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Discrete and Computational Geometry

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Assignment 5

Problem 1: (4 Points)

Let P be a set of $n \geq 4$ points in $\mathbb{R}^2$ in general position. Consider the set $P' \subset \mathbb{R}^3$ from Lecture 11, defined as

$$P' = \{ \ u(x,y) \ | \ (x,y) \in P \ \}$$

with $u(x,y) = (x, y, x^2 + y^2)$. Can there exist a facet of the convex hull of P' which does not correspond to a Delaunay triangle of P? If yes, give an example of such a facet and show that it does not correspond to a Delaunay triangle of P.

Problem 2: (6 Points)

Suppose that we are given a subdivision of the plane into n convex regions, where each vertex is adjacent to at most three regions. We suspect that this subdivision is a Voronoi diagram, but we do not know the sites. Develop an algorithm that finds a set of n point sites whose Voronoi diagram is exactly the given subdivision, if such a set exists.

Problem 3: (6 Points)

The weight of a triangulation is the sum of the lengths of all edges of the triangulation. A minimum weight triangulation is a triangulation whose weight is minimal. Disprove the conjecture that the Delaunay triangulation is a minimum weight triangulation.