***Programming Assign Unit 3***

Department of Computer Science, University of the People

## CS 3304 Analysis of Algorithms

9 July 2024

### Introduction

![A diagram of a network

Description automatically generated]()"A graph is a type of data structure that is used to describe the relationships between entities. An entity is any item that has a separate and autonomous existence; it can be a physical object or an abstract idea" (Great Learning Team, 2022, para.1). Graphs are used to establish a double correlation between elements. A graph is defined as a mathematical structure that connects a set of points to represent a specific function. It involves the study of how vertices (nodes) and edges (lines) interact. Formally, a graph is denoted as the pair G (V, E), where V represents the vertices of the finite set and E represents its edges (A, 2021).

***Q1: Create a data structure to represent the detailed graph in the following picture:***

V = {1, 2, 3, 4, 5, 6, 7, 8}

E = {(1, 2), (1, 3), (2, 3), (2, 4), (3, 5 ), (4, 7), (5, 4), (5, 6), (6, 7), (7, 8 )}

### ***Q2: Was the graph (Acyclic or not- Directed or undirected- Connected or not- Simple or not)?***

I will answer the second question using the approach outlined in the "Types of Graphs in Data Structure" lesson (javatpoint, n.d.):

* **Acyclic or not**: A graph is cyclic if it contains at least one cycle, meaning it begins and ends at the same node. This involves a path that traverses all vertices and returns to the starting vertex. If this criterion is not met, the graph is acyclic. Therefore, our graph is acyclic.
* **Directed or undirected**: A directed graph has edges with specific directions, indicated by arrows pointing from one node to another. For example, if an arrow points from node A to node B, we can only travel from A to B. An undirected graph lacks direction in its edges, meaning the edges do not indicate a start or end node. Therefore, our graph is directed.
* **Connected or not**: A graph is connected if there is at least one path between every pair of vertices. This means starting at one vertex allows you to reach any other vertex in the graph. If this condition is not satisfied, the graph is disconnected. Therefore, our graph is disconnected.
* **Simple or not**: A graph is simple if it does not contain self-loops (edges connecting a vertex to itself) and no parallel edges (multiple edges connecting the same pair of vertices) (javatpoint, n.d., para.17). Therefore, our graph is simple.

References:

Great Learning Team. (2022). *Graph in Data Structure and Algorithm | What is Graph in Data Structure?* Great Learning Blog: Free Resources What Matters to Shape Your Career! <https://www.mygreatlearning.com/blog/representing-graphs-in-data-structures/>

A (2021). *Graph Theory - Discrete Mathematics (Types of Graphs).* BYJUS. <https://byjus.com/maths/graph-theory/>

javatpoint. (n.d.). *Types of Graph in Data Structure.* www.javatpoint.com. <https://www.javatpoint.com/types-of-graph-in-data-structure>