

COMP163 Homework Assignment 7: Due Wednesday, March 5, 2008

General Information: When describing an algorithm, do not forget to analyse its running time and explain why the algorithm is correct. Although you may discuss these problems in the preliminary stages with others, work submitted should be done individually. If you have any discussions with others (students, friends, TAs, faculty, ...) relative to a homework problem or if you gain information from a written source other than your own notes from lecture, you are expected to identify your collaborator/source.

Reading:

Read the chapter on Voronoi diagrams/Delaunay triangulations in your text, if you haven't already. Read the comparable sections in the lecture notes. Read about arrangements and duality in the lecture notes, the User Guide, and the text.

Problems

1. Voronoi Diagrams

Consider the following set of six points: A(1,1); B(1,11); C(5,15); D(7,7); E(9,1); F(9,11).

- (a) Plot these points on (large) graph paper.
- (b) Compute the Voronoi Diagram of A,B,C and draw the result.
- (c) Compute the Voronoi Diagram of D,E,F, and draw the result.
- (d) "Merge" the two Voronoi Diagrams and draw the result.
- (e) (optional) Try out what happens with the sweep-line algorithm on these 6 points.

2. Voronoi Diagrams, Planar Point Location, and Graph Searching:

Let A be a set of N points.

Let D represent a disk of radius r and center c .

Describe an efficient algorithm that will, if possible, output a path inside the convex hull of A from a query start point S_i to a query finish point F_i that can be traced by center c in such a way that disk D never contains any point of A . Assume that the set A and the size of disk D will remain fixed, but that there will be multiple queries of the form (S_i, F_i) .

Analyse the preprocessing time, the query time, and the space complexity of your algorithm.

3. Programming Project

Begin thinking about what geometric algorithm/data structure you would like to implement. Please send me and Mashhood email as to what you are thinking about this.