**Summer 2021**

**CSC 1310**

**Lab 9: Graphs**

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| **Reference:** | Chapter 8 – “*8.3 Graph representations: Adjacency lists,*  *8.4 Graph representations: Adjacency matrices”* |

**Objective:** To gain a better understanding of Graph representation.

**Source File (s)**: main.cpp, GraphMat.h, GraphList.h

**INTRODUCTION:**

A **graph** is a data structure for representing connections among items, and consists of vertices connected by edges.

* A **vertex** (or node) represents an item in a graph.
* An **edge** represents a connection between two vertices in a graph.

In a graph:

* Two vertices are **adjacent** if connected by an edge.
* A **path** is a sequence of edges leading from a source (starting) vertex to a destination (ending) vertex. The path length is the number of edges in the path.
* The **distance** between two vertices is the number of edges on the shortest path between those vertices

Various approaches exist for representing a graph data structure. Recall that two vertices are adjacent if connected by an edge. In an **adjacency list graph representation**, each vertex has a list of adjacent vertices, each list item representing an edge. In an **adjacency matrix** **graph representation**, each vertex is assigned to a matrix row and column, and a matrix element is 1 if the corresponding two vertices have an edge or is 0 otherwise.

The adjacency lists and matric representation of above graph is given below in Table 1 and 2 respectively:

Table 1 Table 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 |
| 0 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 |
| 2 | 1 | 1 | 0 | 1 |
| 3 | 0 | 0 | 1 | 0 |

|  |
| --- |
| 0 |
| 1 |
| 2 |
| 3 |

Null

**2**

**1**

**2**

**0**

Null

Null

**1**

**3**

**0**

**2**

Null

**Show adjacency list and matrix representation of the following graph (as above).**

**WHAT SHOULD THIS PROGRAM DO?**

**main.cpp and graph.txt are given for you. GraphList.h and GraphMat.h** are partially provided for you. **You will be completing these files where you see the following comment section:**

// Write your code here!

**(*Note: Hints and directions are given as comments in the program files. Please read them carefully*)**

**How confident are you that your implementation is *correct*? And why?**

**You have finished!**

**In order to receive credit, you must submit this lab exercise (handout) with answers filled in along with the following files:**

* **GraphMat.h**
* **GraphList.h**
* **main.cpp**
* **graph.txt**

**[*possible full credit*]**