



Computational Thinking

Exercise 2

1 Egg dropping

Imagine you are inside a skyscraper with a total of n floors, and you are given a certain number of eggs in a box. You want to find the lowest floor from which an egg will break when tossed out of the window. However, you want to minimize the number of throws needed to find this out in the worst case. Once an egg is broken, you cannot use it again.

Give an algorithm to find the solution if you have

- a) a single egg.
- b) $\lceil \log n \rceil$ eggs.
- c) k eggs.

2 Pizza world record

You and your friends are trying to beat the world record for the largest circular pizza. You have already cooked your pizza on a polygonal baking tray, and are now wondering how to cut out a disc in order to maximize the radius of the pizza.

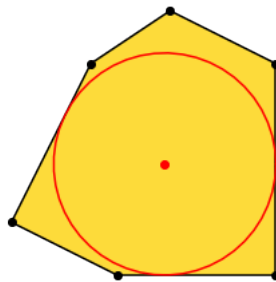


Figure 1: Example of the largest pizza (in red) we can extract from the polygonal cast (in yellow)

Formally, you are given a list of n 2D coordinates representing the vertices of a **convex** polygon in clockwise order. You are asked to write an algorithm returning the radius and the center of the largest circle that can be drawn inside the polygon. It is guaranteed to be unique.

Hint: The goal is to formulate the problem as a linear program. What are the variables that describe a circle? What do you want to maximize, and what are the constraints?

Hint: Recall that all points (x, y) on a line can be described by an equation $a_1 \cdot x + a_2 \cdot y = b$ for an appropriate choice of a_1, a_2, b . Given two points (x_1, y_1) and (x_2, y_2) on the line, one way to find these parameters is as follows: $a_1 = y_1 - y_2$, $a_2 = x_2 - x_1$, and $b = a_1 \cdot x_1 + a_2 \cdot y_1$.