15-887: Assignment #2

Due on Wednesday, October 19, 2016

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Problem 1

(a)

To run this planner, please use the following command: **python world.py -a prob1.txt**

This planner performs a forward djikstra search in x and y and uses the result as an informed heuristic for a single backward A* search in x, y, and t.

The 2D djikstra search expands all nodes in the graph - one million nodes for test case one. On my machine, it takes about 8 seconds to complete this phase of the search. The distances calculated by the djikstra search are then used as the heuristic for a backward A* search which searches in both position and time.

TODO: Time, cost, number of states expanded

(b)

To run this planner, please use the following command: **python world.py -b prob1.txt**

One of the advantages of the algorithm I chose for part (a) is its ease of extension to part (b). By weighting the backward A* search, it is easy to trade optimality for speed, and it comes with the typical weighted A* performance guarantees.

TODO: Time, cost, number of states expanded

Problem 2

2.1

Suppose you have two consistent heuristic functions: h_1 and h_2. Prove that h(s) = max($h_1(s)$, $h_2(s)$) for all states s in the graph is also a consistent heuristic function.

A heuristic is consistent if

$$h(n) \leq c(n, n') + h(n')$$

for every node n and its child node n'.

Proof:

$$\begin{aligned} h(n) &= max(h_1(n), h_2(n)) \\ &\leq max(c(n, n') + h_1(n'), c(n, n') + h_2(n')) \\ &\leq c(n, n') + max(h_1(n'), h_2(n')) \\ &\leq c(n, n') + h(n') \end{aligned}$$

Suppose you have two consistent heuristic functions: h_1 and h_2. Prove that h(s) = min($h_1(s)$, $h_2(s)$) for all states s in the graph is also a consistent heuristic function.

Problem 2 [2.1] continued on next page. . .

A heuristic is consistent if

$$h(n) \leq c(n, n') + h(n')$$

for every node n and its child node n'.

Proof:

$$\begin{aligned} h(n) &= min(h_1(n), h_2(n)) \\ &\leq min(c(n, n') + h_1(n'), c(n, n') + h_2(n')) \\ &\leq c(n, n') + min(h_1(n'), h_2(n')) \\ &\leq c(n, n') + h(n') \end{aligned}$$

2.2

d. Monotonically non-increasing sequence

2.3

f. None of the above

2.4

e. None of the above