



UNIVERSITY OF CALOOCAN CITY
COMPUTER ENGINEERING DEPARTMENT



Data Structure and Algorithm

Laboratory Activity No. 10

Intro to Graphs

Submitted by:
Delinia, Filjohn B.

Instructor:
Engr. Maria Rizette H. Sayo

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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.

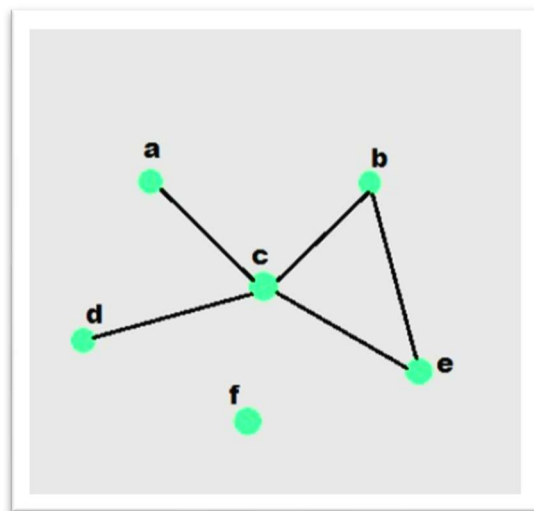


Figure 1. Sample graph with vertices and edges

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

Undirected Graph - An **undirected graph** is a type of graph where the edges (connections between nodes) have no direction. This means that if there is an edge between two nodes A and B , it can be traversed in either direction (from A to B , or from B to A). In simple terms, the relationship between the nodes is mutual.

Direct Graph - A **directed graph** (or **digraph**) is a graph where edges have a direction. Each edge has a starting point (tail) and an endpoint (head), represented as an ordered pair (u, v) , where u is the tail and v is the head. This means the relationship between nodes is one-way.

Nodes - A **node** (or **vertex**) is a fundamental unit of a graph. It represents an entity or object in the graph. Nodes can be connected by edges, and each node can have various properties, such as labels or attributes.

Vertex - The term **vertex** is synonymous with **node** in graph theory. Both refer to a point in the graph where edges meet. The term **vertex** is more commonly used in mathematical discussions, while **node** is more often used in computer science and applications.

Degree - The **degree** of a vertex (node) is the number of edges incident to it. For an undirected graph, it counts both incoming and outgoing edges as the same. In a directed graph, degree can be further split into **indegree** and **outdegree**.

Indegree – The **indegree** refers to the number of edges that point **into** a node in a directed graph. In other words, it counts how many edges have the node as their destination.

Outdegree - The **outdegree** refers to the number of edges that originate **from** a node in a directed graph. In other words, it counts how many edges have the node as their source.

Path - A **path** in a graph is a sequence of vertices connected by edges. In a directed graph, the edges in the path must be traversed in the direction they point. A path can be either simple (no repeated vertices) or allow repeated vertices.

Cycle - A **cycle** is a path in a graph that begins and ends at the same vertex, with all edges in the path being distinct. In directed graphs, a cycle requires that the direction of edges be respected.

Simple Cycle - A **simple cycle** is a cycle where no vertex (except for the starting/ending vertex) is repeated. Essentially, a simple cycle has no repeated vertices or edges other than the

starting/ending vertex. In a directed graph, a simple cycle would have a set of distinct vertices connected by edges, with the path starting and ending at the same vertex.

IV. Conclusion

Graphs are prevalent in our daily lives, appearing in social networks, maps, and computing systems. Grasping the fundamentals, such as the definitions of nodes and edges, the distinctions between directed and undirected graphs, and the ideas of paths and cycles, enhances our comprehension of how various elements are linked and interact. Although these concepts may initially seem complex, they serve as valuable instruments for addressing numerous challenges in both ordinary scenarios and technological environments. Once these notions are understood, it becomes simpler to investigate more intricate networks and their uses.

References

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