



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.

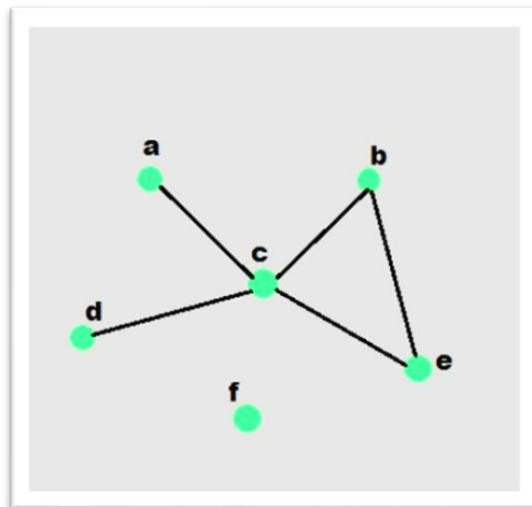


Figure 1. Sample graph with vertices and edges

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

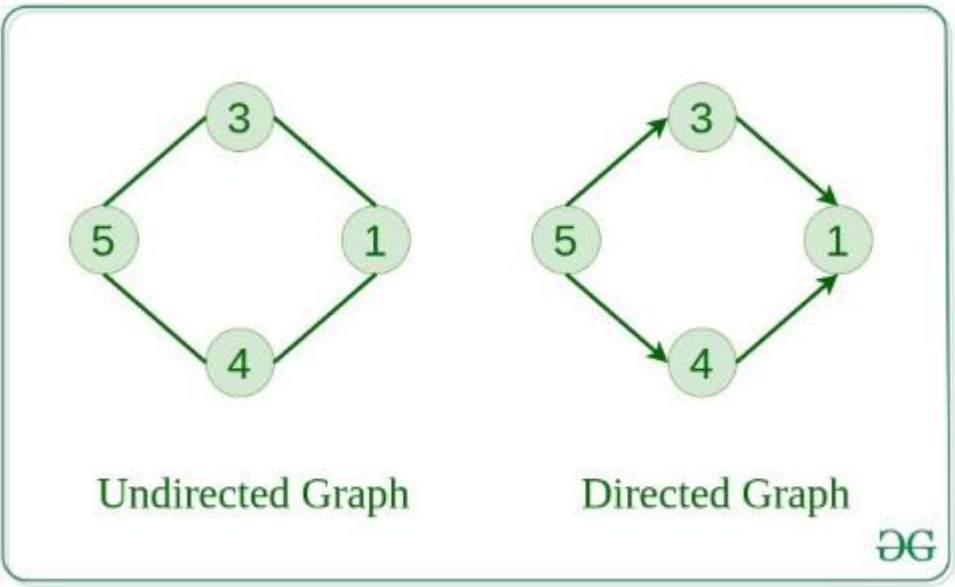


Figure 1 Undirected Graph and Directed Graph (Digraph)

1. Undirected Graph

An undirected graph is a type of graph where the edges (connections between nodes or vertices) have no direction. In other words, if there is an edge between node A and node B, you can traverse it in either direction, A to B or B to A. The edge is simply a pair of nodes, and there is no distinction between the two nodes in terms of directionality.

2. Directed Graph (Digraph)

A directed graph (or digraph) is a graph where the edges have a direction, indicated by an arrow. In a directed graph, each edge has a starting node (tail) and an ending node (head), and you can only traverse the edge from the tail to the head.

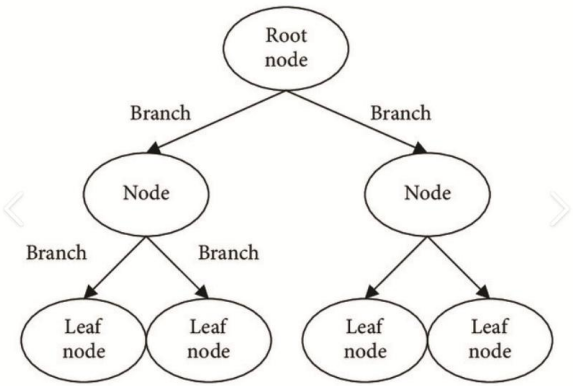


Figure 2 Nodes

3. Nodes

Nodes (also called vertices) are the fundamental units or elements in a graph that represent entities or objects. In simpler terms, a node can be seen as a point or position in the graph. For example, in a social network graph, each person might be represented by a node.

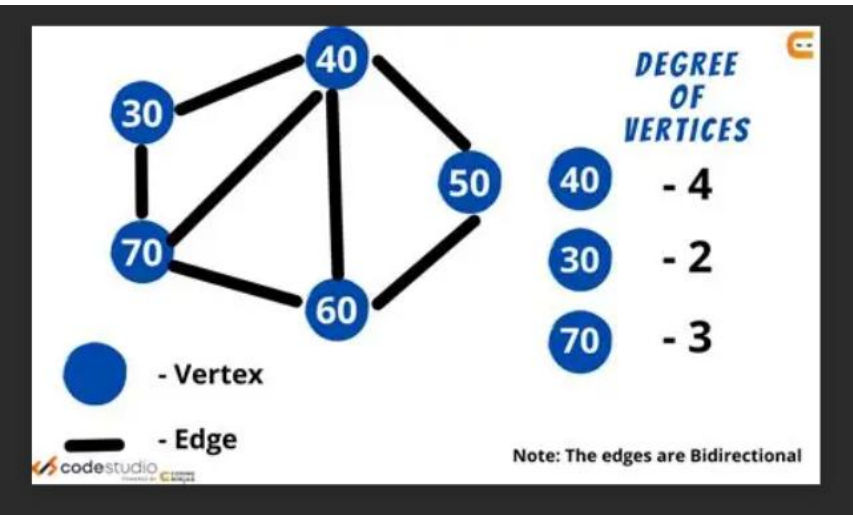


Figure 4 Vertex

4. Vertex

A vertex is essentially the same as a node. Both terms are used interchangeably in graph theory. A vertex is a fundamental part of the graph that can have edges connecting it to other vertices.

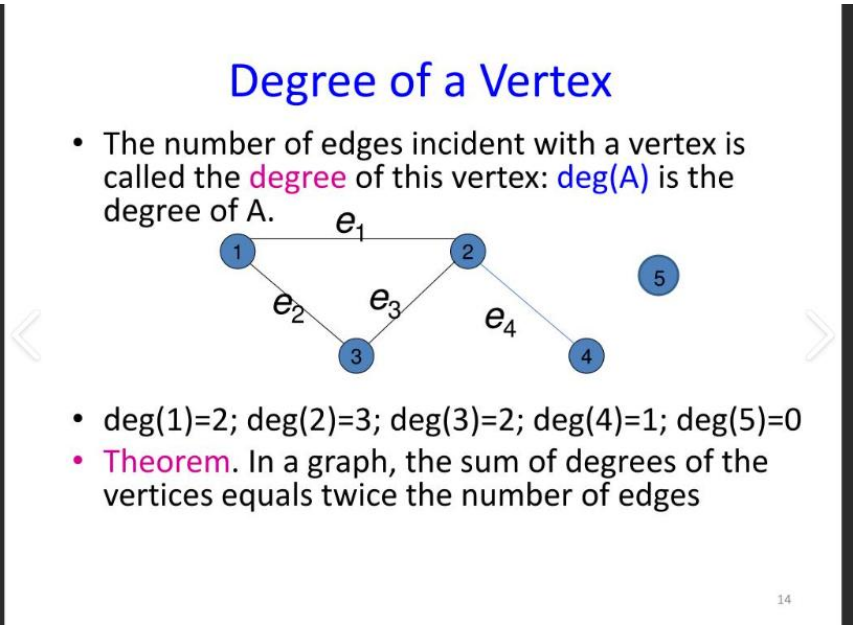


Figure 5 Degree

5. Degree

The degree of a vertex is the number of edges connected to it. It tells you how many direct connections (neighbors) a node has in the graph. The degree can be classified as:

For undirected graphs: It is simply the count of edges connected to the vertex.

For directed graphs: It includes both in-degree and out-degree

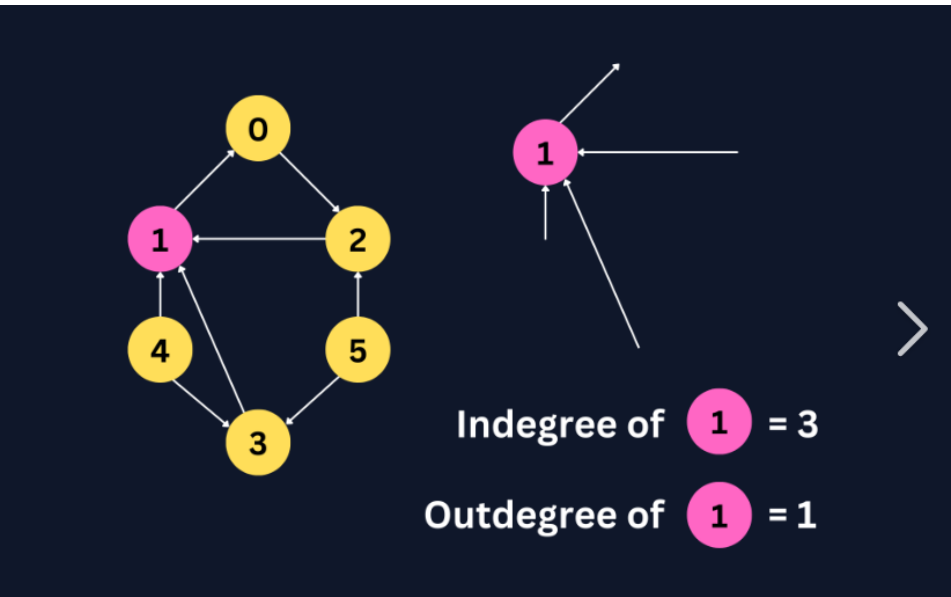


Figure 6 Indegree and Outdegree

6. Indegree

In a directed graph, the indegree of a vertex is the number of edges that point to that vertex (i.e., the number of incoming edges). It represents how many vertices are "pointing" to this vertex.

7. Outdegree

In a directed graph, the outdegree of a vertex is the number of edges that originate from that vertex (i.e., the number of outgoing edges). It represents how many vertices this vertex is "pointing" to.

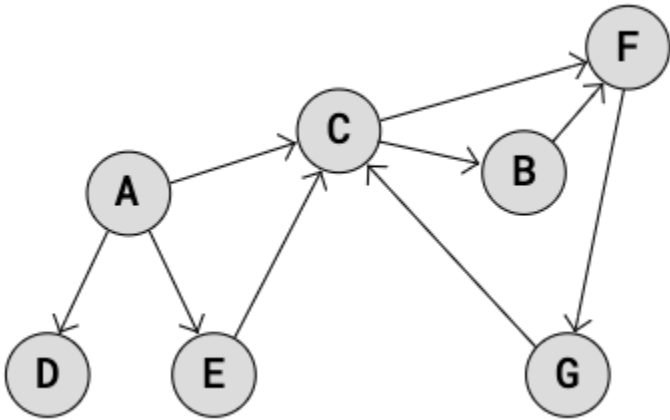


Figure 8 Path

8. Path

A path in a graph is a sequence of vertices where each consecutive pair of vertices is connected by an edge. A path does not necessarily need to be simple (i.e., it can visit the same vertex multiple times). The length of the path is the number of edges it traverses.

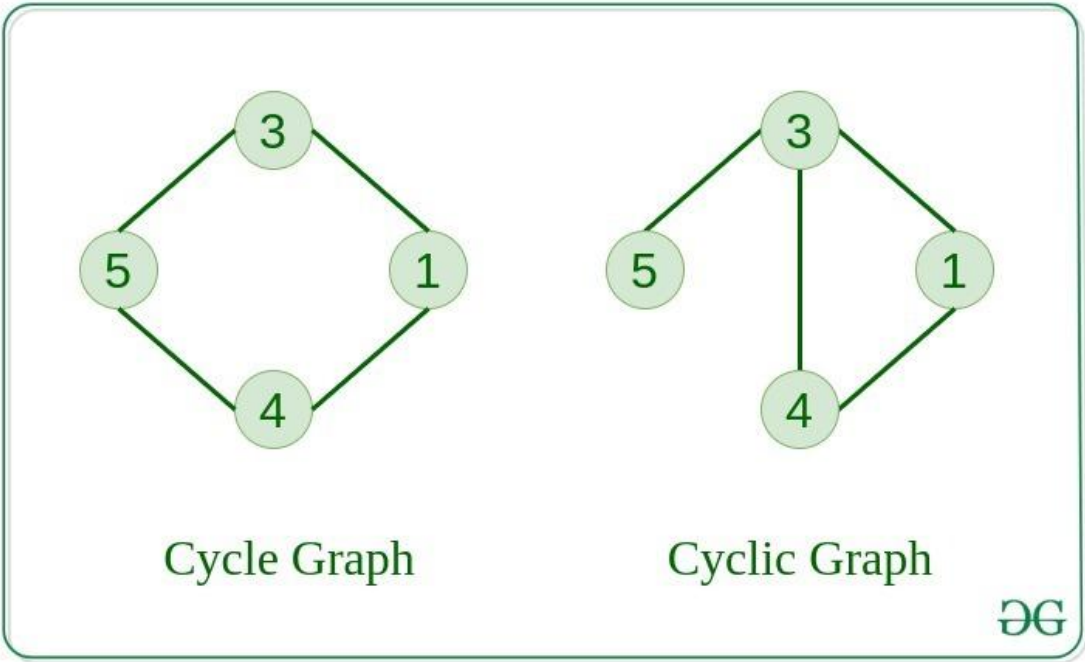


Figure 9 Cycle

9. Cycle

A cycle is a path in a graph that starts and ends at the same vertex, and no other vertex is repeated. It is essentially a closed loop. A graph that contains at least one cycle is called a cyclic graph.

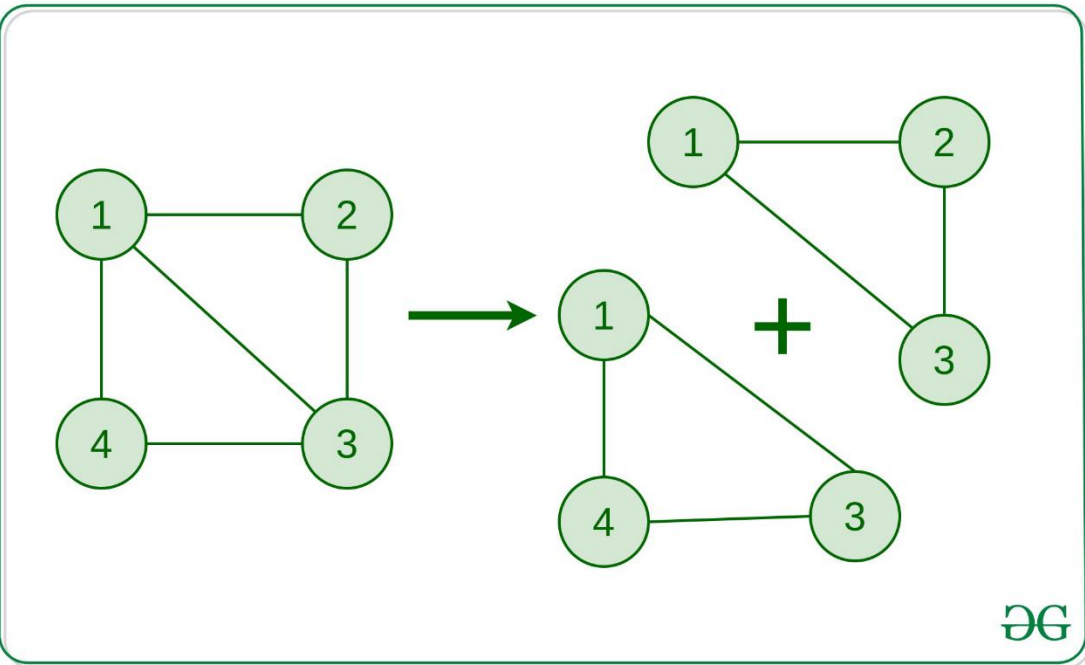


Figure 10 Simple Cycle

10. Simple Cycle

A simple cycle is a cycle that does not repeat any vertex except for the starting and ending vertex. In other words, it is a cycle in which each vertex (except the start/end) appears only once.

IV. Conclusion

This laboratory activity provided a comprehensive introduction to graphs, which are essential non-linear data structures used to represent relationships between various entities in programming. We explored the fundamental concepts such as undirected and directed graphs, nodes (or vertices), degrees, indegrees, outdegrees, paths, cycles, and simple cycles.

Understanding these terms is crucial for solving complex problems, this will help us students understand and apply graphs in non-linear data structures

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