Analysis

Comparing the performance of these 3 algorithms in 50 puzzles, we came to the following conclusions.

1. The length of the solutions across algorithms and heuristics. When do you have the lowest-cost solution?

|  |  |  |  |
| --- | --- | --- | --- |
|  | Length of the solution | Length of the search path | Execution time |
| UCS | 10.94 | 920.96 | 1.175 |
| GBFS | 11.21569 | 211.3 | 0.19615 |
| A/A\* | 11.04 | 514.865 | 0.602438 |

UCS has the lowest-cost solution.

|  |  |  |  |
| --- | --- | --- | --- |
| Heuristic | Length of the solution | Length of the search path | Execution time |
| H1 | 11.06 | 477.73 | 0.5704 |
| H2 | 11.06 | 477.73 | 0.5704 |
| H3 | 11.2 | 222.29 | 0.2105 |
| H4 | 11.12 | 274.009901 | 0.2511 |

H1 and h2 have the same value of the length of solution, h3 has the highest value and h1 and h2 are the lowest-cost solution.

1. The admissibility of each heuristic and its influence on the optimally of the solution.

H1 is admissible in this game. First, h1 represents the number of blocking vehicles, and these vehicles must be moved. So, the optimal true minimum cost is n+1>h1. This is also reflected in the data. The lengths of the solutions of A-algorithm (A\* algorithm) using h1 returns the same as USC.

When there are vehicles with length >= 3 and on the line with A, h2 is not acceptable. As shown in the figure below, the predicted cost is 3, but the actual minimum is 2.

A picture containing text

Description automatically generated

Edited from Example 2

If h is not admissible, it will cause the A algorithm to return a solution that is not optimal. It is like the next data.

Table

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3. The execution time across algorithms and heuristics. Is an informed search always faster?

As we can see, for the average value, both GBFS and A are faster than UCS, so in most cases informed algorithms are faster than uninformed. But sometimes A algorithm with h1 or h2 are slower than UCS. So informed search is not always faster than uninformed.

表格

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Example of A with h1 and h2 are slower than UCS

1. Other interesting facts that you deem worthy of describing.

GBFS has the shortest length of the search path, but it has the longest length of the solution.