Data Structure Assignment 2

Theoretical Question

Question: What are the differences between Adjacency List and Adjacency Matrix representation of a Graph?

Adjacency List and **Adjacency Matrix** are two common ways to represent graphs. The main differences between them are explained below:

1. Structure:
Adjacency List represents a graph as an array of lists. Each index represents a vertex, and the list at that index contains all adjacent vertices. Adjacency Matrix represents a graph using a 2D array where rows and columns represent vertices, and each cell shows whether an edge exists.

2. Space Complexity:
Adjacency List uses $O(V + E)$ space, where V is the number of vertices and E is the number of edges. Adjacency Matrix uses $O(V^2)$ space regardless of the number of edges.

3. Time Complexity:
Checking whether an edge exists: - Adjacency List: $O(deg(V))$ - Adjacency Matrix: $O(1)$ Traversing neighbors: - Adjacency List: Efficient - Adjacency Matrix: Less efficient

4. Suitable Usage:
Adjacency List is best for sparse graphs. Adjacency Matrix is best for dense graphs.

5. Memory Efficiency:
Adjacency List is more memory efficient for graphs with fewer edges. Adjacency Matrix may waste memory when many edges are absent.

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