

1 Task 1

Number of nodes: 9877
Number of edges: 25998

2 Task 2

Number of connected components: 429
Largest connected component - Number of nodes: 8638
Largest connected component - Number of edges: 24827
Fraction of total nodes in largest connected component: 0.8746
Fraction of total edges in largest connected component: 0.9550

3 Question 1

2. Number of edges in G :

The number of edges in the first connected component that is a complete graph with 100 vertices is:

$$\binom{100}{2} = 4950$$

The number of edges in the second connected component that is a complete bipartite graph with 50 vertices in each partition set is:

$$50 \times 50 = 2500$$

Thus, the number of edges in G is 7450.

2. Number of triangles in G :

The the number of triangles in the first connected component that is a complete graph with 100 vertices is:

$$\binom{100}{3} = 161700$$

A complete bipartite graph has no triangles, as triangles require three vertices all connected to each other, which cannot occur in a bipartite graph.

Thus, the number of triangles in G is 161700.

4 Question 2

a)

$$Q = \frac{6}{13} - \left(\frac{13}{26}\right)^2 + \frac{6}{13} - \left(\frac{13}{26}\right)^2 = \frac{12}{13} - \frac{1}{2} = \frac{11}{26}$$

b)

$$Q = \frac{1+1}{13} - \left(\frac{2+3+3+3}{26}\right)^2 + \frac{4}{13} - \left(\frac{3+3+2+4+3}{26}\right)^2 = \frac{6}{13} - \left(\frac{11}{26}\right)^2 - \left(\frac{15}{26}\right)^2 = -0.05$$

5 Task 6

Modularity (Spectral Clustering): 0.12507511742810173
Modularity (Random Clustering): -0.009229884414357691

6 Question 3

$$\phi(C_4) = (4, 4, 0, 0, \dots, 0)$$

$$\phi(P_4) = (3, 2, 1, 0, \dots, 0)$$

$$\text{Thus, } K(C_4, C_4) = 32$$

$$K(P_4, P_4) = 14$$

$$K(C_4, P_4) = 20$$

7 Question 4

A kernel value equal to 0 means that the graphs G and G' do not share any common structural similarity in terms of the graphlets of size 3. In other words, there is no overlap in the local structure of graphlets between G and G' .

Example:

Consider the following two graphs:

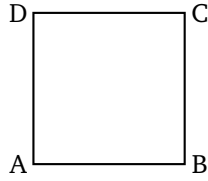


Figure 1: Square without diagonals

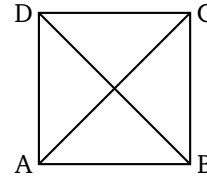


Figure 2: Square with diagonals

8 Task 10

Accuracy shortest path kernel: 0.8947368421052632

Accuracy graphlet kernel: 0.8157894736842105

References