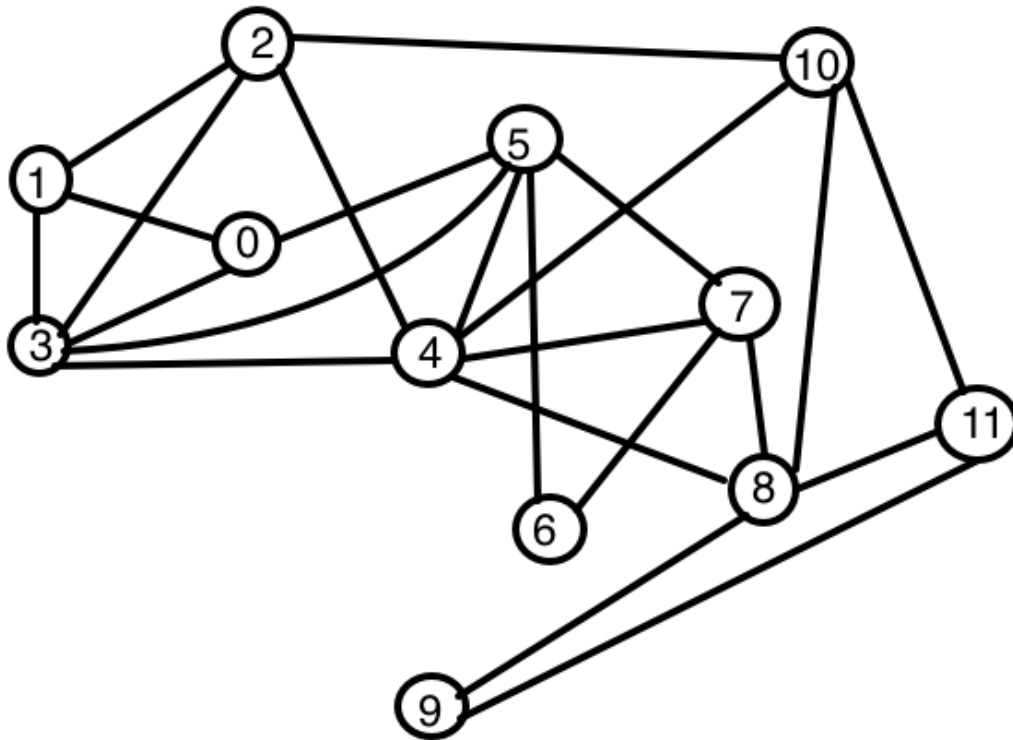


Exercise 6: Friendship Triangles Project

The normalized **degree of centrality** of a graph gives a value based on the number of connections a node has. A person on a social graph like Facebook has a high degree of centrality if they have many connections. The degree of centrality is calculated by dividing the degree of a specified vertex by (n-1) number of vertices in the graph

$$\text{Degree}(v) / (n-1)$$



For Example:

The degree of centrality for vertex 9 is

$$2/(12-1) = 0.1818$$

A *triangle* is a set of three vertices p, q, r , from the graph where there is a graph edge between p and q (that is q is in $\text{AdjacencyList}(p)$), and there is a graph edge between q and r and there is a graph edge between p and r . In other words, a triangle is formed on Facebook when they are friends with you, as well as each other.

For Example:

The number of triangles incident to vertex 9 is 1.

The number of triangles incident to vertex 1 is 2.

The number of triangles incident to vertex 10 is 3.

The **clustering of a vertex** is a percentage of how close an individual vertex is to forming a complete graph. In a social graph this value gives how connected other people are to a given individual. This is calculated by $(2 * \text{number of triangles incident to vertex}) / ((v * (v-1))/2)$. Recall that for vertices (v) a complete graph will have $(v * (v-1))/2$ edges.

For example vertex 9 has an average clustering of

$[(2 \text{ triangles} * 1) / ((12 * 11)/2)] * 100 = 3.03.06\%$

Vertex 10 has an average clustering of

$[(3 \text{ triangles} * 2) / ((12 * 11)/2)] * 100 = 9.09\%$

What to do:

Design and implement a social graph class with undirected edges whose vertices are represented with numbers. The graph should have a menu that performs the following operations:

Allow the user to type in the data file for the graph, and type in a specific vertex number. The output should display:

- a) The Normalized Degree of Centrality for the given vertex.
- b) The number of triangles incident to the given vertex.
- c) The clustering of the individual vertex

Rubric Requirements

1. Your program shall include a test program that prompts the user to enter a file name with a .txt extension to parse through
2. The program shall display the graph input from the text file using the previous graph representation program
3. The program shall prompt the user to enter a number for a given vertex and then display the correct calculations for:
 - a) The Normalized Degree of Centrality for the inputted vertex.
 - b) The number of triangles incident to inputted vertex.
 - c) The clustering of the inputted vertex
4. You shall use the given Graph Unit files from the graph representation program, and the program should be able to run test files similar to the given example text file.
5. To receive credit, the program shall include all files required to run the program.