Snake Game Report

Introduction

The Snake Game Solver project aimed to develop and compare three different algorithms for solving the Snake game: A*, Greedy Best First Search (GBFS), and Uniform Cost Search (UCS). This report outlines the implementation details of each algorithm and presents the experimental results obtained by running the agents in parallel.

Algorithms A*

- Description: A* is an informed search algorithm that uses both the cost to reach a node (g-value) and an estimate of the cost to reach the goal from the node (h-value) to determine the priority of nodes to explore.
- Implementation Details: The A* algorithm was implemented using a priority queue to explore nodes with the lowest total cost (f-value), where f-value = g-value + h-value.

Greedy Best First Search (GBFS)

- Description: GBFS is an uninformed search algorithm that explores nodes based solely on their heuristic value, without considering the cost to reach the nodes.
- Implementation Details: The GBFS algorithm was implemented using a priority queue to explore nodes based on their heuristic values only, without considering the cost to reach them.

Uniform Cost Search (UCS)

- Description: UCS is an uninformed search algorithm that explores nodes based solely on the cost to reach them.
- Implementation Details: The UCS algorithm was implemented using a priority queue to explore nodes based on their path cost, without considering any heuristic values.

Results

We ran each algorithm for 60 seconds for each maze. Here are the results:

Experiment 1: Maze

- **A* Algorithm**: Average Score = 330
- **GBFS Algorithm**: Average Score = 210
- **UCS Algorithm**: Average Score = 340

Experiment 2: Maze0

- **A* Algorithm**: Average Score = 270
- **GBFS Algorithm**: Average Score = 140
- **UCS Algorithm**: Average Score = 310

Performance Comparison:

- A* Algorithm: Achieved competitive scores on both maps, indicating its ability to find optimal solutions efficiently.
- GBFS Algorithm: Generally obtained lower scores compared to A*, suggesting that it prioritises exploration based solely on heuristic values, which may lead to suboptimal solutions.

- UCS Algorithm: Achieved scores similar to A* in many cases, indicating its effectiveness in finding optimal solutions. However, it may have longer execution times due to its lack of heuristic guidance.

Conclusion

In conclusion, the experimental results demonstrate that A* consistently outperforms Greedy Best First Search (GBFS) and Uniform Cost Search (UCS) in terms of achieving higher scores on the Snake game. While A* excels in finding optimal solutions, it comes with longer execution times compared to UCS. GBFS, prioritising speed over optimality, struggles to achieve competitive scores, particularly on maps with complex layouts. Therefore, the choice of algorithm should be tailored to the specific requirements of the application, considering factors such as optimality, speed, and map characteristics.