

GUARDING OUR HIGH SCHOOL



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INDEX

- 1.Introduction and background.
- 2.Description of the problem and tools.
- 3.Solution of the problem.
- 4.Bibliography.

1. Introduction and background.

THE PROBLEM OF THE ART GALLERY

It was raised by Victor Klee in 1973.

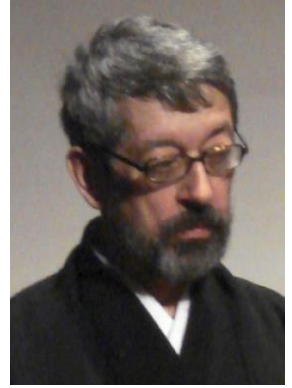


How can we watch an art gallery with the minimum number possible of cameras?

1. Introduction and background.

The first solution was given by V. Chvátal in 1975.

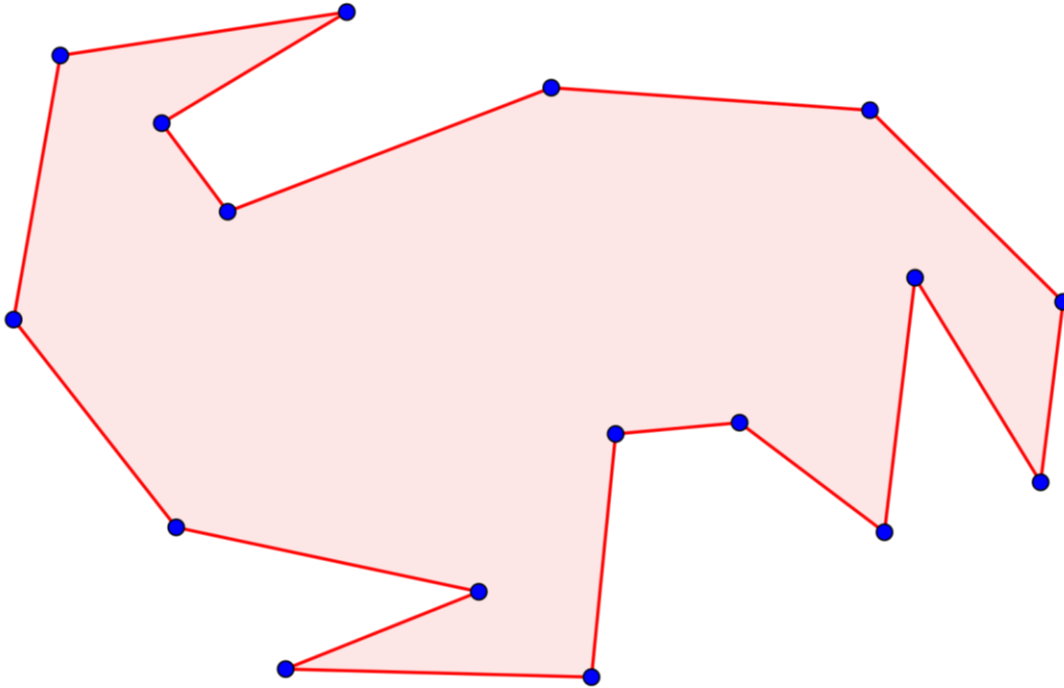
Although, usually, it is used the solution given by Steve Fisk, in 1978.



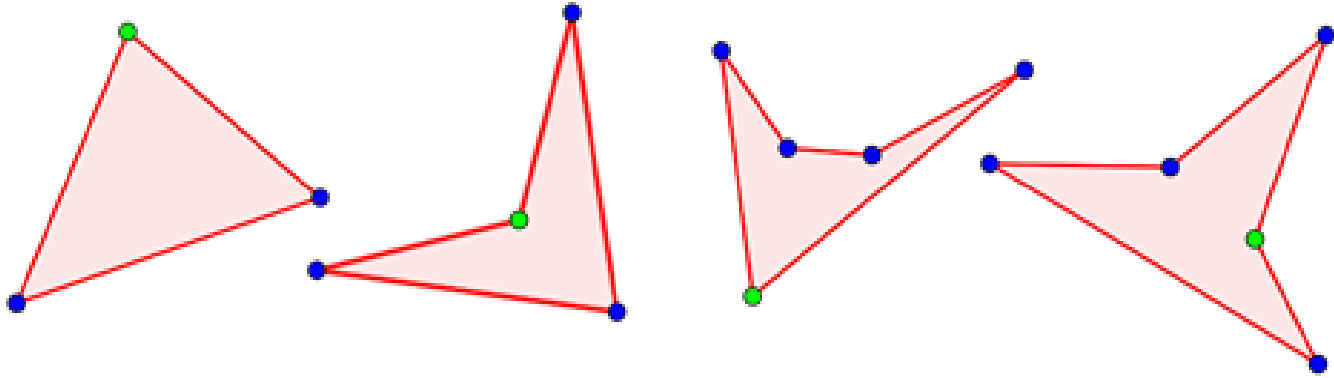
Theorem (Chvátal–Fisk, 1978):

Given a polygon with n vertices and without holes, $\lfloor \frac{n}{3} \rfloor$ cameras are enough, and sometimes necessary, to guarding it.

2. Description of the problem and tools.

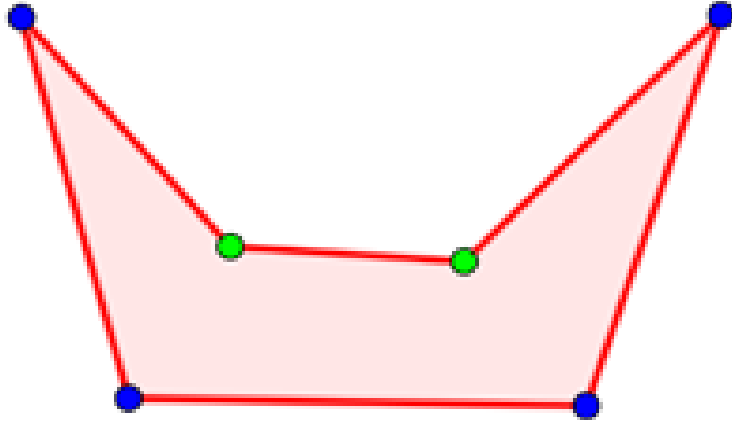


2. Description of the problem and tools.



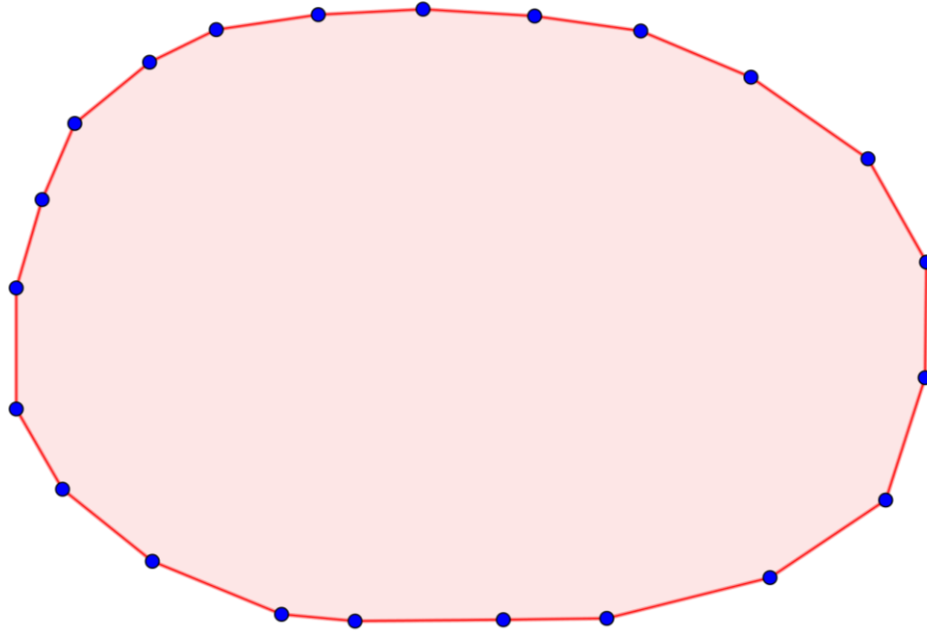
If the polygon has **three, four or five vertices** just **one** camera is enough.

2. Description of the problem and tools.



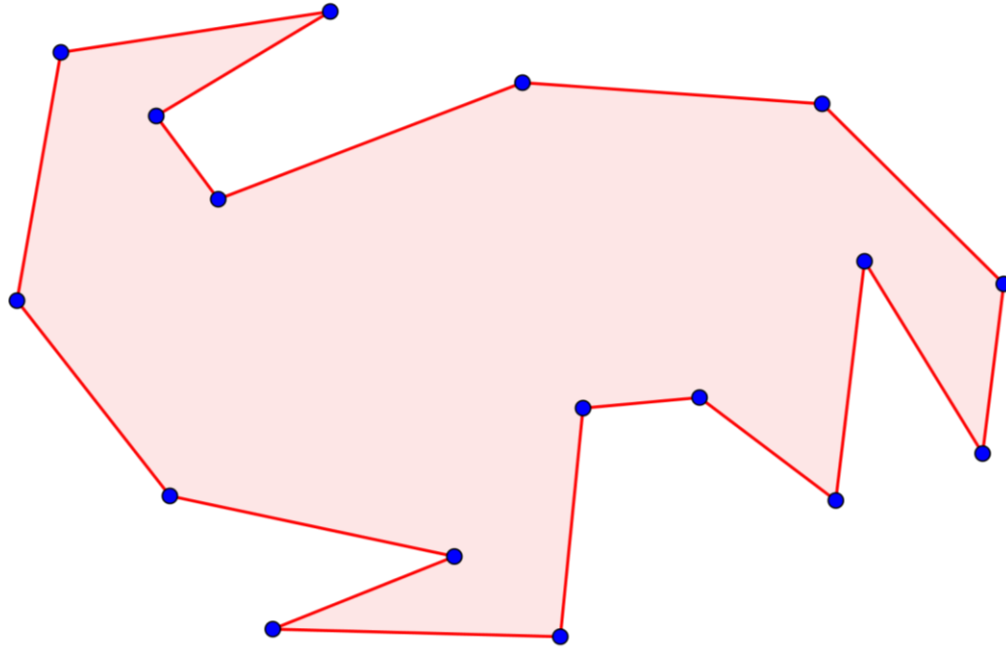
And if the polygon has **six vertexes** just **two** cameras are enough.

2. Description of the problem and tools.

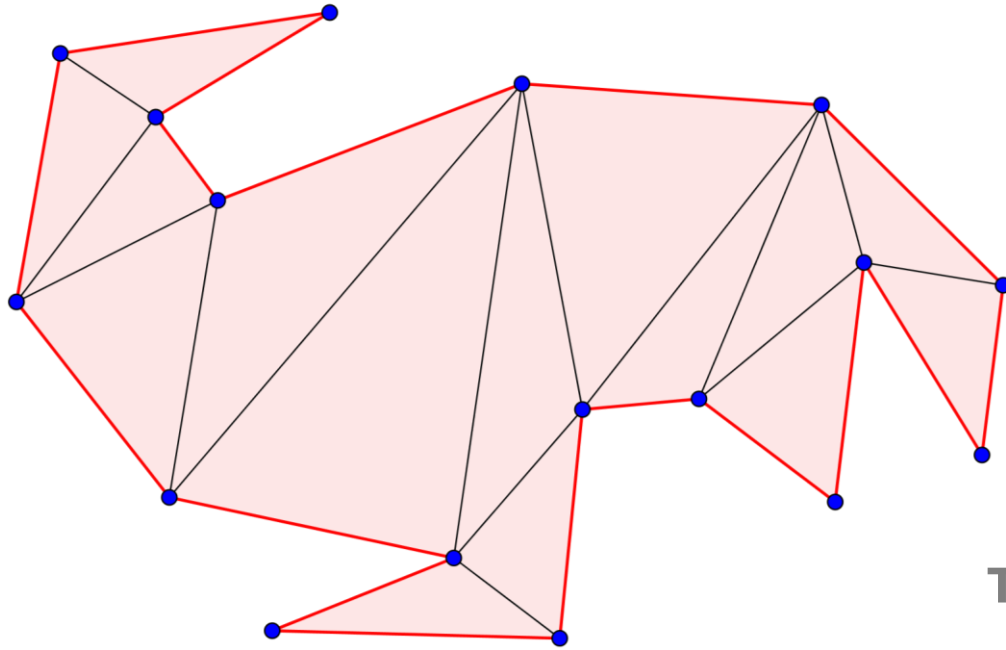


If the polygon is **convex**, we need just **one** camera.

2. Description of the problem and tools.

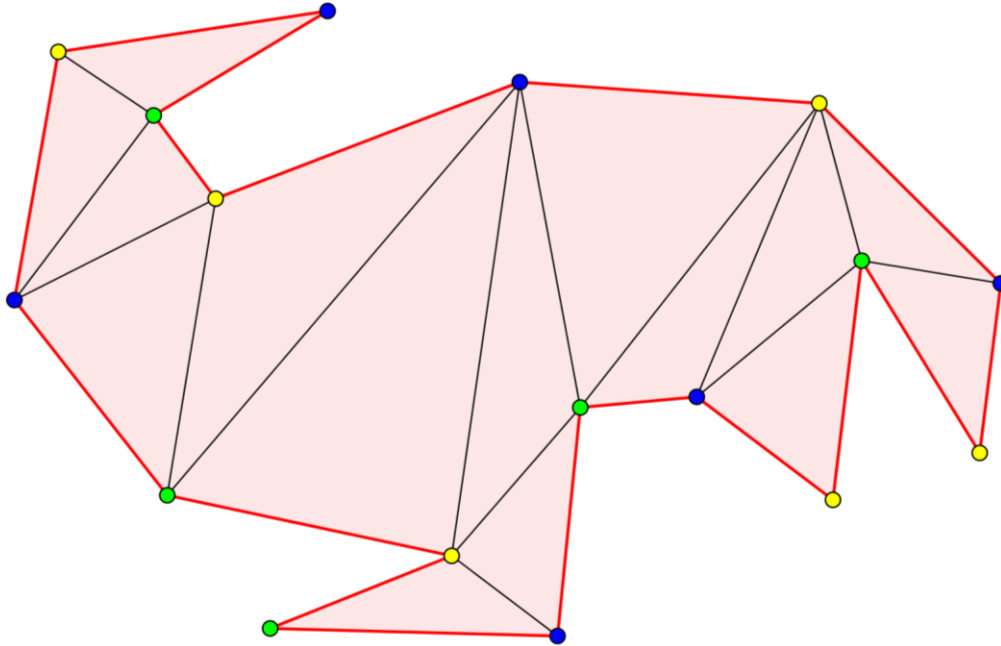


2. Description of the problem and tools.



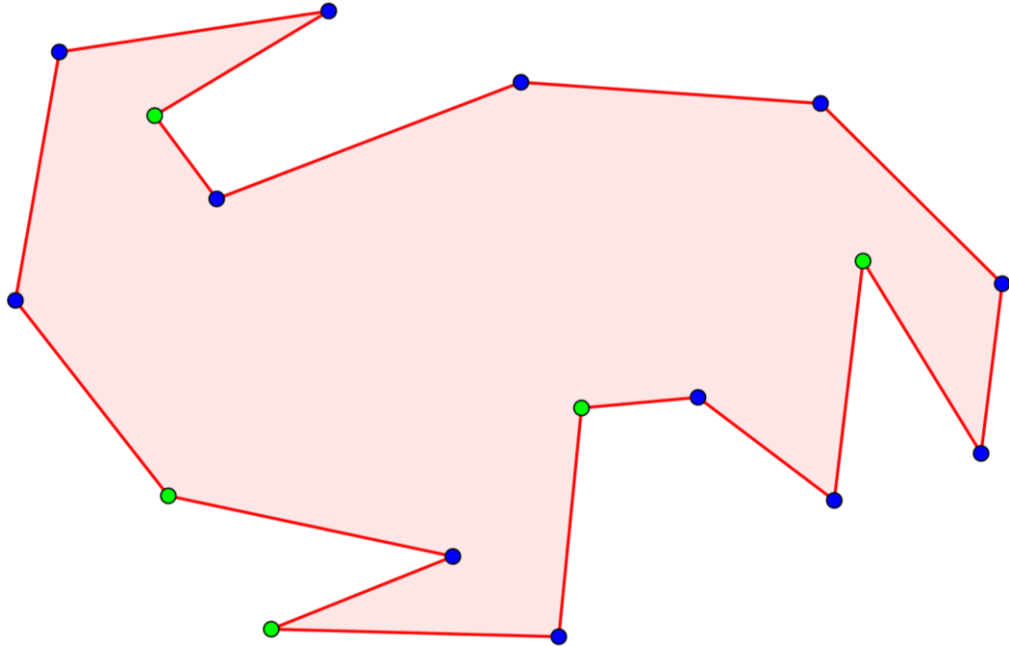
Triangulation

2. Description of the problem and tools.



Coloration

2. Description of the problem and tools.



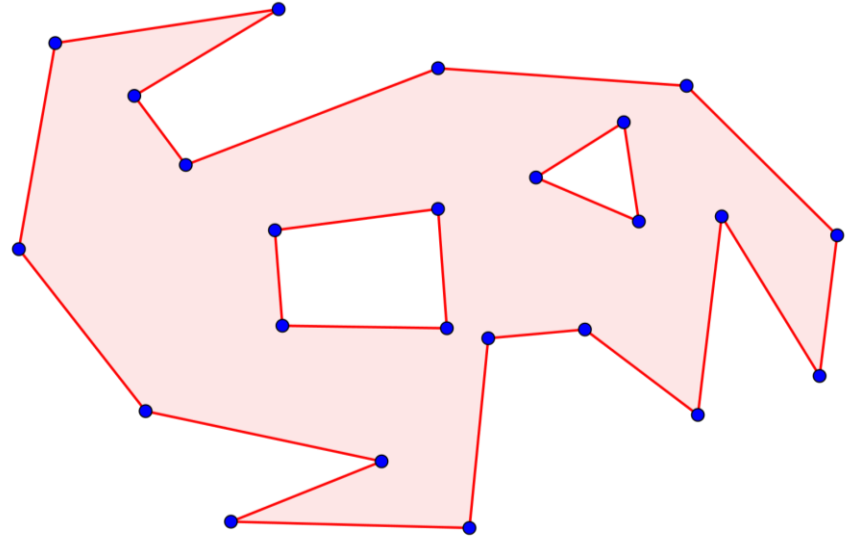
5 cameras

Solution

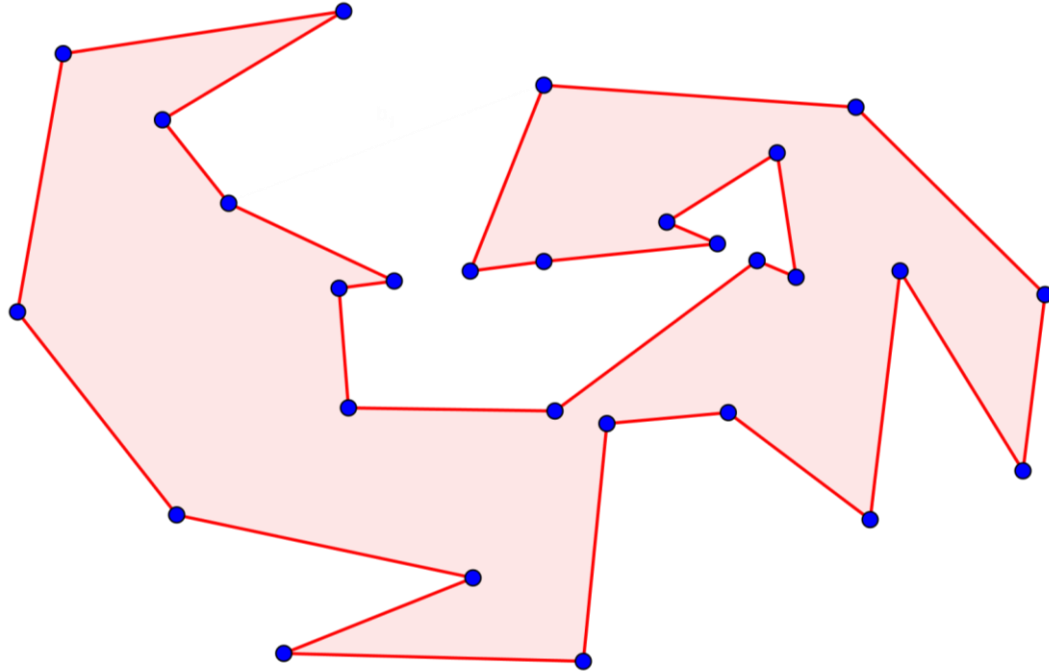
2. Description of the problem and tools.

Theorem (Bjorling-Sachs, Souvaine, Hoffman, Kaufman, Kriegel, 1991):

Given a polygon with n vertices and h holes, $\lfloor \frac{n+h}{3} \rfloor$ cameras are enough, and sometimes necessary, to guarding it.



2. Description of the problem and tools.

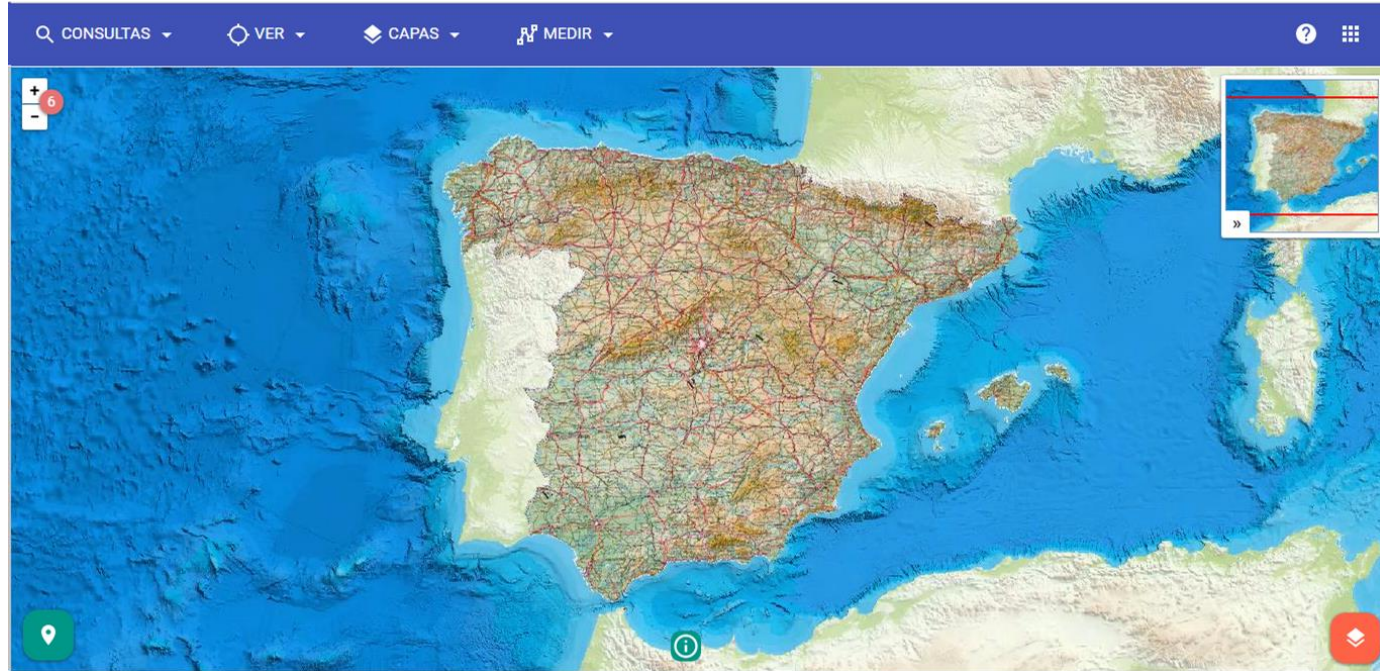


2. Description of the problem and tools.

The problem consists on discovering where to place **the least number of video surveillance cameras** to monitor the courtyard of our high school.



2. Description of the problem and tools.



Iberpix

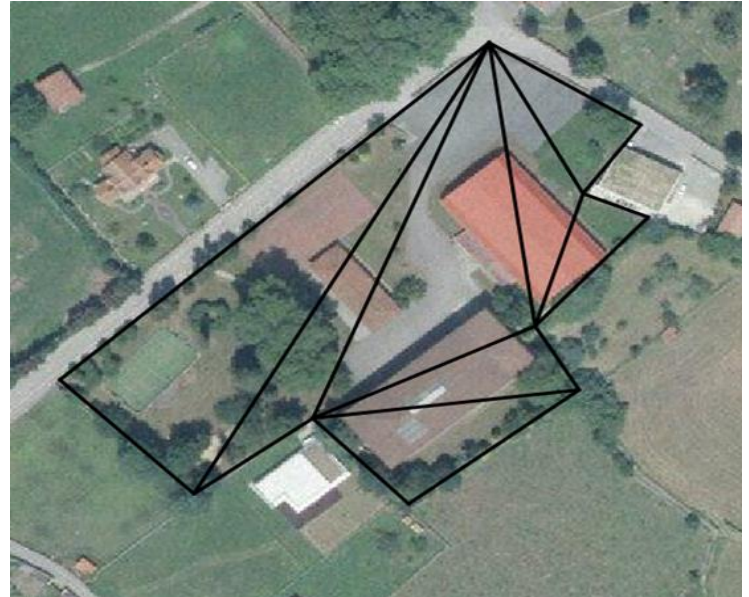
2. Description of the problem and tools.

Ge \circ Gebra

3. Solution of the problema.

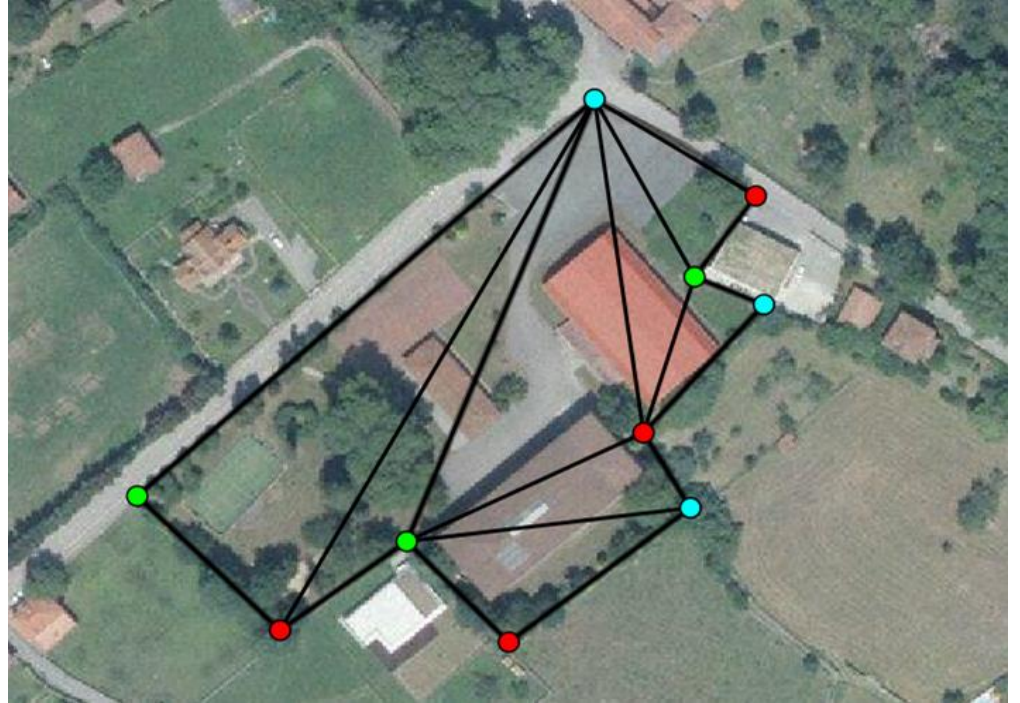
Without buildings (holes).

To know where locate, we must **triangulate** the polygon.



3. Solution of the problema.

We **color** the vertices:



10 vertices. 3 cameras.

3. Solution of the problema.

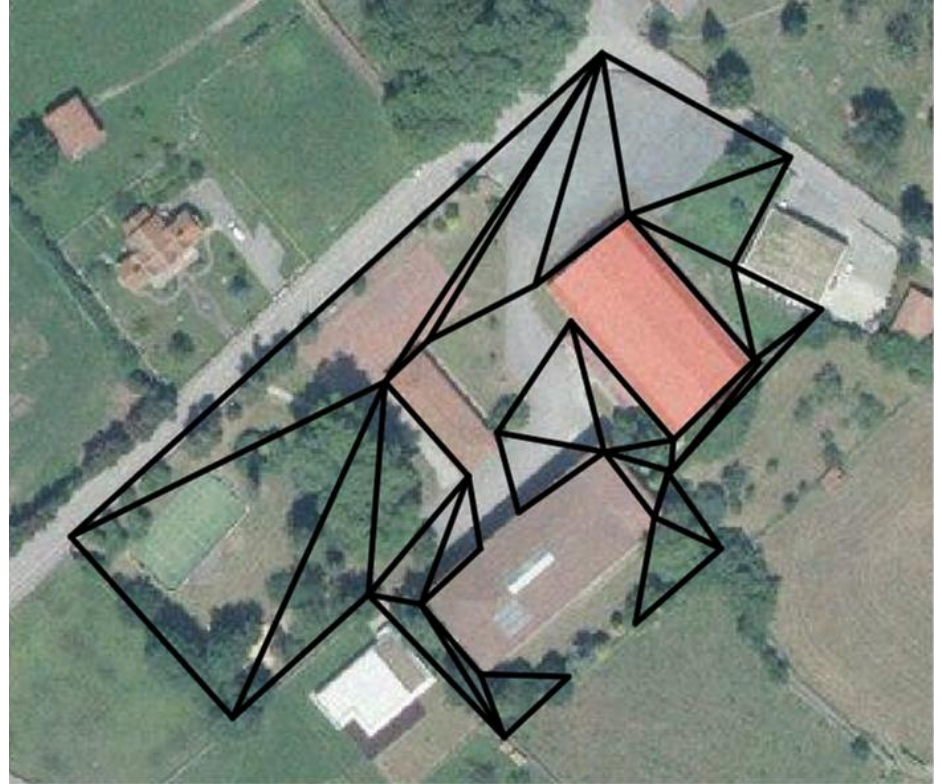
With buildings (holes).

We draw the polygons considering the buildings.



3. Solution of the problema.

We **triangulate** the polygon.

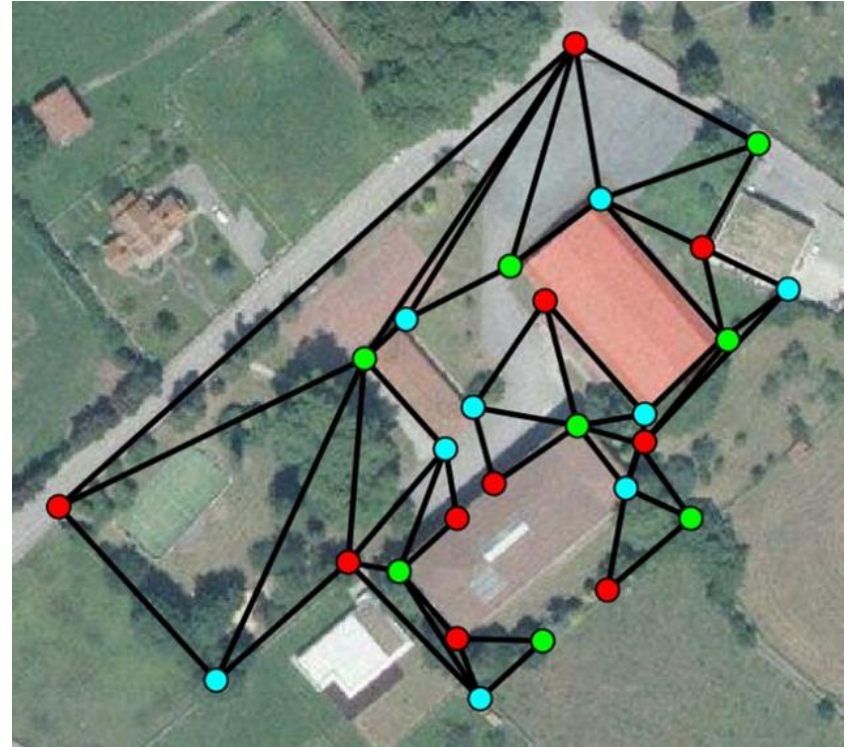


3. Solution of the problema.

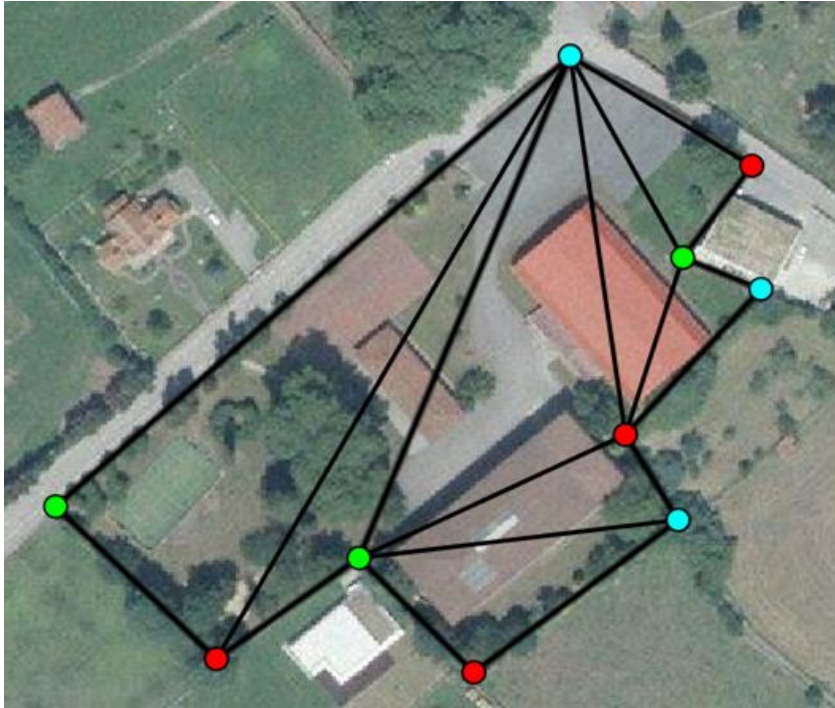
We **color** the vertices:

27 vertices, 3 holes. 10 cameras.

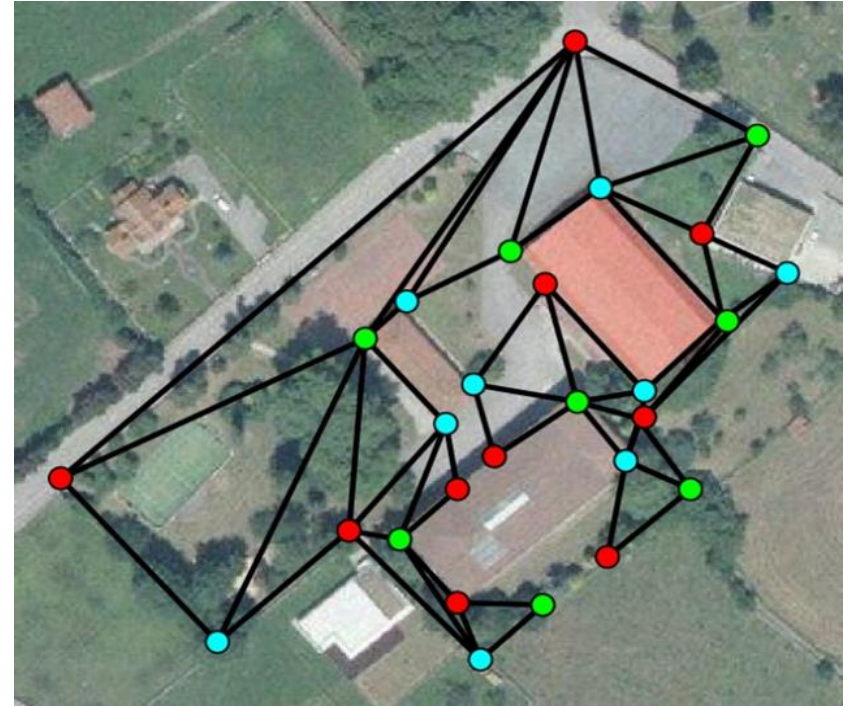
Better solution: 8 cameras
(green).



3. Solution of the problema.



Not real solution (green or blue).



Real solution (green).

3. Solution of the problema.

There can be another valid solutions in which the video cameras are placed in different positions.

The most important thing is that **they doesn't pass the maximum number of cameras that Chavtál established.**

4. Bibliography.

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