CSE 6403: Computational Geometry
Final Exam, 18/03/2008
Full Marks: 40 + 10 (for True/False)
Time: 1:30 hour (including the True/False part)

Answer all the following eight questions. 5×8=40

1. Prove that any triangulation of a simple polygon P with n vertices has n-3 diagonals and n-2 triangles. You may assume any necessary theorem for P.

2. Define a monotone polygon. Explain how a trapezoidalization of a simple polygon P can be converted to a monotone partition of P.

3. Explain with time complexity **only one step** (i.e., selecting next face in the convex hull) of the gift wrapping algorithm for finding the convex hull of a given set of points in 3D.

4. State Steinitz's theorem. Use this theorem to find the smallest (jn terms of number of vertices) 3-connected planar graph.

5. Write 5 properties of Voronoi diagram and corresponding 5 properties of Delaunay triangulation.

6. Prove that the Euclidean minimum spanning tree of a set of points P in the plane is a subset of the Delaunay triangulation of P.

7. Consider the following duality between a point p: (m, c) and line L: $y = mx + c$ in 2D. Prove or disprove that p lies on L if and only if dual(L) lies on dual(p).

8. State the zone theorem. Use this theorem to sketch an $O(n^2)$-time algorithm for constructing the arrangement of n lines in 2D.

Signature of the Invigilator ……..

Student No: …….. **Date: …….**

Signature of the student: ……..

Write "T"/"F" for true/false for the following statements. Write in the left margin please. 10×1=10

1. Jordan sorting takes $O(n\log n)$ time.
2. "H-P model" means the Hannenhalli-Pevzner model in protein folding.
3. Symmetry in musical rhythms often follows geometric symmetry.
4. Morphing means cutting geometric objects into small pieces.
5. The geometry of the folding of a protein, besides its content, determines it biological nature.
6. There is no difference between a minimum link shortest path and a minimum distance shortest path.
7. A theoretically good geometric algorithm may fail in practice due to the limitations of computation models.
8. Unit disk graph is a well studied graph class in wireless sensor network.
9. Finding a simple linear time algorithm for polygon triangulation is a challenging open problem till today.
10. The best known convex hull algorithm is due to the famous scientist Erik Demaine.