CS-E4800 AI Exercises 3: Search January 24, 2017

1 Exercise

Find the edit distance between “green” and “yellow” by using dynamic programming as shown in the lecture.

2 Exercise

Consider also the corresponding state-space search problem arising from edit distance. Consider two words, respectively of length N and M. Obviously, considering arbitrary strings of arbitrary lengths leads to an infinite state space. How much better can you do? Specifically, what kind of strings can you limit to, in terms of length and characters occurring in the strings?

1. What are the states in your state space?
2. For “green” and “yellow”, what is the size of the whole state space?

3 Exercise

Consider a navigation problem in a grid of size $N \times M$ cells. The goal is to move from cell (1,1) to cell (N,M) by moves north, south, west, and east, and the cost of each action is 1. Clearly, the shortest plans (there are several of them!) have length/cost $N - 1 + M - 1$ (the Manhattan distance).

Lets use the lower bound function $h((x, y)) = \max(N - x, M - y)$ with the A* algorithm.

1. How many states will A* expand, i.e. how many states have an f-value $< N - 1 + M - 1$?
2. How about WA* with $w = 3$?

4 Exercise

Let the state variables be $X = \{x_0, x_1, x_2, x_3, x_4\}$. Now the state can be viewed as 5-bit integers $x_4x_3x_2x_1x_0$.

1. Define actions for incrementing the 5-bit integer (i := i + 1). You need to define 5 actions, for the 5 cases when the least significant bits are respectively 0, 01, 011, 0111, and 01111.
2. Let the initial state be 00000 and the goal 11111. What plan reaches the goal from the initial state?

5 Exercise

1. For the actions in your solution to the previous exercise, construct the table representing Bonet & Geffner’s h^{max} heuristic as given in the lecture, starting from the state 00000.
2. Determine distance from 00000 to 00000.
3. Determine distance from 00000 to 00100
4. Determine distance from 00000 to 11111.