Exercises for distance-based centrality measures

1. Write a function that takes as arguments a graph G or a graph G and a pair of nodes u and v. Determine the number of shortest paths and number of walks of specified length k between the nodes *u* and *v*.

2. Using the function that counts the number and length of shortest paths between any two nodes u and v in a given graph G (based on the BFS-based algorithm described in the lecture) write a function that determines the numbers of shortest paths between u and v that pass through a third node w.

Homework

1. The center of a graph is composed of those nodes whose eccentricity equals the radius of the graph. The periphery of a graph is composed of those nodes whose eccentricity equals the diameter of the graph. Use the solutions to questions 1 to determine the center and the periphery of a given graph. Are there graphs for which the center and the periphery coincide?

   Please answer as code comment or in markdown.

2. Is there a relation between the number of shortest paths passing through a node and the node eccentricity? Provide a function which tests whether there is a significant positive, significant negative, or no significant correlation between these two properties of nodes for a given graph G. Classify Erdos-Renyi and Barabasi-Albert graphs on the same number of nodes and (almost) the same number of edges based on the provided function.

   Note: test the function on graph with no more than 50 nodes, to limit the computation time!