Project 1 – Pacman Path/Location Search

CSC 412 –Intelligent Systems

California Baptist University

Instructor: Dr. Dan Grissom

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Johana Chazaro Cortes

Roberto Rodriguez

# Individual Results

## Question 1 – Tiny DFS

### Screenshot

A picture containing icon

Description automatically generatedGraphical user interface, text

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 10 | 0.0 | 15 | 500 |

## Question 1 – Medium DFS

### Screenshot

A picture containing timeline

Description automatically generatedText

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 130 | 0.1 | 146 | 380.0 |

## Question 1 – Big DFS

### Screenshot

A picture containing qr code

Description automatically generatedGraphical user interface, text

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 210 | 0.0 | 390 | 300.0 |

## Question 2 – Tiny BFS

### Screenshot

A picture containing icon

Description automatically generatedText

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 8 | 0.0 | 15 | 502.0 |

## Question 2 – Medium BFS

### Screenshot

Background pattern

Description automatically generated with medium confidenceText

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 68 | 0.0 | 269 | 442.0 |

## Question 2 – Big BFS

### Screenshot

A picture containing qr code

Description automatically generated Text

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 210 | 0.0 | 620 | 300.0 |

## Question 3 – Tiny UCS

### Screenshot

A picture containing icon

Description automatically generatedText

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 8 | 0.0 | 15 | 502.0 |

## Question 3 – Medium UCS

### Screenshot

Background pattern

Description automatically generatedText

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 68 | 0.0 | 269 | 442.0 |

## Question 3 – Big UCS

### Screenshot

wA picture containing qr code

Description automatically generatedText

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 210 | 0.2 | 620 | 300.0 |

## Question 3 – Medium Dotted Stay East UCS

### Screenshot

A picture containing background pattern

Description automatically generatedText

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 1 | 0.0 | 186 | 646 |

## Question 3 – Scary Stay West UCS

### Screenshot

A screenshot of a computer

Description automatically generated with medium confidence

Text

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 1 | 0.0 | 186 | 646 |

## Question 4 – Big A\*

### Screenshot

A picture containing icon

Description automatically generated Text

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 8 | 0.0 | 14 | 502.0 |

## Question 4 – Big A\*

### Screenshot

A picture containing background pattern

Description automatically generated

Text

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 68 | 0.0 | 221 | 442 |

## Question 4 – Big A\*

### Screenshot

A picture containing qr code

Description automatically generatedText

Description automatically generated

### Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| Cost | Execution Time (sec) | # Nodes Expanded | Pacman Score |
| 210 | 0.1 | 549 | 300.0 |

# Summary

## Summary Chart

The following chart summarizes the individual results provided in the previous section:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Alg.** | **Maze** | **Cost**  **(Solution Quality)** | **Execution Time (s)** | **# Nodes**  **(Time Complexity)** |
| **DFS** | **Tiny** | 10 | 0.0 | 15 |
| **Med** | 130 | 0.1 | 146 |
| **Big** | 210 | 0.0 | 390 |
| **BFS** | **Tiny** | 8 | 0.0 | 15 |
| **Med** | 68 | 0.0 | 269 |
| **Big** | 210 | 0.0 | 620 |
| **UCS** | **Tiny** | 8 | 0.0 | 15 |
| **Med** | 68 | 0.0 | 269 |
| **Big** | 210 | 0.2 | 620 |
| **A\*** | **Tiny** | 8 | 0.0 | 14 |
| **Med** | 68 | 0.0 | 221 |
| **Big** | 210 | 0.1 | 549 |

## Summary Explanation

There were some interesting observations when comparing the four search algorithms across each maze size and application. Firstly, DFS demonstrated a slight slowdown as the size of the maze was increased. This could mostly be due to how depth first search is designed to look for the goal state. For instance, as DFS searches, it goes through the deepest nodes in the search tree before returning to the next node and following it to its deepest path. We also observe the ratio of nodes searched is smaller than the other search algorithms. This observation is expected because UCS and BFS are expected to follow the same base style of algorithm that searches the entire tree of opportunities and therefore searches through all the nodes before identifying the most optimal. Thus, it is reasonably expected for the number of nodes explored for all maze sizes to be the same for BFS and UCS. Another expected observation that can be seen is the equal reported costs of BFS, UCS, and A\*. This is because these algorithms are guaranteed to be optimal and complete, meaning that after searching through the tree, the resulting path is required to be the most cost efficient (specifically concerning UCS/A\* since cost is not considered in BFS) and most optimal (all three).