Abteilung Algorithmik
Institut für Betriebssysteme
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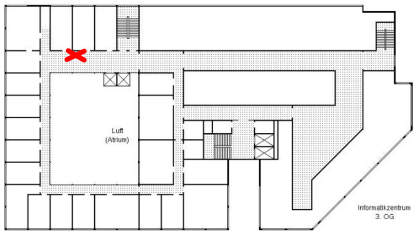
WS 12/13

Computational Geometry
Homework Set 3, 05. 12. 2012

Solutions are due Wednesday, December 19th, 2012, until 11:25 in the cupboard for handing in practice sheets. **Please put your name on all pages!**



Exercise 1 (Monotonicity): Show:

a) For every $n \in \mathbb{N}$ there is a polygon with at least n vertices that is monotone with respect to any line.

b) There is a polygon with 10 or more vertices that is not monotone with respect to any line.

(5+10 Punkte)

Exercise 2 (Triangulation):

a) Triangulate the polygon shown in Figure 1 using the algorithms from the lecture.

b) Give an algorithm that triangulates a polygon with holes in $O(n \log n)$.

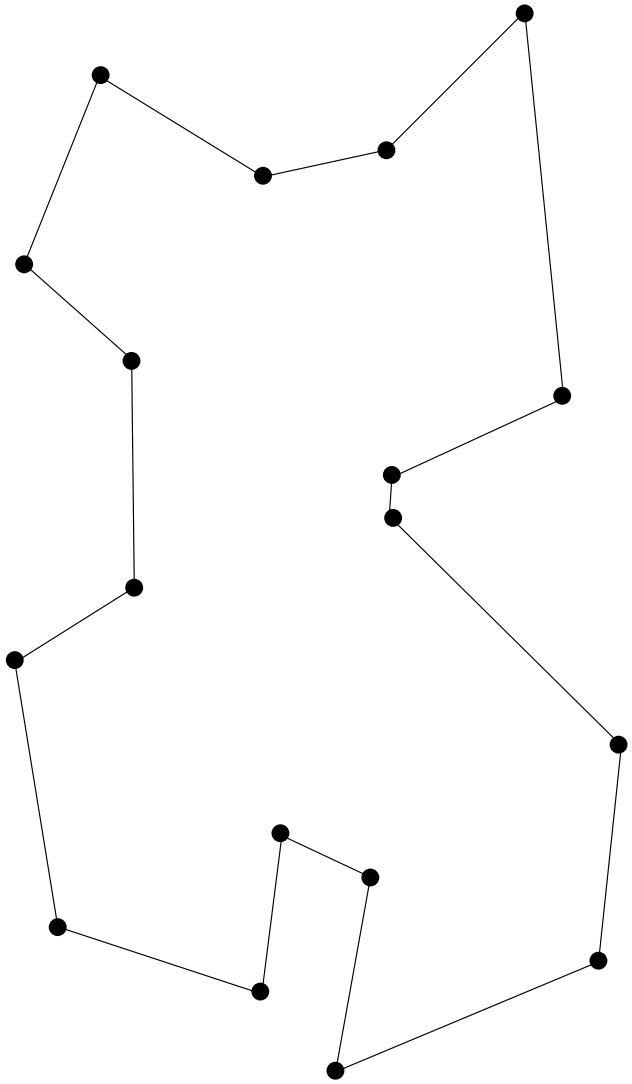


Figure 1: A Polygon.

(10+10 Punkte)

Exercise 3 (Art Galleries and reflex vertices):
For a polygon P let r denote the number of reflex vertices.

a) Give a polygon with $r = n - 3$.

b) Prove the following Lemma: Any polygon can be partitioned into at most $r + 1$ convex pieces.

c) Prove the following art gallery theorem, which considers the guard number as a function of r: r guards are sometimes necessary and always sufficient to see the interior of a simple n-gon for $r \geq 1$ reflex vertices. (That is, you need to establish both necessity and sufficiency! for all r!)

(5+10+10 Punkte)