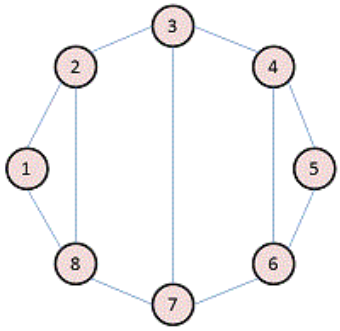
Communities

Question 1:

For the following graph:



Write the adjacency matrix A, the degree matrix D, and the Laplacian matrix L. For each, find the sum of all entries and the number of nonzero entries.

Adjacent matrix:

	1	2	3	4	5	6	7	8
1	0	1	0	0	0	0	0	1
2	1	0	1	0	0	0	0	1
3	0	1	0	1	0	0	1	0
4	0	0	1	0	1	1	0	0
5	0	0	0	1	1	0	0	0
6	0	0	0	1	1	0	1	0
7	0	0	1	0	0	1	0	1
8	1	1	0	0	0	0	1	0

Number of non-zero entries = 22, Sum of all elements = 22

Degree Matrix:

	1	2	3	4	5	6	7	8
1	2	0	0	0	0	0	0	0
2	0	3	0	0	0	0	0	0
3	0	0	3	0	0	0	0	0

4	0	0	0	3	0	0	0	0
5	0	0	0	0	2	0	0	0
6	0	0	0	0	0	3	0	0
7	0	0	0	0	0	0	3	0
8	0	0	0	0	0	0	0	3

Number of non- zero entries = 8, Sum of all entries = 8

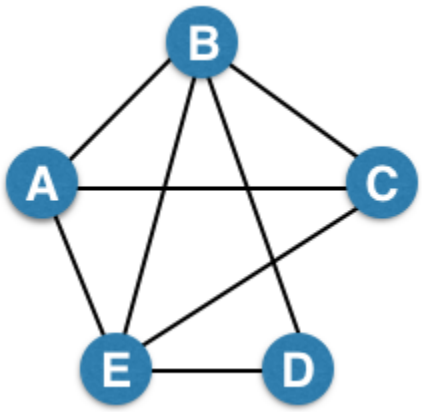
Laplacian matrix(L=D-A):

	1	2	3	4	5	6	7	8
1	2	-1	0	0	0	0	0	-1
2	-1	3	-1	0	0	0	0	-1
3	0	-1	3	-1	0	0	-1	0
4	0	0	-1	3	-1	-1	0	0
5	0	0	0	-1	2	-1	0	0
6	0	0	0	-1	-1	3	-1	0
7	0	0	-1	0	0	-1	3	-1
8	-1	-1	0	0	0	0	-1	3

Number of non-zero entries = 30, Sum of all entries = 0

Question 2:

Consider the following undirected graph (i.e., edges may be considered bidirectional):



Run the "trawling" algorithm for finding dense communities on this graph and find all complete bipartite subgraphs of types $K_{3,2}$ and $K_{2,2}$. Note: In the case of $K_{2,2}$, we consider {{W, X}, {Y, Z}} and {{Y, Z}, {W, X}} to be identical.

From the graph
A={B, C, E},B={A, C, D, E},C={A, B, E}, D={B, E},E={A, B, C, D}
So, B and E have support more than 3 Therefore, Bipartite subgraph of $K_{3,2}$

1)A B

C E

D

A={B,E} C={B,E} D={B,E}

Bipartite subgraph of $K_{2,2}$

1)A C

B E

A={C,E} B={C,E}

2)B A

E D

B={A,D} E={A,D}

3)B A

E C

B={A,C} E={A,C}

4)B A

C E

B={A,E} C={A,E}

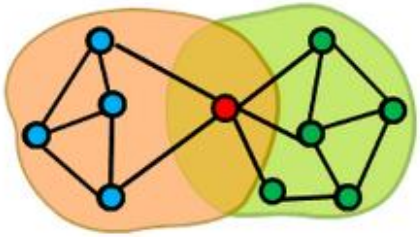
5)B C

E D

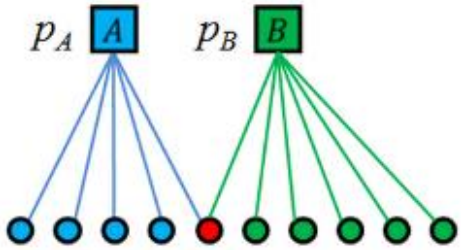
B={C,D} E={C,D}

Question 3:

We fit AGM to the network on the left, and found the parameters on the right:



Network



Learned AGM parameters

Find the optimal values for p_A and p_B.

p_A=no.of edges in the network/total possible number of edges=7/5c2==>7/10==>0.7

p_B=no.of edges in the network/total possible number of edges=9/6c2==>9/15==>0.6