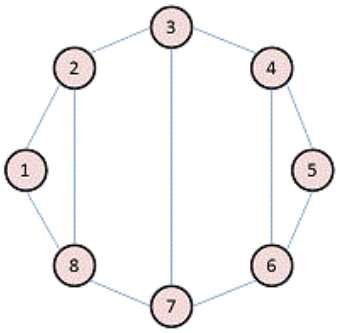
Communities

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.

Adjacency Matrix A:

	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	0	1	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

Sum of all entries = 22

No. of non-zero entries = 22

Degree Matrix D: D[i, j] = {degree(V_i), if i==j; 0 otherwise}

	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

Sum of all entries = 22

No. of Non-Zero entries = 22

Laplacian Matrix L:

L [i, j] = $\{degree\left(V_i\right),\ if\ i == j\ -\ 1,\ \ if\ \ i \neq j\ and\ V_i\ is\ adjacent\ to\ V_j\ 0,\ \ else$

And also L = D – A

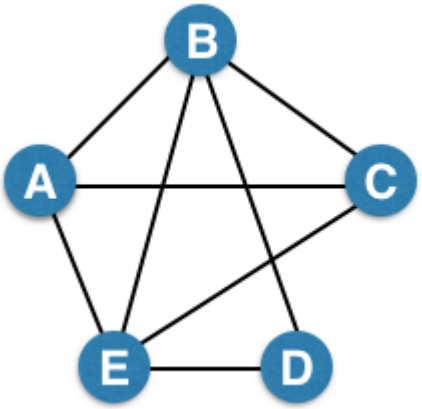
	1	2	3	4	5	6	7	8
1	2	-1	0	0	0	0	0	-1
2	-1	3	-1	0	0	0	0	-1
3	0	-1	3	-1	0	0	-1	0
4	0	0	-1	3	-1	-1	0	0
5	0	0	0	-1	2	-1	0	0
6	0	0	0	-1	-1	3	-1	0
7	0	0	-1	0	0	-1	3	-1
8	-1	-1	0	0	0	0	-1	3

Sum of all entries = 0

No. of Non-Zero entries = 30

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.

Adjacency List:

A = {B, C, E}

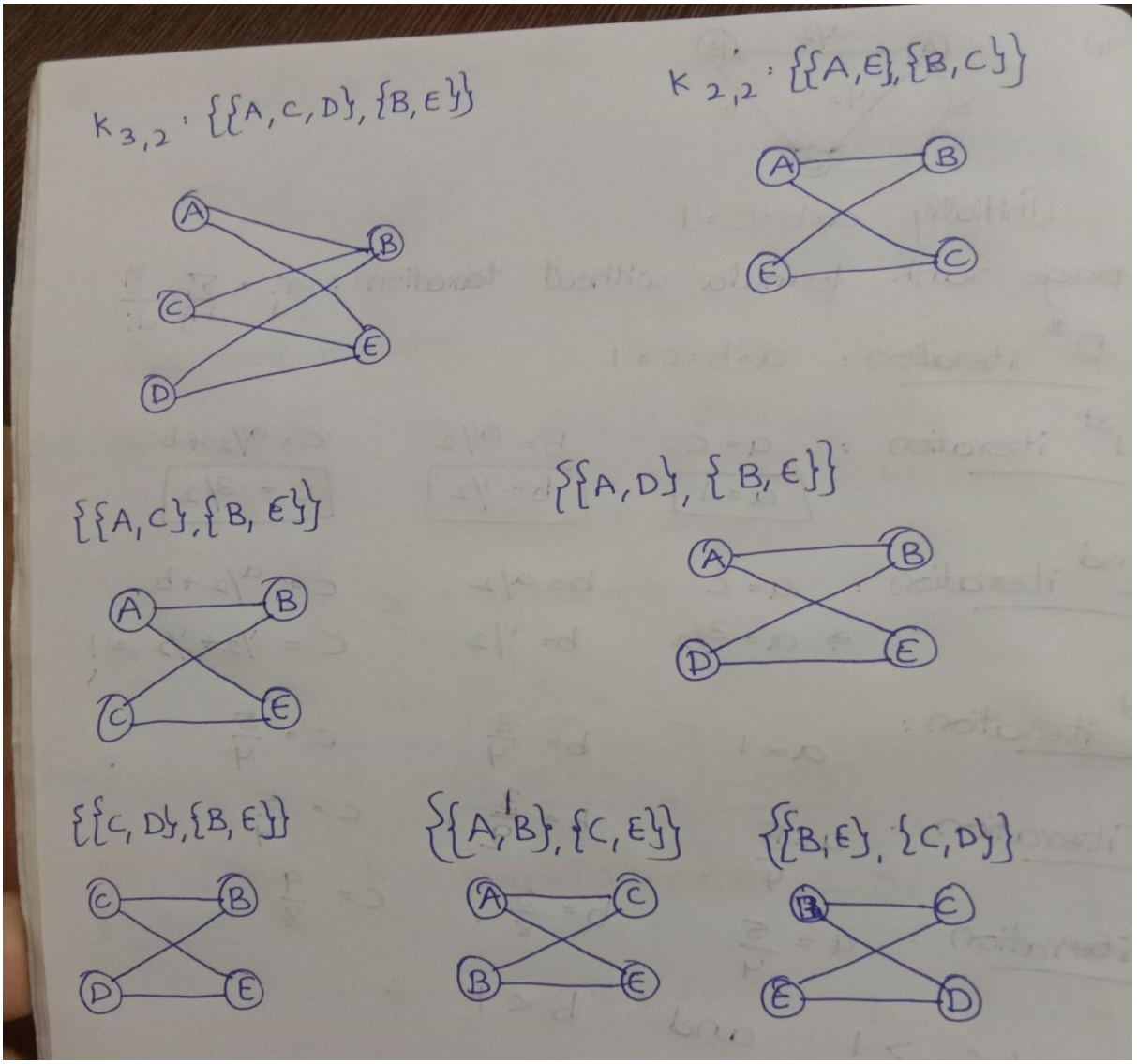
B = {A, C, D, E}

C = {A, B, E}

D = {B, E}

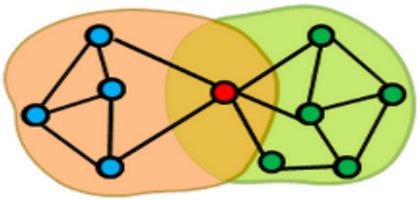
E = {A, B, C, D}

Complete bipartite graphs

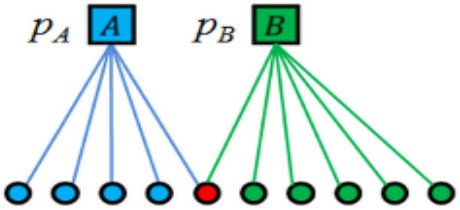


Question 3:

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.

After examining the AGM network and the parameters figure, we can say that

$p_A = 0.4$

$p_B = 0.6$ would be the optimal values