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Assignment #04

Analysis Of Algorithm

Algorithm A: Breadth-First Search (BFS):

- Strengths:
- Guaranteed to find the shortest path in an unweighted graph.
- Efficient for finding all nodes at a given distance from the source.

Weaknesses:

- Can be memory-intensive for large graphs.
- Less efficient for finding the shortest path in a weighted graph.

Algorithm B: Depth-First Search (DFS):

Strengths:

- Efficient in terms of space usage.
- Can be used for topological sorting and cycle detection.

Weaknesses:

- Doesn't guarantee finding the shortest path.
- May get stuck in deep branches of the graph.

Hybrid Design: Informed Depth-First Search (IDFS):

Idea:

- Combine the space efficiency of DFS with the ability to find shorter paths, inspired by BFS.
- Use a depth limit to prevent excessive exploration of deep branches.

Gradually increase the depth limit until the target node is found or the entire graph is explored.

Algorithm:

1. Initialize:
    - Set the initial depth limit to a small value.
2. Iterative Deepening:
    - While the target node is not found:
    - Perform a depth-limited DFS.
    - If the target node is not found, increase the depth limit.
3. Return:
    - If the target node is found, return the path.
    - Otherwise, return "Not found."

Performance Analysis:

- Space Complexity: Similar to DFS, as it only needs to store the current path.

Time Complexity:

- In the worst case, it may explore the entire graph, but it's often more efficient than BFS, especially for deep graphs.
- The time complexity depends on the branching factor of the graph and the depth of the target node.

Advantages of IDFS:

- Efficient Space Usage: Like DFS, it avoids the memory overhead of BFS.
- Better Path Finding: It's more likely to find shorter paths than a simple DFS.

Flexibility:

- The depth limit can be adjusted based on problem requirements.

Potential Applications:

Game AI: For exploring game trees and finding optimal moves.

Web Crawling: For efficient crawling of large websites.

Network Routing: For finding shortest paths in networks.