

Comparison of Searching Algorithms

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October 2022

1 BFS , DFS, A* Search Comparison

This section compares the performance of the breadth-first search (BFS), depth-first search (DFS), and A* in solving the 8-puzzle Game.

1.1 Time Complexity

Time Spent per Test Case (in sec)			
Test Case Pattern	DFS	BFS	A*
1 2 3 4 8 0 7 6 5	0.034930944	0.01899	0.001994371
3 0 2 6 5 1 4 7 8	N/A	893.50863600	0.283245802
8 7 6 5 4 3 2 1 0	N/A	N/A	9.478372574
2 3 0 1 5 6 4 7 8	0.002991199	0.038897991	0.001994848

Below is a table that shows the time spent (in seconds) in searching a state using searching algorithms. The elapsed time was measured using the time library in Python.

1.2 Analysis

In terms of time spent in solving the 8-puzzle game, the A* Search among the three (3) search algorithms used is the fastest. It has an average time of 2.44140189875 seconds based on the four (4) test cases used. BFS and DFS' algorithm came second and third since most of the test cases result are not possible to measure since it takes a while. In terms of its capability, A* Search is the most capable to crack a pattern with less time. As seen in the table above, in test case 3, only this said search was able to provide a series of actions possible. In conclusion, A* is the most efficient among the three.

1.3 Space Complexity

Memory Usage (in MiB)			
Test Case Pattern	DFS	BFS	A*
1 2 3 4 8 0 7 6 5	59.7734	59.9062	61.4727
3 0 2 6 5 1 4 7 8	N/A	160.2852	93.5039
8 7 6 5 4 3 2 1 0	N/A	N/A	102.0938
2 3 0 1 5 6 4 7 8	97.3789	97.5898	98.5664

Below is a table that shows the space complexity (in mb) using searching algorithms. The elapsed time was measured using the memoryprofiler library in Python.

1.4 Analysis

In terms of space used when algorithm is running, the A* Search among the three (3) search algorithms relatively uses more memory in the majority of the test cases, except with test case 2. It has an average space used of 88.9092 seconds based on the four (4) test cases used. It can be concluded then that even if A* Search is the fastest among the three, it is the algorithm that uses the most memory amongst the three.

2 Informed and Uninformed Search Strategies

This section compares the performance of the uninformed searching algorithms (breadth-first search (BFS) and depth-first search (DFS)), and informed ones like A* Search in solving the 8-puzzle Game.

2.1 Time Complexity

Time Spent (in sec)		
Test Case Pattern	Uninformed	Informed
1 2 3 4 8 0 7 6 5	0.112415472	0.001994371
3 0 2 6 5 1 4 7 8	N/A	0.283245802
8 7 6 5 4 3 2 1 0	N/A	9.478372574
2 3 0 1 5 6 4 7 8	0.020944595	0.001994848

2.2 Analysis

As shown above, informed search algorithms, one of which is A* Search, consumes less time compared with the Uninformed Search algorithm like the BFS and DFS. Based on the test cases, the uninformed searching algorithms ranges from 0.0210 seconds to a time duration that is difficult to determine. With informed searching algorithms, it ranges from 0.0020 seconds to 9.4784 seconds. This is because informed searching algorithms takes into account information about the current state connected to the goal state.

In terms of performance, given that informed search algorithm consume less, this is also directly proportional to the its performance. These algorithms finds more quickly compared to th uninformed search algorithm since it does not use any knowledge for the searching process.

2.3 Space Complexity

Space Consumed (in mb)		
Test Case Pattern	Uninformed	Informed
1 2 3 4 8 0 7 6 5	59.8398	61.4727
3 0 2 6 5 1 4 7 8	N/A	93.5039
8 7 6 5 4 3 2 1 0	N/A	102.0938
2 3 0 1 5 6 4 7 8	97.48435	98.5664

2.4 Analysis

As shown above, informed search algorithms, one of which is A* Search, consumes more space compared with the Uninformed Search algorithm like the BFS and DFS. For test cases that have an average space complexity, informed search algorithms is 1-2 mb more with the uniformed ones. Even if the former is much more efficient, it consumes more space when the algorithm is run