UNIVERSITY OF CALOOCAN CITY
COMPUTER ENGINEERING DEPARTMENT

Data Structure and Algorithm

Laboratory Activity No. 10

Intro to Graphs

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I. Objectives

Introduction

A graph is a visual representation of a collection of things where some object pairs are linked together. Vertices are the points used to depict the interconnected items, while edges are the connections between them. In this course, we go into great detail on the many words and functions related to graphs.

An undirected graph, or simply a graph, is a set of points with lines connecting some of the points. The points are called nodes or vertices, and the lines are called edges.

A graph can be easily presented using the python dictionary data types. We represent the vertices as the keys of the dictionary and the connection between the vertices also called edges as the values in the dictionary.

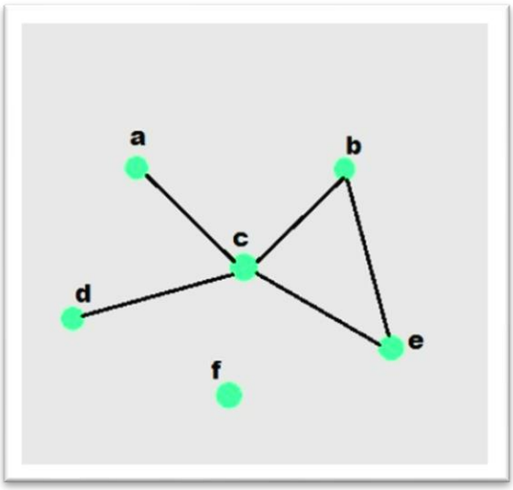


Figure 1. Sample graph with vertices and edges

This laboratory activity aims to implement the principles and techniques in:

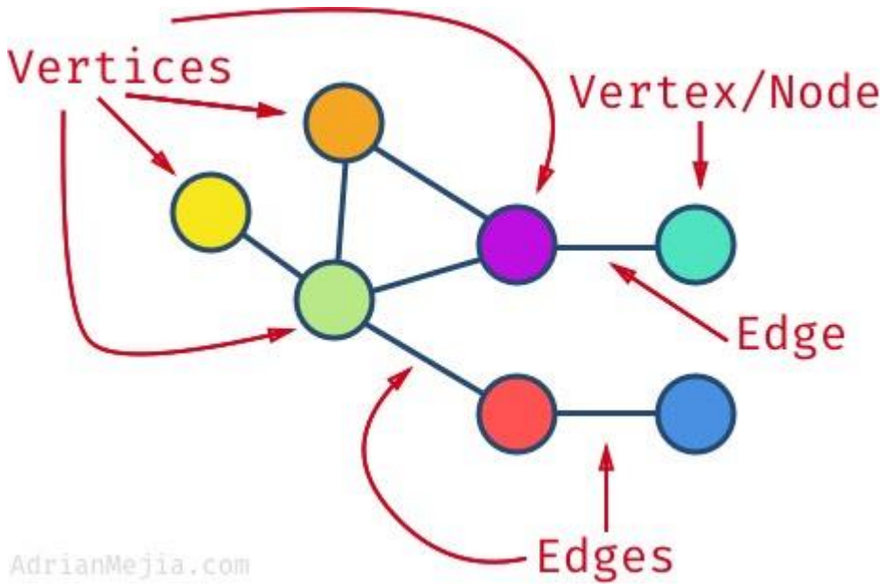
- To introduce the Non-linear data structure – Graphs
- To discuss the importance of Graphs in programming

II. Methods

A. Discuss the following terms related to graphs:

1. Undirected graph
2. Directed graph
3. Nodes
4. Vertex
5. Degree
6. Indegree
7. Outdegree
8. Path
9. Cycle
10. Simple Cycle

III. Results



A. GRAPH

1. Undirected graph

It is a kind of graph where the edges are non-directional or do not have a specific direction. If node A is connected to node B, then you can move from A to B and thus B to A without any limitation.

2. Directed graph

It is a kind of graph where the edges have a definite direction. Thus, it is a one-way connection, where node A may be linked to node B, but it is not necessary that node B will be linked to node A. Directed graphs are excellent choice in operations like web page linking, task scheduling, and one-way street systems.

3. Nodes

Nodes or points are the primary elements of a graph which depict either entities or data points. In a social network graph, for example, nodes would represent the people. Nodes are linked with each other via edges to develop relations or links within the graph.

4. Vertex

Vertex is a single word that means a point or node in a graph. Both words vertex and node are very closely similar and thus are used interchangeably in most cases. Moreover, a vertex can hold some information and be connected to other vertices through the edges. The collection of all the vertices determines the characteristics and the degree of the graph.

5. Degree

Degree of the vertex is the number of the edges connected to the vertex. In the case of an undirected graph, each edge increases the degree of both vertices that are connected by one. The degree shows the number of direct links that a vertex has, which can be used to find out how "connected" the vertex is in the network.

6. Indegree

Within a directed graph, the indegree of a vertex is the number of edges that lead to it. The indegree reveals the number of vertices that have their connections pointing toward this particular one. To illustrate, the indegree of a webpage in a web linkage graph shows how many pages link to it.

7. Outdegree

The outdegree of a vertex in a directed graph is the number of edges that are going out from it. The outdegree tells the number of other vertices to which the current vertex is pointing. The outdegree of a webpage in the example of the web is the number of other sites it links to.

8. Path

Having a path in graph means there exists a sequence of vertices with edges connecting them and one can travel from the one vertex to the other following the connections. The length of a path is the number of edges it has. The main uses of paths are for showing access since one vertex may also be a shortest way to another vertex.

9. Cycle

Where a cycle is, the starting point is also the ending point, and the path has no repetitions of edges. Or the set of vertices that forms a closed loop. Cycles are not only possible in directed graphs but also in undirected ones and they are essential for detecting loops or recurring connections within a system.

10. Simple Cycle

Simple cycle is a form of cycle where aside from the starting and the ending one, no vertices are repeated. It is a unique closed path without revisiting any vertex along the way. Simple cycles are utilized in graph theory for a better understanding of routes, loops, and circuit designs that do not contain any redundancies.

IV. Conclusion

In conclusion, the concepts of nodes (or vertices), edges, and the properties of these, such as degree, indegree, and outdegree, are means of describing which elements are connected to each other and how. Whether a graph is directed or undirected only affects the direction of the relationships, whereas concepts like paths, cycles, and simple cycles help to understand the structure and connectivity of the graph. So, essentially, knowing these graph components inside out gives one a solid base for the use of graphs in network design, social media analysis, route optimization, and a vast number of computational processes that are based on the relationships and connections between data points.

References

[1] Co Arthur O.. “University of Caloocan City Computer Engineering Department Honor Code,” UCC-CpE Departmental Policies, 2020.