CSC 445, Spring 2018, Assignment 5

Purpose: Path Planning

Due: 4:30pm, Tuesday, March 27, 2018

Program: A* search

There is a file named `map.txt` that contains an occupancy grid map representation where the value 1 is occupied and the value 0 is free. Create a Python script named `assignment5.py` that does the following:

1. Define a function with the signature

   ```
   def Astar(M, start, goal):
   ```

   where M is a 2D numpy array representation of the map, start is a tuple indicating the starting coordinate and goal is a tuple indicating the goal position. This function should implement the A* search algorithm and return the path as a list of tuples.

   Each cell in the map is connected to the eight cells surrounding it; the cost of an edge between cells is $\sqrt{2}$ if it is diagonal, otherwise the cost of the edge is 1. The Euclidean distance from a given cell to the goal point should be used as the heuristic.

   Note: Python has an implementation of a priority queue in the `heapq` module.

2. Write a program that reads in the `map.txt` file and uses the function Astar to find the path from the coordinate (22, 33) to the coordinate (40, 15).

3. Plot the path from step 2 on the occupancy map. The following python function will properly plot the occupancy map.

   ```
   def plot_map(M):
       plt.figure()
       plt.imshow(M.T, cmap=plt.cm.gray_r, interpolation='none', origin='upper')
       plt.axis([0, M.shape[0]-1, 0, M.shape[1]-1])
       plt.xlabel('x')
       plt.ylabel('y')
   ```

Turning in the Assignment

Submit the `assignment5.py` file to the appropriate folder on D2L.