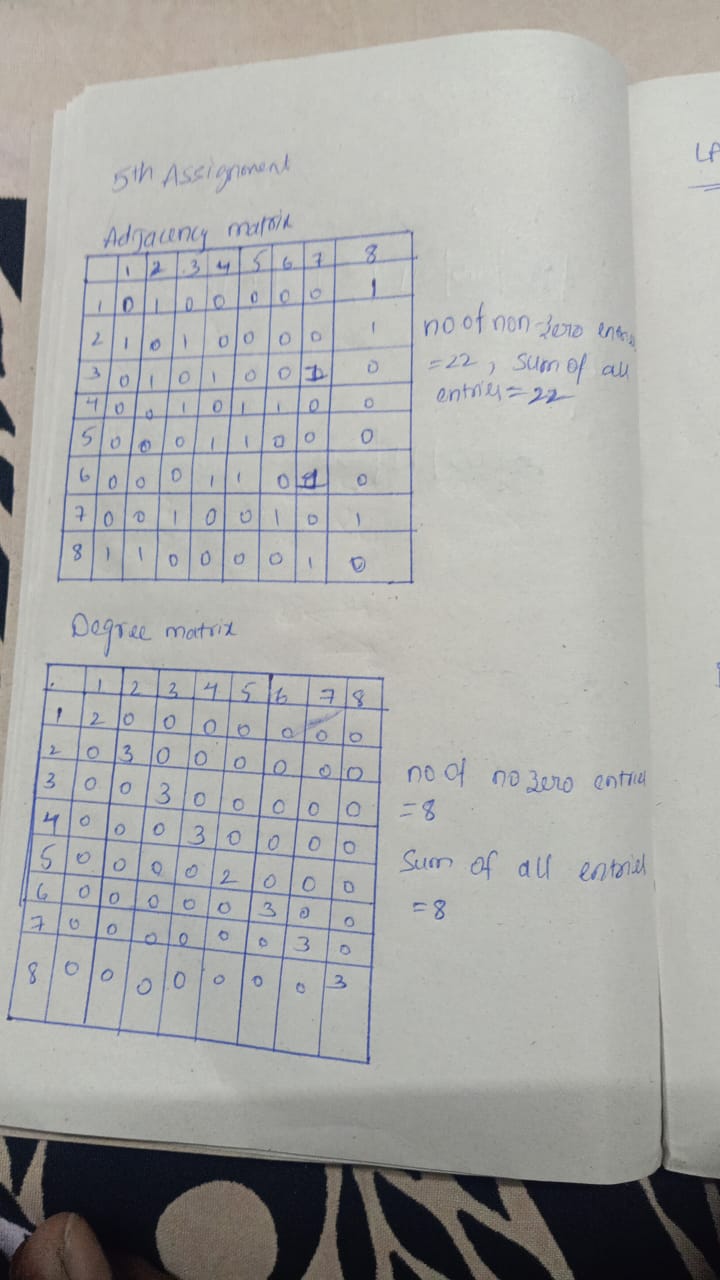
### **Communities**

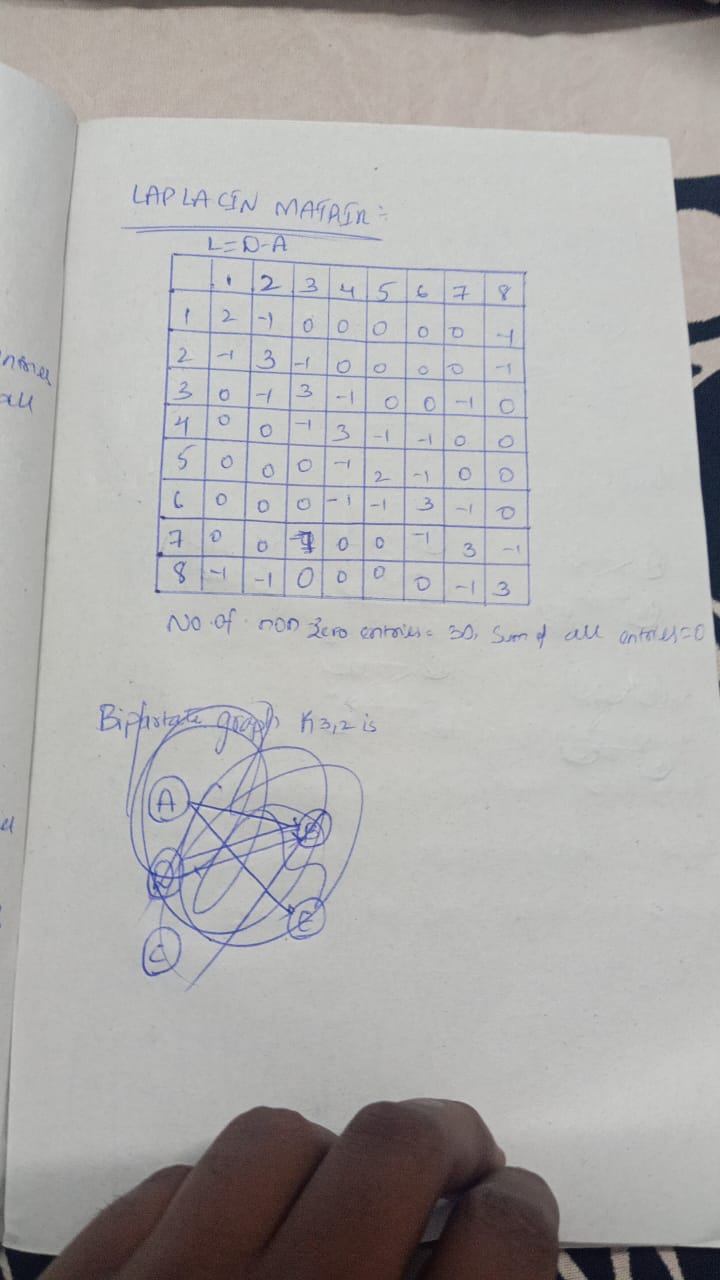
**Question 1**:

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.

Solution:

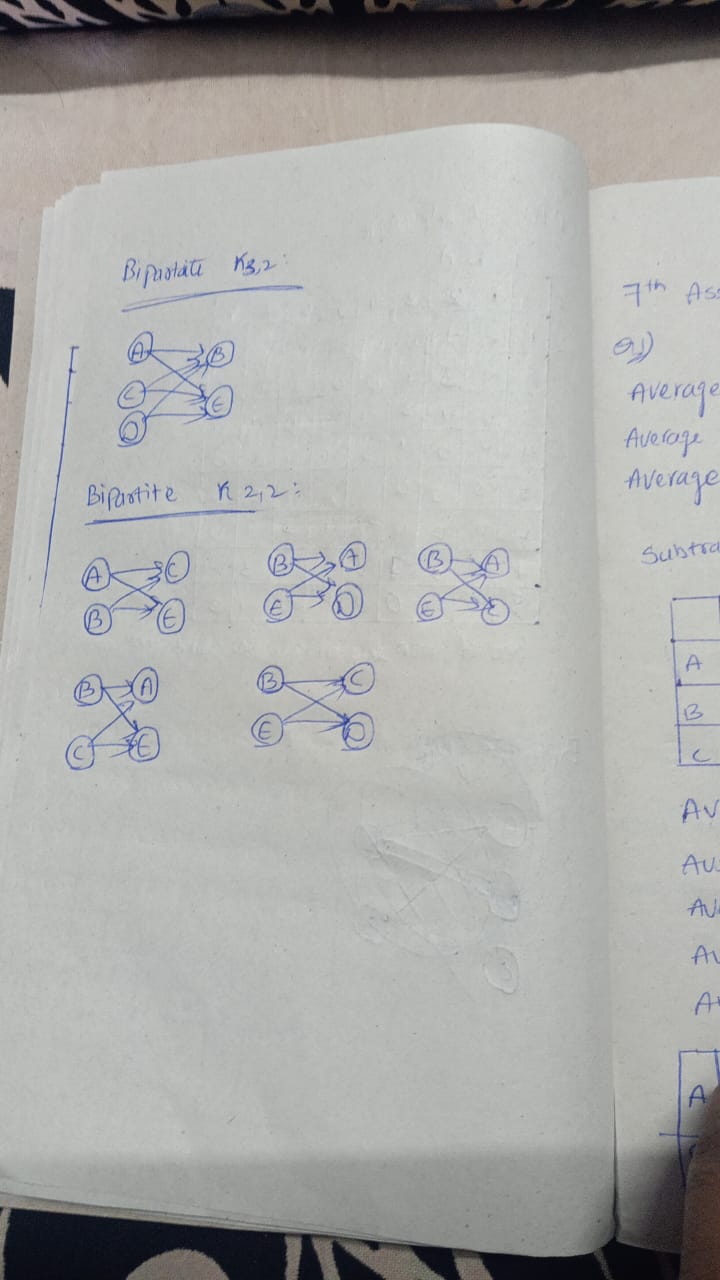


**Question 2**:

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 K3,2 and K2,2. Note: In the case of K2,2, we consider {{W, X}, {Y, Z}} and {{Y, Z}, {W, X}} to be identical.



**Question 3**:

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



Find the optimal values for pA and pB.

Solution:

**Pa = Number of edges in the network / Total possible number of edges = 7 / 5c2 = 7/10.**

**Pb = Number of edges in the network / Total possible number of edges = 9 / 6c2 = 9/15.**