CS 461 – ARTIFICIAL INTELLIGENCE

HOMEWORK #5 (5%)

Assigned: Mon Nov 26, 2018

Due: Mon Dec 10, 2018 **14:00**

You can do this homework in groups of 5 or less. Submit your homework to our TA. (He may send you further, specific instructions.)

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Since this is your last homework, I'm assigning it a bit early so that you can work on it comfortably. You'll also notice that this is going to be a pretty straightforward homework, once you have a good grasp of k-d trees, as explained by Winston in chapter 19.

You job is to write a simple k-d tree program (or use one which is already available). In any case, you have to include the code and tell in detail how you wrote it, or where you've found it and made it work for your own purpose.

To finish this homework, you only need to consider a 2-d tree. (In other words, you don't have to worry about k > 2.) And if the program you've found is a general one (works for any k), no problem, just make sure that it works in this simpler case too.

A k-d tree program normally has two functionalities: (I) build a tree from the given set of data points, (ii) query that tree with a new data point. Thus, the tree in part (i) never changes, once it is built.

The goal of the homework is to query the tree (built on data from figure 19.2) with several unknowns (U). For each unknown you have to find the nearest neighbor using the Euclidean metric and

report it (its color). Thus, your input to build the tree are the points given in that figure and, additionally, an unknown point (see presently).

Make sure that you submit a trace of your program's calculations for each query. Essentially, a trace tells us which parts of the decision tree (cf. Figure 19.7) the program is visiting until it finds the answer.

Finally, here's a list of the query points (unknowns). Note that the first coordinate is the width and the second coordinate is the height.

- U(1,4) -- this is the unknown analyzed in the chapter; the answer will be the orange block at (2,5)
- U(1,1)
- U(6,6)
- U(6,1)
- U(4,4)