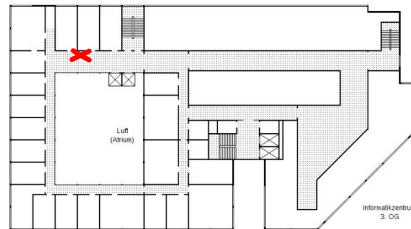


Prof. Dr. Sándor Fekete  
Dr. Christiane Schmidt

## Computational Geometry Homework Set 1, 07. 11. 2012

Solutions are due Wednesday, November 21st, 2012, until 11:25 in the cupboard for handing in practice sheets. **Please put your name on all pages!**



**Exercise 1 (Number of Triangulations):** Find the number of distinct triangulations for the polygon in Figure 1.

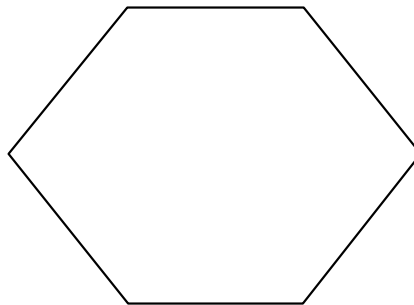


Figure 1: A polygon.

(12 Punkte)

**Exercise 2 (Triangulation of Polygons with Holes):**

Prove the following theorem:

Every polygon with  $n$  vertices and  $h$  holes may be triangulated.

Hint: induction.

(12 Punkte)

**Exercise 3 (Number of Triangles):** Prove the following theorem:

Every polygon with  $n$  vertices and  $h$  holes may be triangulated. The triangulation has  $n + 2h - 2$  triangles. (Exercise 2 provides you with the first statement, hence, here you should prove the number of triangles.)

Hint: consider the sum of interior angles or Euler's formula.

(12 Punkte)

**Exercise 4 ( Number of Reflex Vertices):** Prove the following theorem:  
In an orthogonal polygon of  $n$  vertices,  $r$  of which are reflex,  $n = 2r + 4$ .  
Advice: First, show that the sum of interior angles of a polygon is  $(n - 2)\pi$ .  
(12 Punkte)

**Exercise 5 (Third Vertex):** Construct a polygon with  $n = 3k$  vertices  
such that placing a guard at every third vertex fails to protect the gallery.  
(12 Punkte)