Mini Project 2

Comp 472

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

We calculate the average of 50 random puzzles from the length of the solutions in Uniform Cost Search, Greedy Best First Search, and Algorithm A*.

Uniform Cost Search vs. Greedy Best First Search vs. Algorithm A*

	Length of the Solution	Length of the SearchPath	Execution Time
UCS	8.42	506.34	2.630843463
GBFS	8.895	352.27	1.340298223
A/A*	8.525	410.22	1.818085889

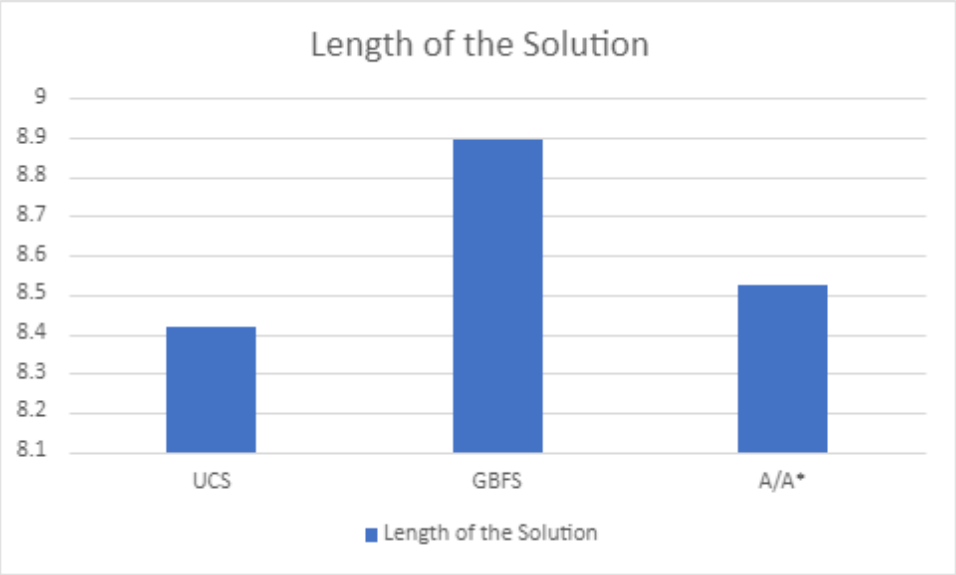
We can see:

The average the length of the solutions (UCS): 8.42

The average the length of the solutions (GBFS): 8.895

The average the length of the solutions (A*): 8.525

Then, we use the bar graph to help better compare them.



Therefore, USC has the lowest-cost solution in our case.

Now, we compare the length of the average of the solutions across heuristic.

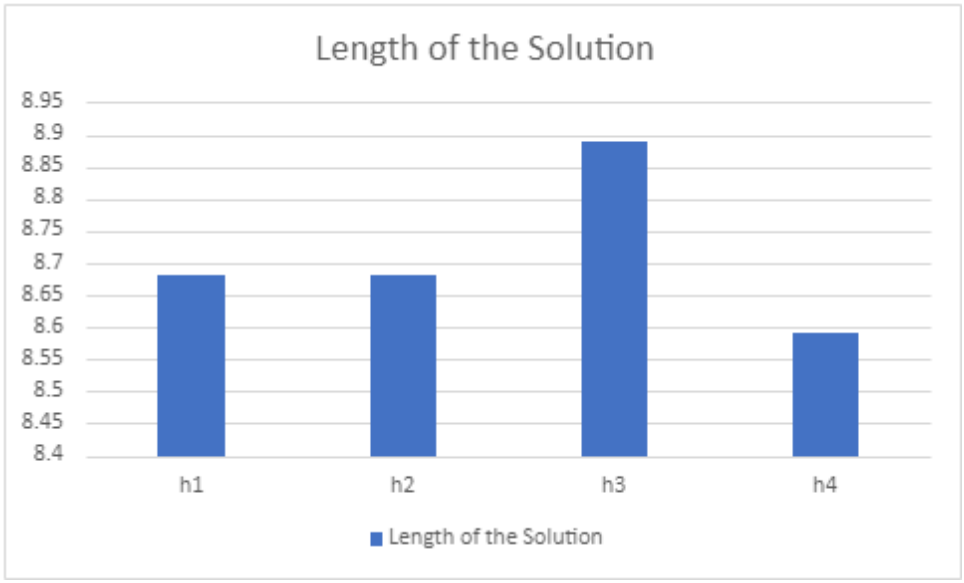
Heuristic	Length of the Solution	Length of the SearchPath	Execution Time
h1	8.68	376.78	1.552879775
h2	8.68	376.78	1.530881109
h3	8.89	329.14	1.162544484
h4	8.59	442.28	2.070462856

The average the length of the solutions (h1): 8.68

The average the length of the solutions (h2): 8.68

The average the length of the solutions (h3): 8.69

The average the length of the solutions (h4): 8.59



We can see h1 and h2 have the same value which are 8.68. h3 has the highest value with 8.69. h4 is the lowest value with 8.59, so h4 is also the lowest-cost solution.

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

For a heuristic to be admissible to a search problem, needs to be lower than or equal to the actual cost of reaching the goal.

h1 is allowed in this game. First, h1 denotes the number of blocking vehicles, which must be moved. Therefore, the true optimal minimum cost is n+1>h1. This is also reflected in the data. The length of the solution returned by the A-algorithm (A* algorithm) using h1 is the same as the USC.

When there are vehicles of length >= 3 and on the same line as A, h2 is unacceptable. As shown below, the predicted cost is 3, but the actual minimum cost is 2

	a	b	c	d	e	f
1	C	.	B	.	.	.
2	C	.	B	H	H	H
3	A	A	D	D	D	.
4	.	.	.	.	.	.
5	E	E	G	G	G	F
6	.	.	.	.	.	F

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

	Length of the Solution	Length of the SearchPath	Execution Time
UCS	8.42	506.34	2.630843463
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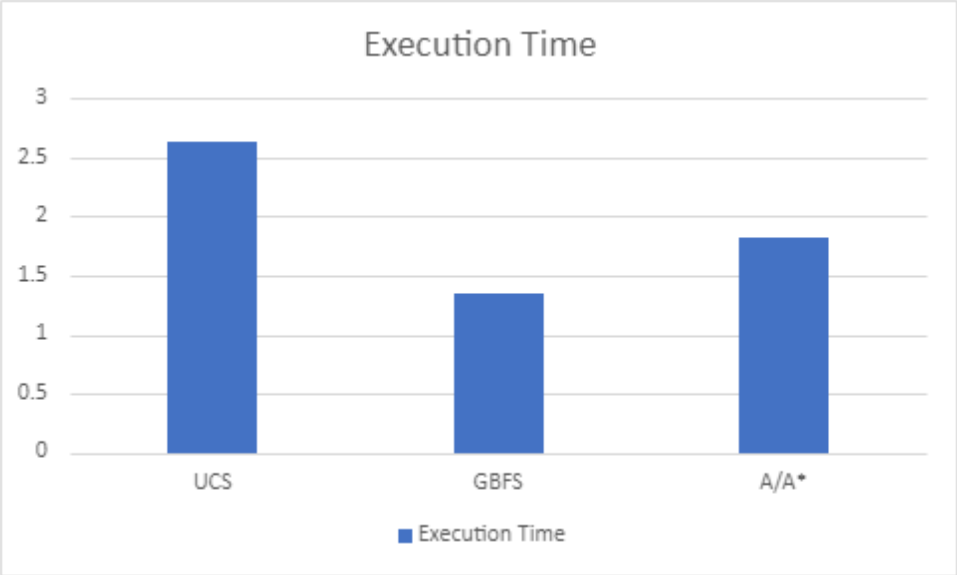
A/A*	8.525	410.22	1.818085889



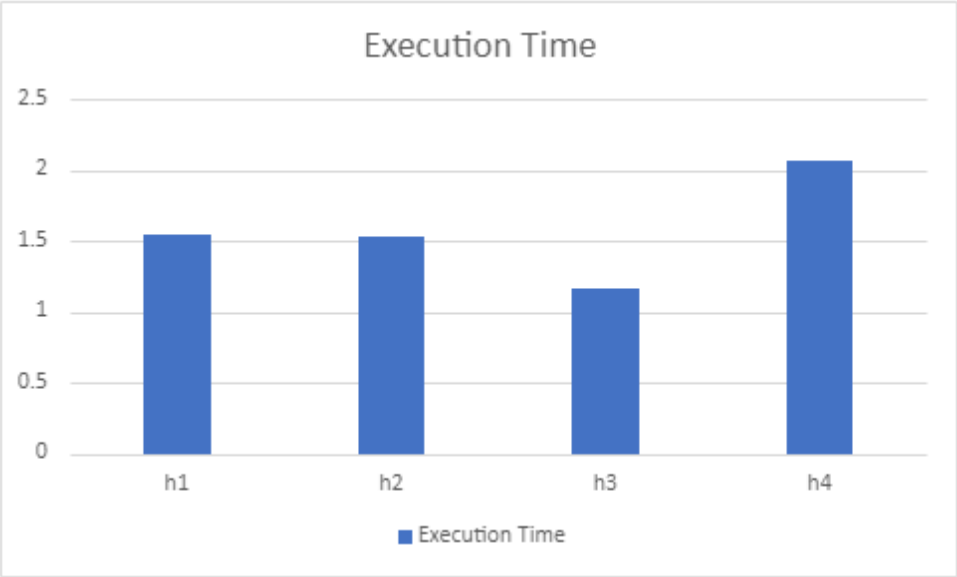
The average the execution time (UCS): 2.630843463

The average the execution time (GBFS): 1.340298223

The average the execution time (A*): 1.818085889

The GBFS and A* search is faster than UCS.

Heuristic	Length of the Solution	Length of the SearchPath	Execution Time
h1	8.68	376.78	1.552879775
h2	8.68	376.78	1.530881109
h3	8.89	329.14	1.162544484
h4	8.59	442.28	2.070462856



The average the execution time (h1): 1.552879775

The average the execution time (h2): 1.552879775

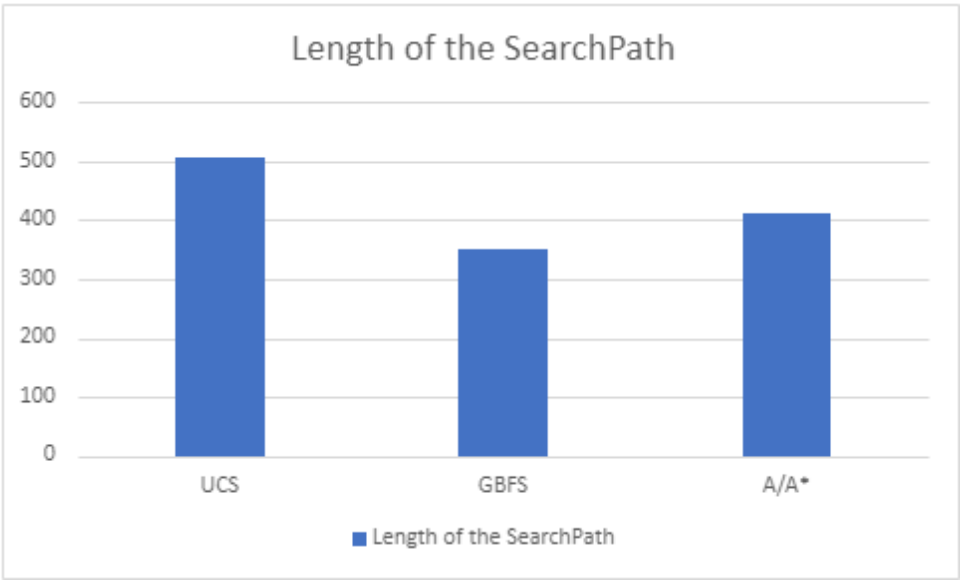
The average the execution time (h3): 1.162544484

The average the execution time (h4): 2.070462856

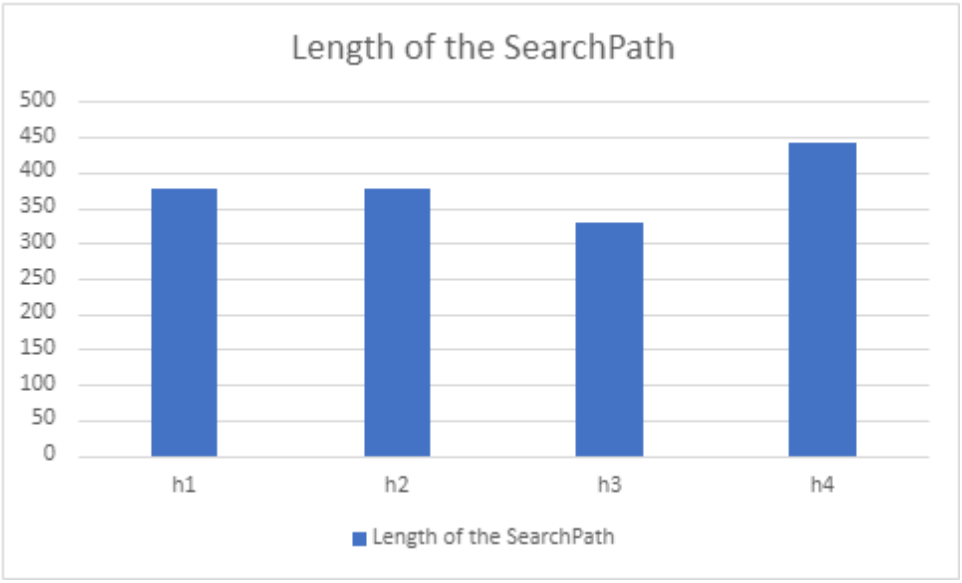
The h1 and h2 are faster than h3 and h4.

Therefore, informed search is always faster. And the h1 and h2 are faster than h3 and h4.

4. Other interesting facts that you deem worthy of describing. You will present these slides at the demo



USC has the lowest-cost solution in our case, but it has the highest length of the search path.



h1 and h2 have the same value which are 8.68 in length of the solution, and they also have the same value of the length of the solution.