DS 402 Assignment 2

Please submit your solution to Canvas by 11:59pm, October 6th.

Problem 1 - Eigenvector Centrality - Power Iterations (15pts)

- (10pts) Perform 2 iterations (not including the initialization) of Eigenvector Centrality for the Figure 1. Please provide step by step details. For initialization, please initialize the eigenvector centrality of all nodes as 1.
- (5pts) Please use NetworkX to calculate the eigenvector centrality. Set maxiter as 100. Please write down the eigenvector centrality for each node.

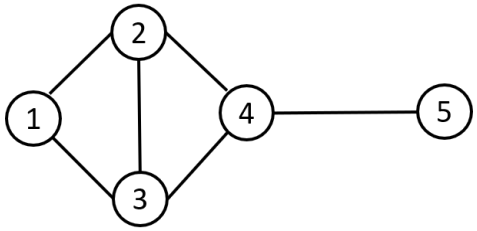


Figure 1: Calculate Eigenvector Centrality

Problem 2 - Clustering Coefficient (10pts) For the graph in Figure 2

- (6pts) What's the global clustering coefficient?
- (4pts) What are the local clustering coefficients of node 2 and 4?

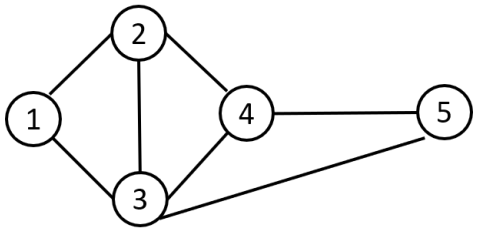


Figure 2: Clustering Coefficient

Problem 3 - Node Similarity (10pts) In Figure 3, Compute node similarity using Jaccard and cosine similarity for nodes v_5 and v_4.

Problem 4 - Regular Lattice and Small World (25pts) For the graphs in Figure 4

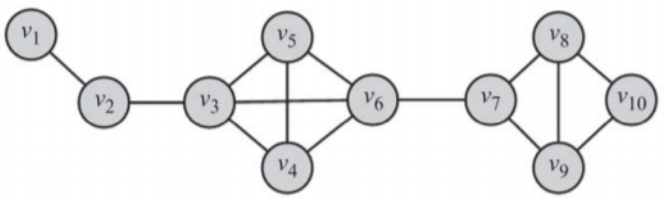
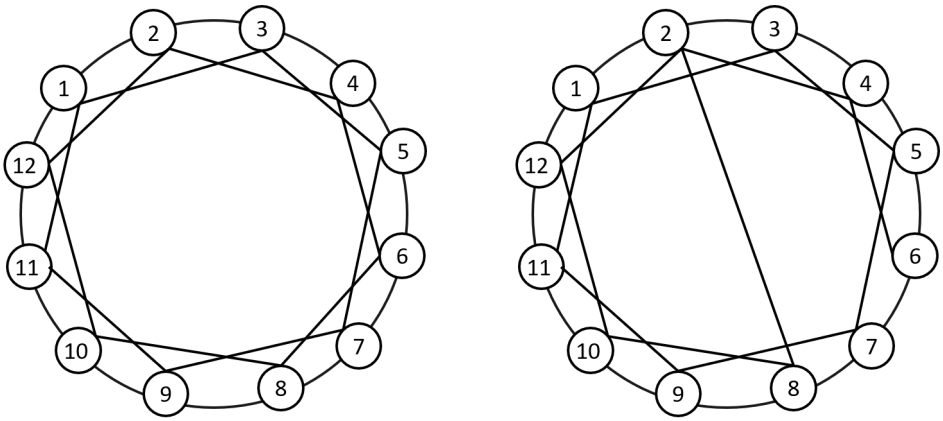


Figure 3: Calculate Node Similarity

- (5pts) Please calculate the exact average local clustering coefficient of the regular lattice in Figure 4(a).
- (5pts) Please calculate the exact average shortest path length of the regular lattice in Figure 4(a).
- (5pts) If we break the edge from node 8 to node 6 and rewire it to node 2 as shown in Figure 4(b), what is the average shortest path length of node 2 to other nodes.
- (5pts) Based on the calculations, explain why regular lattice is used as a basic model for small world model and why do we need rewiring for small world model.
- (5pts) Please show that for a regular lattice with average node degree d, the local clustering coefficient for any node is approximately $\frac{3(d-2)}{4(d-1)}$.



(a) regular lattice (b) regular lattice after rewiring

Figure 4: figure for multiple choice