Comparing Search Strategies

I will be using the three search strategies to test the hypothesis that:

*A\* is more efficient than breath-first, and the efficiency gain is greater the more difficult the problem and the closer the estimates are to the true cost.*

The search strategies I will be comparing are breadth-first and two variations of the A\* search using different methods of calculating the estimated remaining cost of a solution path. These two variations are hamming and Manhattan. Hamming is calculated by summing up the total of all the positions that are out of place. Manhattan is calculated by taking the sum of all the states that are out of position and the difference between their given position and their target position. In order to compare these three strategies and make deductions I will carry out the searches on the various puzzle states and see what their returned efficiency is using the same seed number of the epuzzgen random puzzle generator. I will also look at how changing the difficulty of the puzzle affects the efficiency.

Difficulty of 6

|  |  |  |  |
| --- | --- | --- | --- |
| Puzzle seed using epuzzgen random puzzle generator | A\* with Hamming efficiency | A\* with Manhattan efficiency | Breadth-first search |
| 12345 | 0.032 | 0.056537103 | 0.0028922632 |
| 22436 | 0.4444445 | 0.5714286 | 0.050632913 |
| 23446 | 0.03426124 | 0.055944055 | 0.0022509848 |
| 23566 | 0.5625 | 0.64285713 | 0.036437247 |
| 23666 | 0.02526003 | 0.0453333 | 0.0018679266 (20+ mins!) |

Difficulty of 12

|  |  |  |  |
| --- | --- | --- | --- |
| Puzzle seed using epuzzgen random puzzle generator | A\* with Hamming efficiency | A\* with Manhattan efficiency | Breadth-first search |
| 12345 | 0.0073072705 | 0.031796504 | NA |
| 22436 | NA | NA | NA |
| 23446 | 0.005892256 | 0.0208333 | NA |
| 23566 | 0.033542976 | 0.051779937 | 0.002912268 |
| 23666 | 0.005988024 | 0.032608695 | NA |

NA: used where tests took too long to complete

Discussion of results

It is clear from the results obtained after running the tests on all different search strategies that A\* search with Manhattan is the best search solution for a given 8 puzzle problem. This supports the hypothesis that A\* is more efficient than breadth first and is more efficient as the difficulty of the solution increases. The latter is supported after running the tests on the same puzzles but with a difficulty of 12 rather than six since the breadth first search was not even able to find a solution even after leaving the simplest puzzle (23566) running for way over 30 mins.

From the results the conclusion can also be made that using the Manhattan variant is better than the Hamming variant since it performed better with every given puzzle. This is most likely because the estimated cost generated with Manhattan is much closer to the true cost than hamming is which makes it a more efficient search solution. The Manhattan variant of A\* could be improved if the estimated costs were even closer to the true cost although this would be difficult to implement.