CSE355/AMS345 Homework 1

Jie Gao*

September 4, 2018

The following problems are due on September 16th 9pm.

1. **Guarding the walls. (10pts)** Construct a polygon P and a placement of guards such that the guards see every point of ∂P, but there is at least one point interior to P not seen by any guard.
2. **Number of triangulations. (15pts)** Can a polygons has only one triangulation? Which polygons have the largest number of triangulations? Which polygons have exactly two triangulations (Hint: modify on the one with unique triangulation). For the above examples, the polygon you find should be generalized to n vertices for each $n > 3$.
3. **Witnesses and lower bounds. (10pts)** Find a minimum number of guards to cover the following polygons. Argue that you are finding the optimal solution – i.e., show a set of k witnesses that require at least k guards.

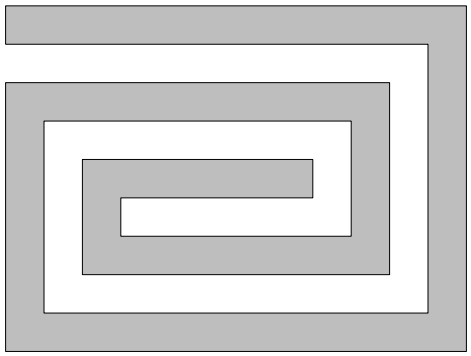

Figure 1: Find a minimum number of guards to cover the above polygon.

4. **Testing if a point is inside a polygon. (10pts)** Design an algorithm to check if a point is (strictly) inside a polygon P. You can assume that P has n vertices in CCW order along the boundary ∂P. What is the running time of your algorithm as a function of n?

*Department of Computer Science, Stony Brook University, Stony Brook, NY 11794. Email: jgao@cs.stonybrook.edu