Hints for the Final

December 14, 2017

This document contains hints for the final. You may use them and receive full credit on the questions. Do write down if you used the hint or not.

1 Hint for problem 1

There are two ways we know of to try to do this.

The first way: suppose $d(f(x), f(y))$ is too big. Then there's a line segment connecting $f(x)$ and $f(y)$ that is contained in C. Show that there is a point on this line segment (that is not an endpoint) that is closer to x than $f(x)$, or else closer to y than $f(y)$.

The second way: try and prove this for intimifesimally close x and y. Argue that this proves the result for all x and y.

You may find the first method easier to rigorize.

2 Hint for problem 2

Try showing this question in two dimensions first. It may help to prove that two boxes intersect in 2D, if and only if the projection of both boxes onto the x coordinate intersect, and the projection of both boxes onto the y coordinate intersect. Use this to prove the problem, and try and generalize to higher dimensions.

3 Hint for problem 3

This is similar to the homework question on circles, but do not directly apply a stereographic projection – try to find a map to a higher dimensional space such that the ellipse separator problem becomes a linear separator problem.

4 Hint for Problem 4

No hint on this one!

5 Hint for problem 5

This is almost identical to homework problem 4 on the last homework, except with an approximate shortest-distance instead of a shortest distance. Try and use the same argument as in problem 4 on the last homework.

You may find this known fact about MSTs helpful, and you can cite it wiithout proof: each edge in the MST has the property that removing that edge disconnects the graph, and let's call the two disconnected vertex sets A and B. Then the shortest distance between A and B is equal to the length of the removed MST edge.