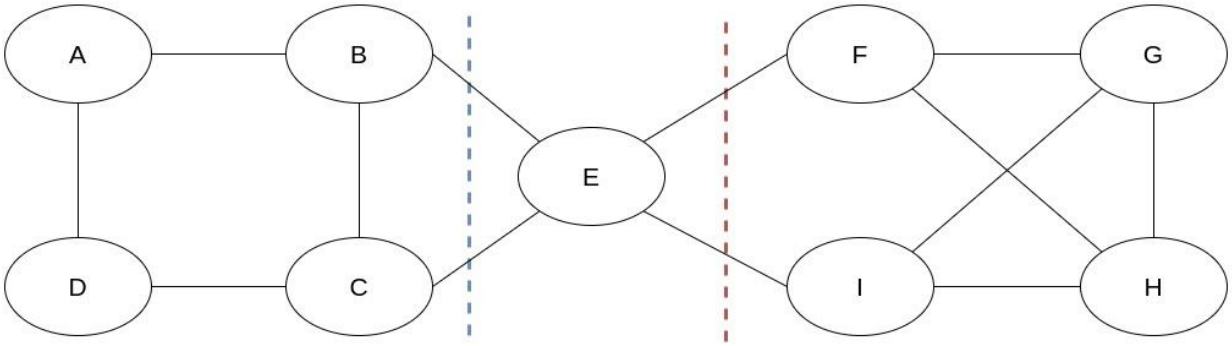
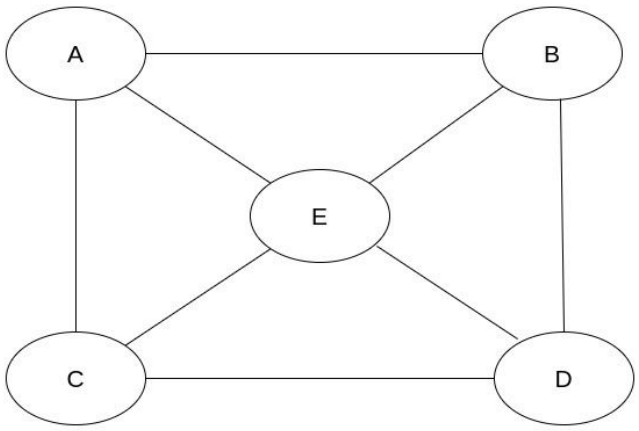
1. [1.5+0.5 points] Consider the following graph. Here, the blue and red dotted lines are 2 possible cuts. For each of these cuts, calculate the value of the normalized cut. Finally, comment which of the 2 cuts is better in terms of breaking the graph into 2 communities.



Normalized cut for blue line: 15/27
Normalized cut for red line: 15/28
Hence the red line is a better cut, as it has a smaller normalized cut value.

2. [3 points] For the following graph, write down the Adjacency matrix, Degree matrix and the Laplacian matrix. Assume the order of the rows and columns is alphabetical, i.e. first row and column in A, second is B and so on. Write each row as [1,2,3,4,5].

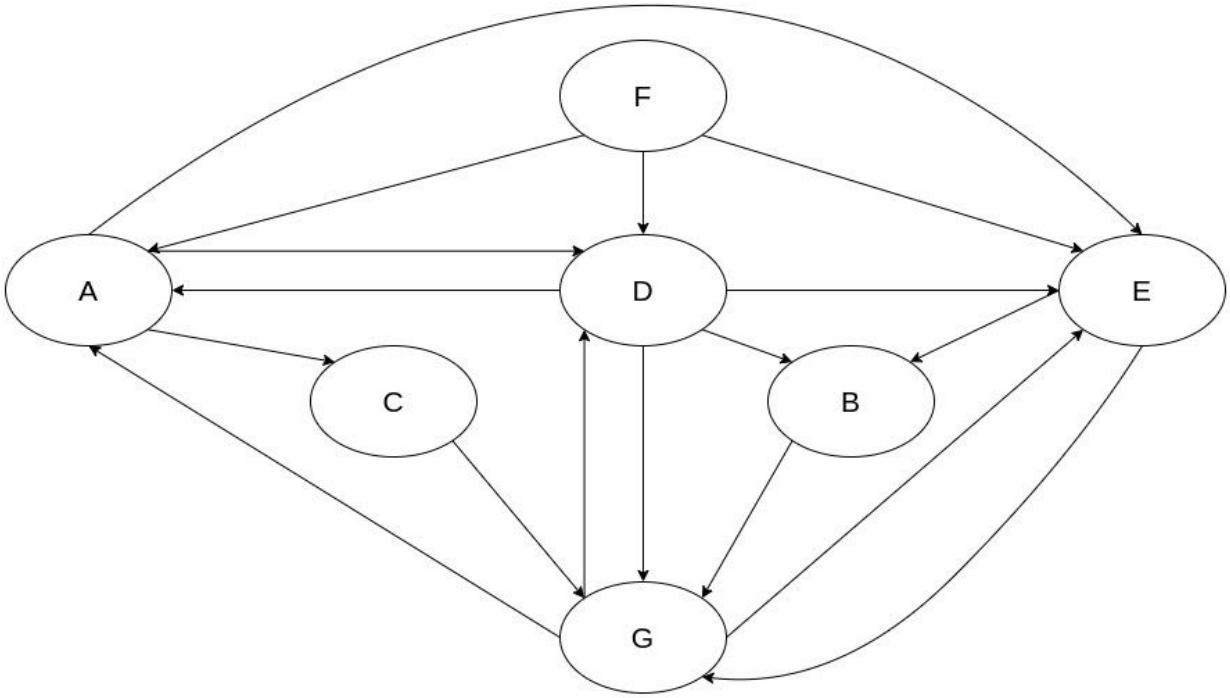


Adjacency Matrix [1 point]
[0, 1, 1, 0, 1]
[1, 0, 0, 1, 1]
[1, 0, 0, 1, 1]
[0, 1, 1, 0, 1]
[1, 1, 1, 1, 0]

Degree Matrix [1 point]
[3, 0, 0, 0, 0]
[0, 3, 0, 0, 0]
[0, 0, 3, 0, 0]
[0, 0, 0, 3, 0]
[0, 0, 0, 0, 4]

Laplacian Matrix [1 point]
[3, -1, -1, 0, -1]
[-1, 3, 0, -1, -1]
[-1, 0, 3, -1, -1]
[0, -1, -1, 3, -1]
[-1, -1, -1, -1, 4]

3. [2+3 points] Trawling: with a support threshold = 3, find all **K(s,t=2)** bipartite sub-graph from the graph below. You need to first convert the graph to a market basket model (i.e., write down baskets and their contents). The bipartite subgraph K(s,t) should be represented as follows: s -> {m, n} ; t -> {p, q}



Market Basket Model: [2 points]
A -> {c, d, e}
B -> {g}
C -> {g}
D -> {a, b, e, g}
E -> {b, g}
F -> {a, d, e}
G -> {a, d, e}

The K(s,2) bipartite subgraphs are: [1.5 + 1.5 points]
S -> {d ,f, g}
T -> {a, e}
And
S -> {a, f, g}
T -> {d, e}