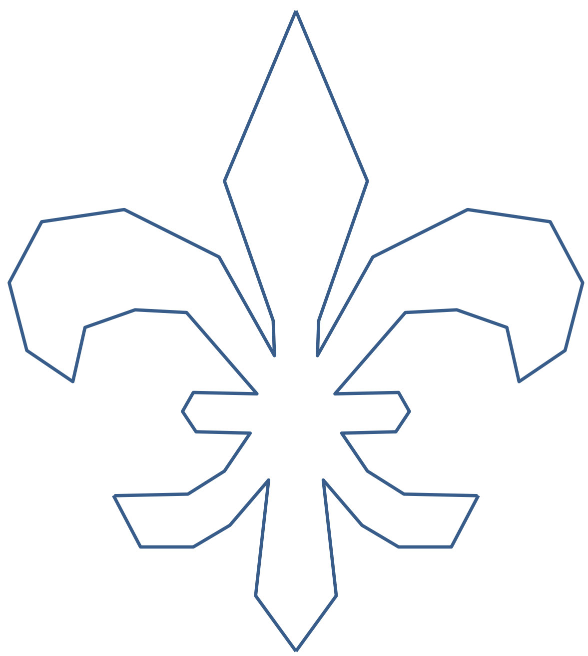
CMPS 3120 Computational Geometry – Spring 13

2/7/13

2. Homework

Due **2/21/13** before class

1. **Guarding the Fleur-de-Lis (12 points)**
   For the simple polygon P below:
   (a) Apply the method employed by the 3-coloring-based proof to obtain a set of at most $\lfloor \frac{n}{3} \rfloor$ **vertex guards** that guard P.
   (b) By inspection, obtain the minimum number of **vertex guards** necessary to guard P. Justify your answer.
   (c) By inspection, obtain the minimum number of **point guards** necessary to guard P, i.e., guards are allowed to be anywhere in the interior or on the boundary of P. Justify your answer.



2. **Guarding Boundary vs. Interior (5 points)**
   Give an example of a polygon together with a placement of vertex guards, such that the whole polygon boundary is guarded but not the whole interior.

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3. **Points inside triangles (8 points)** Let S be a set of n triangles in the plane. The boundaries of the triangles are disjoint, but it is possible that a triangle lies completely inside another triangle. Let P be a set of n points in the plane. Give an $O(n \log n)$ algorithm that reports each point in P lying outside all triangles.

4. **Triangulating a Point Set (5 points)**
   A triangulation of a set of points P in the plane is a simple, planar embedded, connected graph $T = (P, E)$ such that (i) every edge in E is a line segment, (ii) the outer face is bounded by edges of $CH(P)$, and (iii) all inner faces are triangles.
   Explain how to adapt the triangulation algorithm that we discussed in class to efficiently triangulate a set of n points.