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Laboratory #3
September 21st, 2018
Intelligent Systems Group #1 Tuesday and Friday 5:30pm
Rubén Stranders

9. Lab: Implementing (Un)informed Search Algorithms

Goal: Understand the use of various search algorithms and the effort involved in implementing them. **(7 hours)**

Lab

In this lab, we will make use of your programming skills to create practical implementations of several (un)informed search algorithms.

Your report needs to explain at least the following:

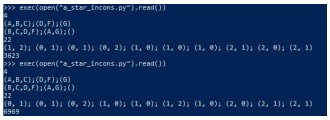
- Which heuristics did you use for the A* algorithm?

For our A* algorithm we used a consistent and an inconsistent heuristic. The consistent one was the number of elements (containers) that were not in their goal state, while the inconsistent one was just a random number going from 0 to 9.

- Test your program with a couple of different problems. Increase the size of the problem to test the limits of your program. Make a table comparing **how many nodes are searched** to find the answer for each problem. For this table, you should compare a number of different problems (at least 3) to avoid a statistical bias. Which of the three algorithms (UCS, A *with consistent and and A* with an inconsistent heuristic) searches the least nodes and which one take the most?

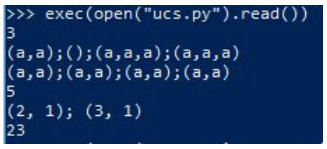
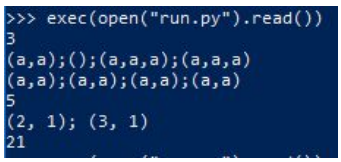
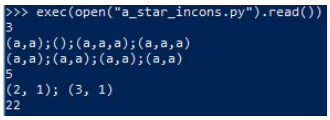
1st problem Input	3 (a,b,c);(d);();(e) (c,d);(a);(e,b);()		
Algorithms	UCS	A* consistent	A* Inconsistent
Final cost	16	16	20
Explored Nodes	3992	1570	4795

Evidence			

2nd problem Input	4 (A,B,C);(D,F);(G) (B,C,D,F);(A,G);()		
Algorithms	UCS	A* consistent	A* Inconsistent
Final cost	22	22	22
Explored Nodes	7168	2773	6969
Evidence			

3rd problem Input	4 (a,b);(c,d);(e,f,g) (c,f,a);(b,g,d);(e)		
Algorithms	UCS	A* consistent	A* Inconsistent
Final cost	26	26	31
Explored Nodes	23,647	7,800	34,691
Evidence			

4rth problem Input	3 (a,a);();(a,a,a);(a,a,a) (a,a);(a,a);(a,a);(a,a)		
Algorithms	UCS	A* consistent	A* Inconsistent
Final cost	5	5	5
Explored Nodes	23	21	22

Evidence			

The algorithm that searches the less amount of nodes is always A* consistent. While A* inconsistent and UCS travel much more nodes in their way to the goal state. There are some problems in which one of those two algorithms is better than the other, but we conclude that UCS it the one that visits more nodes in average.

- Why does this happen?

Because UCS is an uninformed algorithm, whereas A* is an informed one. That is the main difference why one algorithm is more optimal than the other.

- Which algorithms are optimal? Why?

A* with a consistent heuristic is optimal, because it nevers overestimates and always gets closer to the goal following the better path, while A* inconsistent and UCS are non optimal in the cases presented.

- In your opinion, what are the benefits of simpler algorithms versus more complex ones?

The benefits are that you require less code, time and mental effort to program them, and that they tend to give you a normal result, not the most optimal one, but a decent one. While the complex ones even though better and faster, are more difficult to implement, require more time and more code.