**Report on Task 7: A \*Algorithm Implementation**

**1. Introduction**

This task focuses on implementing the A\* (A-Star) pathfinding algorithm a popular choice for graph traversal and pathfinding applications. The algorithm is designed to find the shortest path from a start position to a goal position within a grid-based environment while avoiding obstacles.

**2. Implementation Details**

**2.1 Overview of A\* Algorithm**

A\* is an informed search algorithm that combines:

* G-cost (g): The distance from the start node to the current node.
* H-cost (h): The estimated distance from the current node to the goal (heuristic).
* F-cost (f): The total cost calculated as (`f = g + h`).

The algorithm prioritizes paths that minimize `f`, ensuring the most efficient route to the goal.

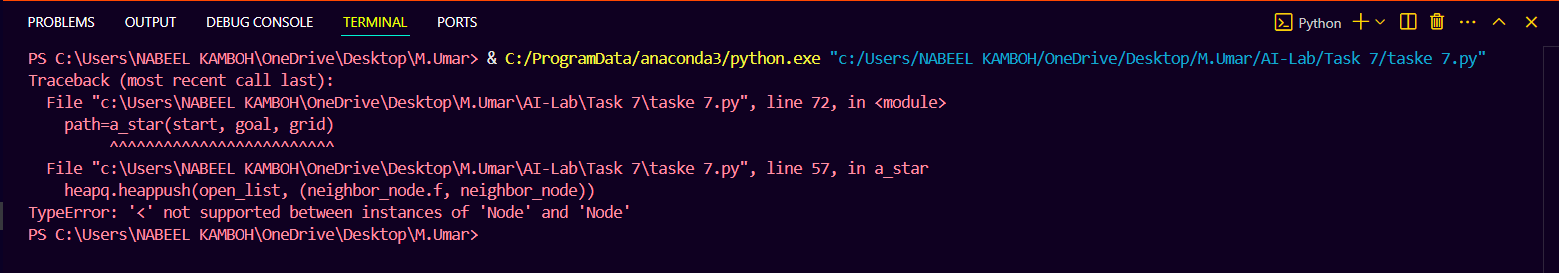
**2.2 Grid Representation**

* The environment is represented as a 2D list (grid
* `0` indicates an open path, while `1` signifies an obstacle.
* Movement is allowed up, down, left, or right (diagonal movement is not permitted).

**2.3 Implementation Components**

* Node Class: Represents a position in the grid, including `g`, `h`, and `f` values.
* Heuristic Function: Utilizes Manhattan Distance to estimate the remaining cost to reach the goal.
* Priority Queue (heapq): Organizes open nodes based on their `f` value.
* Path Reconstruction: After reaching the goal, the algorithm retraces the path take

**3 output**

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