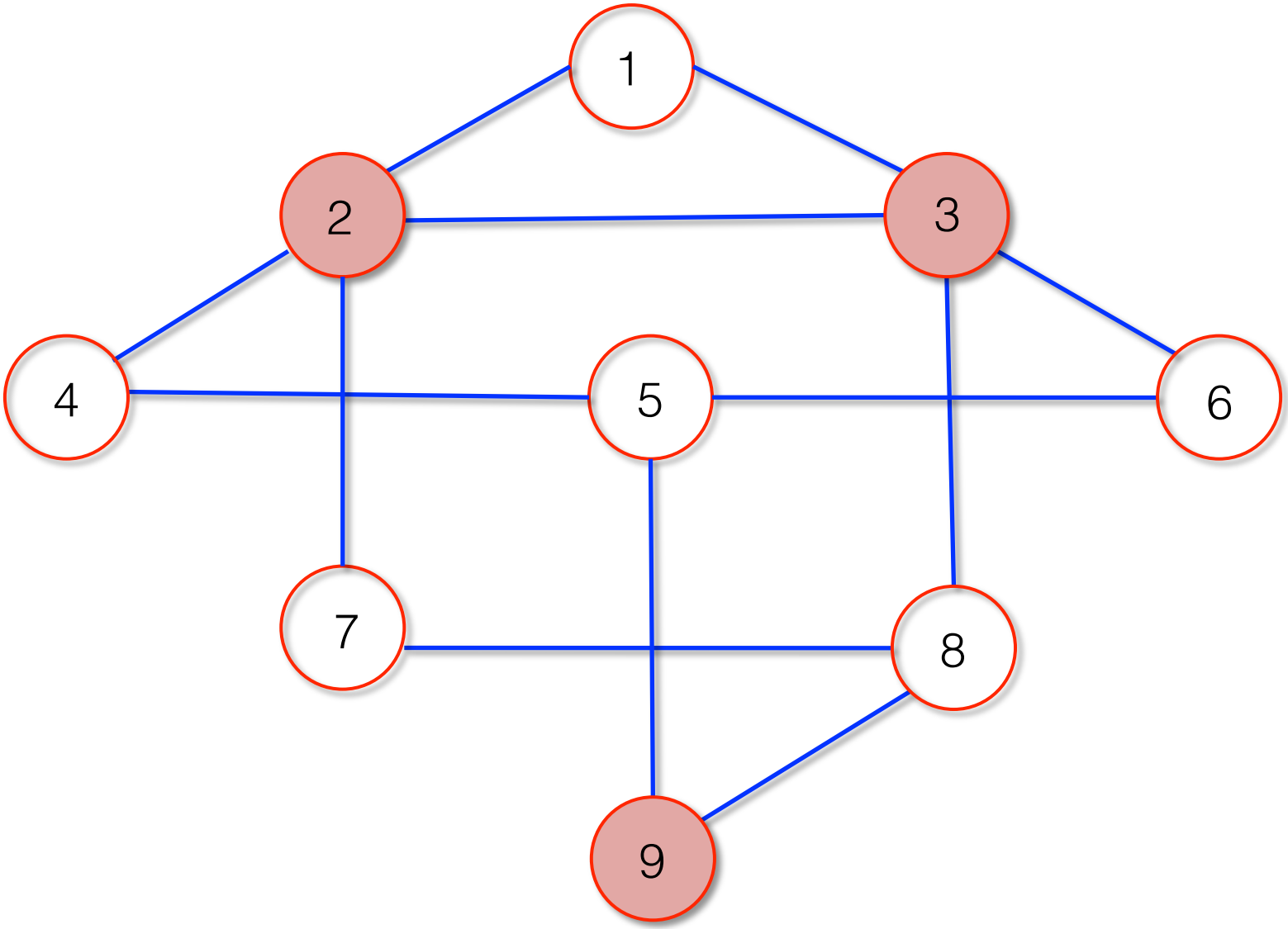
- If *c* contains no zeros, *x* contains the indices of the nodes in the minimum dominating set! Exit!

Example by hand



1. Build adjacency matrix, A
2. Find minimum dominating set (no shortcuts)
3. Use matrix multiplication to check your set

A Minimum Dominating Set



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   Need: biograph and simple A

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   Need: your algorithm, A

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Visualizing the set

You will use biograph to visualize the entire graph just as before, but indicate the minimum dominating set by changing those nodes to purple diamonds.

Your algorithm should have returned the indices of the nodes in the set. The notes provide an example of making node 2 a purple square:

```
G.nodes(2).Shape='square';
G.nodes(2).Color= [ 1, 0, 1];
```

Tasks

1. Use adjacency matrix to visualize graph

   Need: biograph and simple A

2. Solve the Minimum Dominating Set problem

   Need: your algorithm, A

3. Visualize your Minimum Dominating Set

   Need: biograph and output of your algorithm

4. Write a paragraph about your method
5. Extra Credit?