CISC-868 FALL 2011

HOMEWORK 1

These questions come from *Discrete and Computational Geometry* by Satyan Devadoss and Joseph O' Rourke.

Exercise 1.10.: Prove Corollary 1.9 (*Every polygon with more than 3 vertices has at least two ears.*) using induction.

Exercise 1.11.: Show that the sum of the interior angles of any polygon with n vertices is $\pi(n-2)$.

Exercise 1.14.: Let a polygon P with h holes have n total vertices (including hole vertices). Find a formula (and prove that it is correct) for the number of triangles in any triangulation of P.

Exercise 1.17.: For each $n > 3$, find a polygon with n vertices that has a unique triangulation.

Exercise 1.30.: Modify Lemma 1.18 (*A diagonal exists between any two nonadjacent vertices of a polygon P if and only if P is a convex polygon.*) to show that one guard placed anywhere in a convex polygon can cover it.

Exercise 1.31.: Construct a polygon P and a placement of guards such that the guards see every point of ∂P (recall ∂P denotes the boundary of polygon P) but (the interior of) P is not covered.

Exercise 1.35.: Why is it not possible to easily extend Fisk's proof of the Art Gallery Theorem to the case of polygons with holes?

Exercise 1.39.: Prove the Fortress theorem. *To cover the exterior of a polygon with n vertices $\lceil n/2 \rceil$ vertex guards are needed for some polygons, and sufficient for all of them.* Note the guards must be located on vertices of the polygon.