CS 5483 Homework 1

1. The graph is not balanced. For a graph to be balanced, there cannot exist a cycle that is unbalanced. For a triangle of nodes to be balanced, we must have , where represents the value of the edge between nodes *i* and *j* (in our case, a 1 or -1 depending on the positivity or negativity of the edge)*.* Looking at nodes 2, 3, and 4, we can see that which is obviously not . Therefore, the graph is unbalanced.
2. 1. Degree Centrality

Degree Centrality can be calculated by .

1: 3/9 = 1/3

2: 1/3

3: 1/3

4: 2/9

5: 1/3

6: 1/3

7: 1/3

8: 1/3

9: 1/3

10: 2/9

*For the following centrality calculations, I wrote scripts in Python using the NetworkX Library*

*A screen shot of a computer program

Description automatically generated*

* 1. Eigenvector Centrality:

A screenshot of a computer

Description automatically generated

* 1. PageRank Centrality:

A screenshot of a computer

Description automatically generated

* 1. Katz Centrality:

A screenshot of a computer

Description automatically generated

1. For this question, I again wrote a Python script and found the assortativity coefficient using the NetworkX library.

A screen shot of a computer program

Description automatically generated

A screen shot of a computer

Description automatically generated

Adjacency List:

1: 2, 3

2: 1, 3

3: 1, 2, 4, 5

4: 3, 5, 6, 7

5: 3, 4, 6, 7

6: 4, 5, 7, 8

7: 4, 5, 6, 8

8: 6, 7, 9

9: 8

Edge List:

1 2

1 3

2 3

3 4

3 5

4 5

4 6

4 7

5 6

5 7

6 7

6 8

7 8

8 9

1. 1. BFS

Parent array:

v1: -

v2: v1

v3: v2

v4: v1

v5: v2

v6: v4

v7: v5

v8: v6

v9: v5

* 1. DFS

Parent array:

v1: -

v2: v1

v3: v2

v4: v5

v5: v3

v6: v4

v7: v6

v8: v7

v9: v8

* 1. Dijkstra’s

Parent array:

v1: -

v2: v1

v3: v2

v4: v1

v5: v2

v6: v4

v7: v6

v8: v6

v9: v5