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CSC 480

Assignment 1: Eight Puzzle Search

Link to YouTube Video: https://youtu.be/a8oseWE-eXw

Discussion

The cost was all relatively the same for easy and medium difficulties except for DFS. I had my moves go in a clockwise rotation which I found to be faster than my original rotation (Up, Down, Left, Right). I believe that DFS went through one whole long branch before it found the solution. This is explained with IDS doing better than DFS and relatively the same as BFS.

As the difficulty increases, we can see how A\* Search begins to outperform the rest of the algorithms. The heuristic for A\*3 is to take the Euclidean Distance of each tile to its respective space in the goal state. As we can see this heuristic really didn’t help the algorithm, but I was on par with A\*1 and A\*2. Another attempt choosing a heuristic of adding both H\*1 and H\*2 to be H\*3 (which I did not include in the final report). This really didn’t have much of an advantage either, but I decided to try the Euclidean Distance after.

I believe that experimenting with different move rotations as you mentioned really affects the output of the algorithm. DFS is really susceptible to this but IDS helps by not getting stuck in long paths when the solution is closer to the start state.

Tables

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Easy** | | | | |
| Algorithm | Length | Cost | Time | Space |
| BFS | 5 | 16 | 43 | 35 |
| DFS | 13 | 68 | 14 | 11 |
| IDS | 5 | 16 | 42 | 6 |
| UCS | 5 | 16 | 40 | 26 |
| GBF | 5 | 16 | 7 | 7 |
| A\*1 | 5 | 16 | 20 | 12 |
| A\*2 | 5 | 16 | 16 | 16 |
| A\*3 | 5 | 16 | 18 | 12 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Medium** | | | | |
| Algorithm | Length | Cost | Time | Space |
| BFS | 9 | 20 | 331 | 213 |
| DFS | 57835 | 283095 | 68856 | 38636 |
| IDS | 9 | 20 | 986 | 12 |
| UCS | 9 | 20 | 69 | 45 |
| GBF | 39 | 97 | 474 | 310 |
| A\*1 | 9 | 20 | 40 | 27 |
| A\*2 | 9 | 20 | 27 | 20 |
| A\*3 | 9 | 20 | 33 | 23 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Hard** | | | | |
| Algorithm | Length | Cost | Time | Space |
| BFS | 30 | 117 | 181357 | 24978 |
| DFS | 24356 | 125568 | 161717 | 42808 |
| IDS | 34 | 133 | 35893 | 31 |
| UCS | 32 | 108 | 181061 | 24682 |
| GBF | 78 | 293 | 1179 | 735 |
| A\*1 | 32 | 108 | 179301 | 25437 |
| A\*2 | 32 | 108 | 167722 | 27615 |
| A\*3 | 32 | 108 | 173783 | 26477 |

Output (This is the code output with just running every algorithm without user input.):

Puzzle Difficulty is set to easy.

BFS

Goal State Reached!

Length: 5.

Cost: 16.

Time: 43

Space: 35

DFS

Goal State Reached!

Length: 13.

Cost: 68.

Time: 14

Space: 11

Iter\_Deep

Goal State Reached!

Length: 5.

Cost: 16.

Time: 42

Space: 6

Uniform-Cost

Goal State Reached!

Length: 5.

Cost: 16.

Time: 40

Space: 26

Best-First

Goal State Reached!

Length: 5.

Cost: 16.

Time: 7

Space: 7

A\*1

Goal State Reached!

Length: 5.

Cost: 16.

Time: 20

Space: 12

A\*2

Goal State Reached!

Length: 5.

Cost: 16.

Time: 16

Space: 10

A\*3

Goal State Reached!

Length: 5.

Cost: 16.

Time: 18

Space: 12

Puzzle Difficulty is set to medium.

BFS

Goal State Reached!

Length: 9.

Cost: 20.

Time: 331

Space: 213

DFS

Goal State Reached!

Length: 57835.

Cost: 283095.

Time: 68856

Space: 38636

Iter\_Deep

Goal State Reached!

Length: 9.

Cost: 20.

Time: 986

Space: 12

Uniform-Cost

Goal State Reached!

Length: 9.

Cost: 20.

Time: 69

Space: 45

Best-First

Goal State Reached!

Length: 39.

Cost: 97.

Time: 474

Space: 310

A\*1

Goal State Reached!

Length: 9.

Cost: 20.

Time: 40

Space: 27

A\*2

Goal State Reached!

Length: 9.

Cost: 20.

Time: 27

Space: 20

A\*3

Goal State Reached!

Length: 9.

Cost: 20.

Time: 33

Space: 23

Puzzle Difficulty is set to hard.

BFS

Goal State Reached!

Length: 30.

Cost: 117.

Time: 181357

Space: 24978

DFS

Goal State Reached!

Length: 24356.

Cost: 125568.

Time: 161717

Space: 42808

Iter\_Deep

Goal State Reached!

Length: 34.

Cost: 133.

Time: 35893

Space: 31

Uniform-Cost

Goal State Reached!

Length: 32.

Cost: 108.

Time: 181061

Space: 24682

Best-First

Goal State Reached!

Length: 78.

Cost: 293.

Time: 1179

Space: 735

A\*1

Goal State Reached!

Length: 32.

Cost: 108.

Time: 179301

Space: 25437

A\*2

Goal State Reached!

Length: 32.

Cost: 108.

Time: 167722

Space: 27615

A\*3

Goal State Reached!

Length: 32.

Cost: 108.

Time: 173783

Space: 26477