Estimating π (Pi)

Using Monte Carlo Simulation

How?

Casino de Monte-Carlo
Monte Carlo Casino

?

Prerequisites

- Thonny with a working Python distribution.
- Variables
- Boolean Expressions
- Selection Statements
- Random number generation
- Familiarity with the Euclidean distance between Points

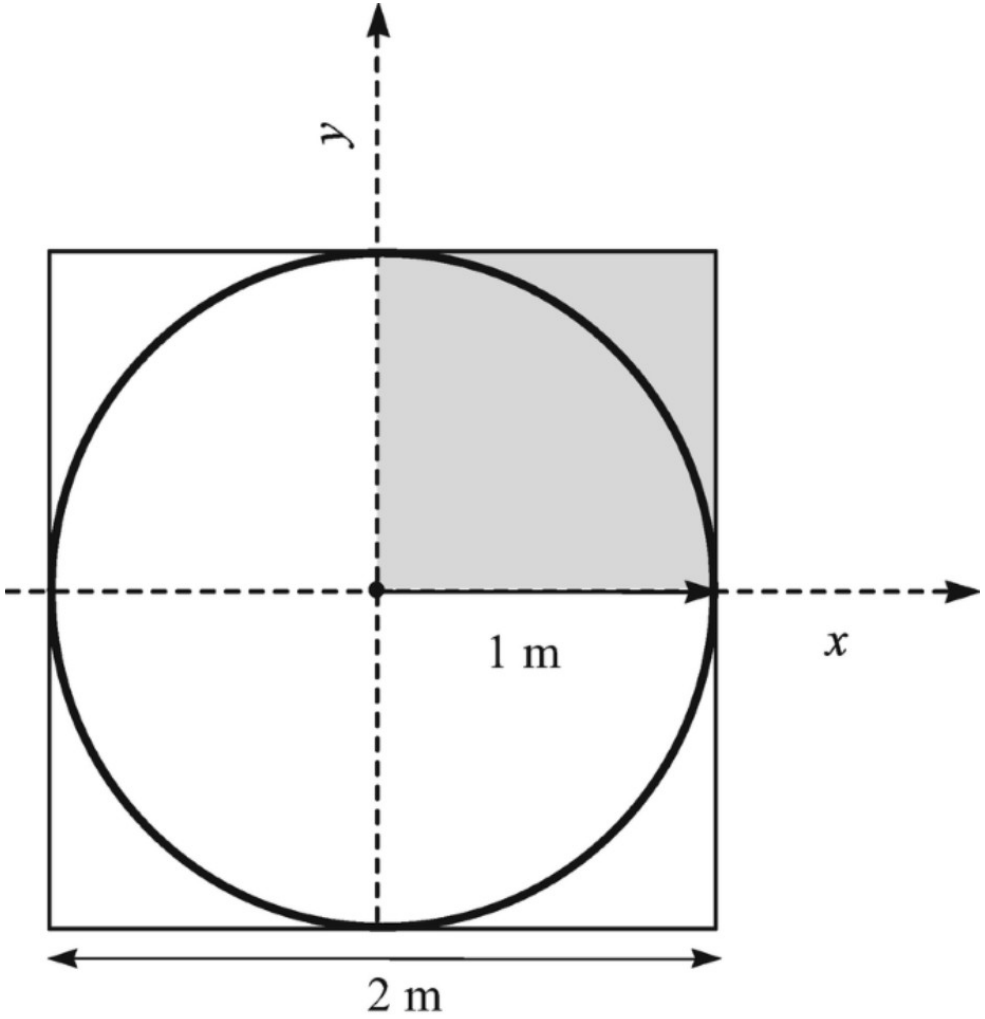
Our Playground

Archimedes' constant

π

Pi is the **ratio** between the *circumference* and *diameter* of a circle in the Euclidean space.

$$C = \pi d = 2 \pi r$$



Our Playground

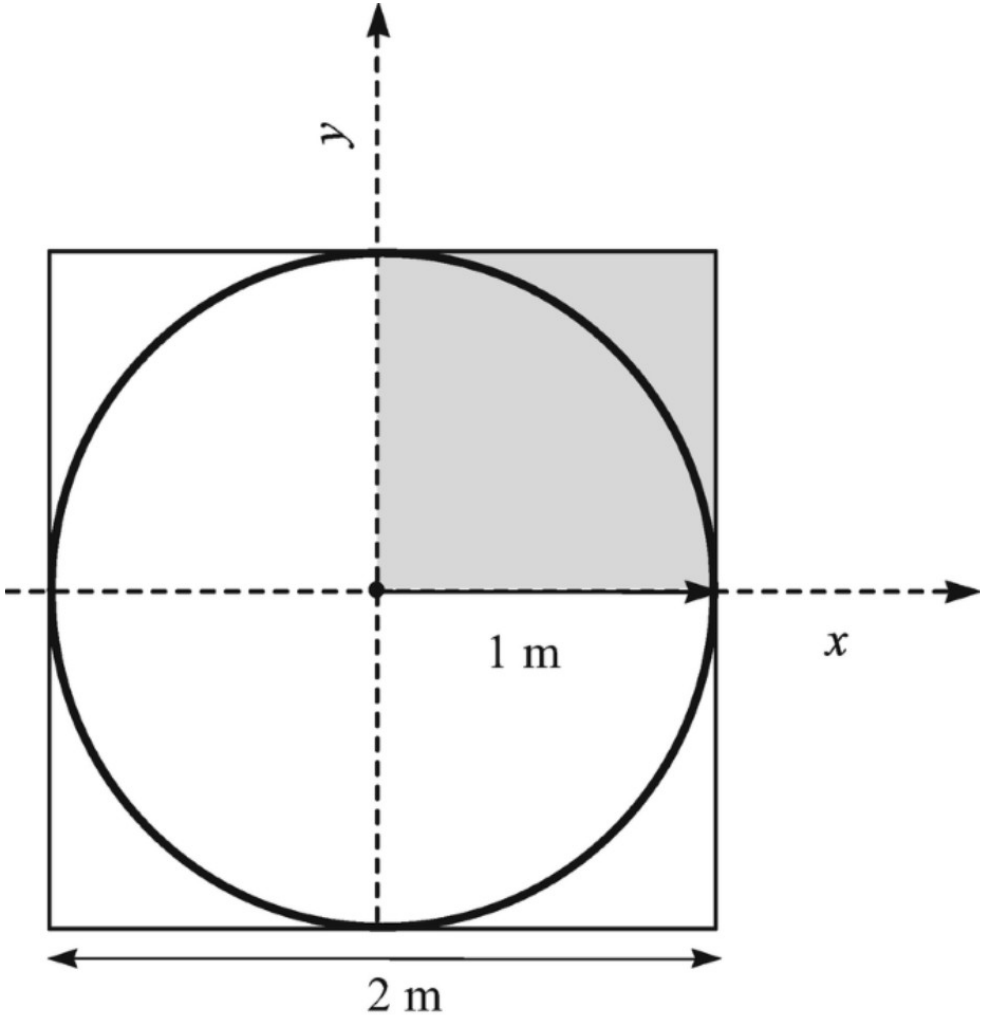
Also, defines the area of a circle

$$A = \pi r^2$$

Or

$$A = \pi$$

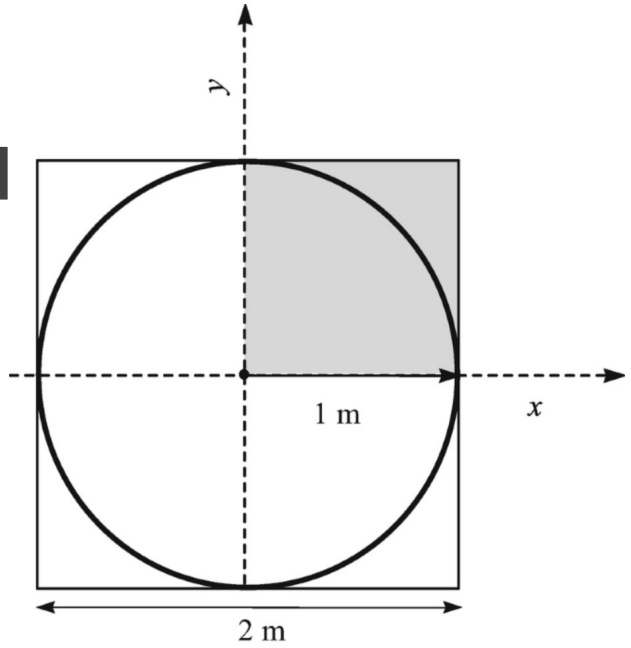
For the circle on the right, why?



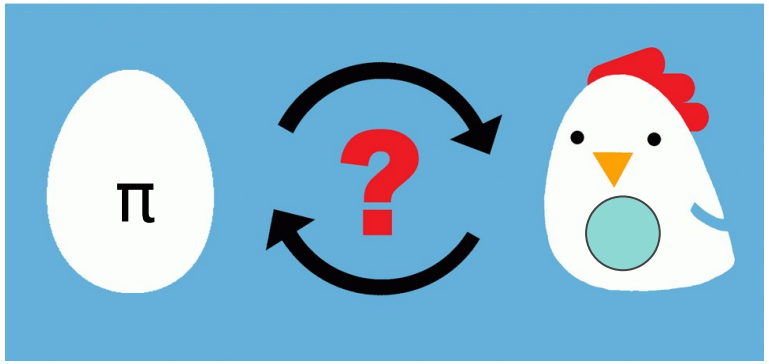
In our simulation experiment it will be easier to use the area of the unit circle as opposed to the circumference in the approximation of *Pi*

Our Playground

$A = \pi$



If we know the area *A* then we know the value of *Pi*. But we need *Pi* to compute *A*!

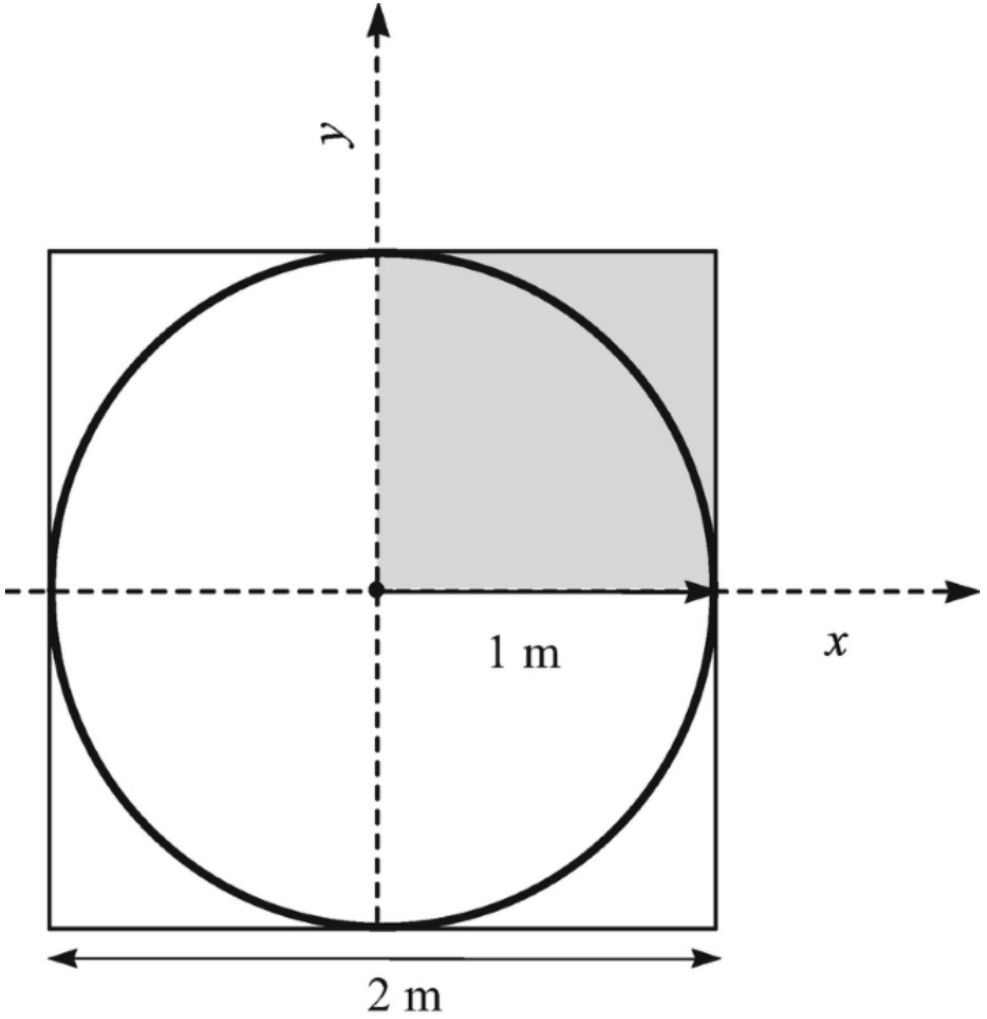


Chicken-or-the-egg causality dilemma

Area = ?

Idea #1

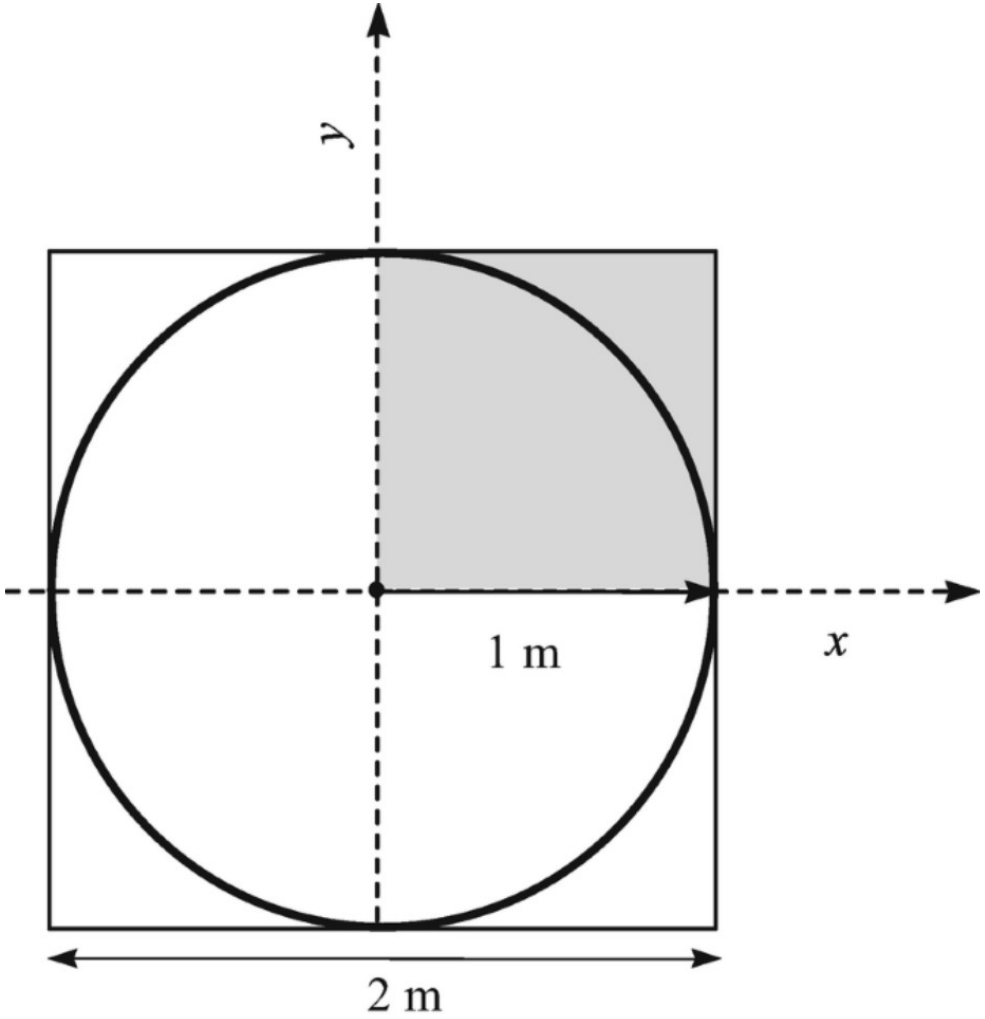
Using Monte Carlo we can simulate throwing darts at the target, the circle? The count of darts inside the circle should be a good estimate of the area, and hence *Pi* ?



Area = ?

Idea #2
We can randomly throw darts at the square area, say N darts.

The ratio of the darts that hit the circle area to N is proportional to the ratio of the circle-area to the square-area



Area = ?

Idea #2

A: circle area = π

S: square area = 4

X: darts in-circle

T: Total # of darts thrown

X/T = A/S

X/T = π/4

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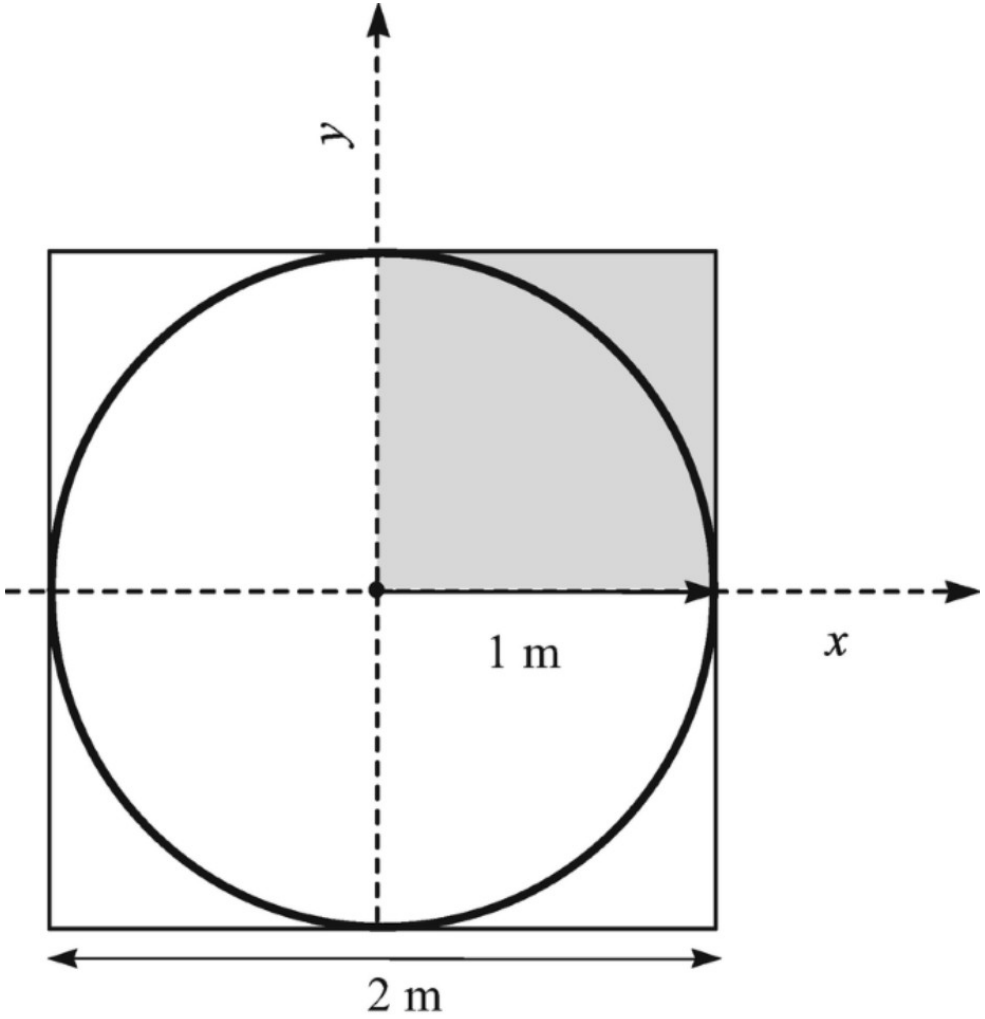
π = 4 (X/T)

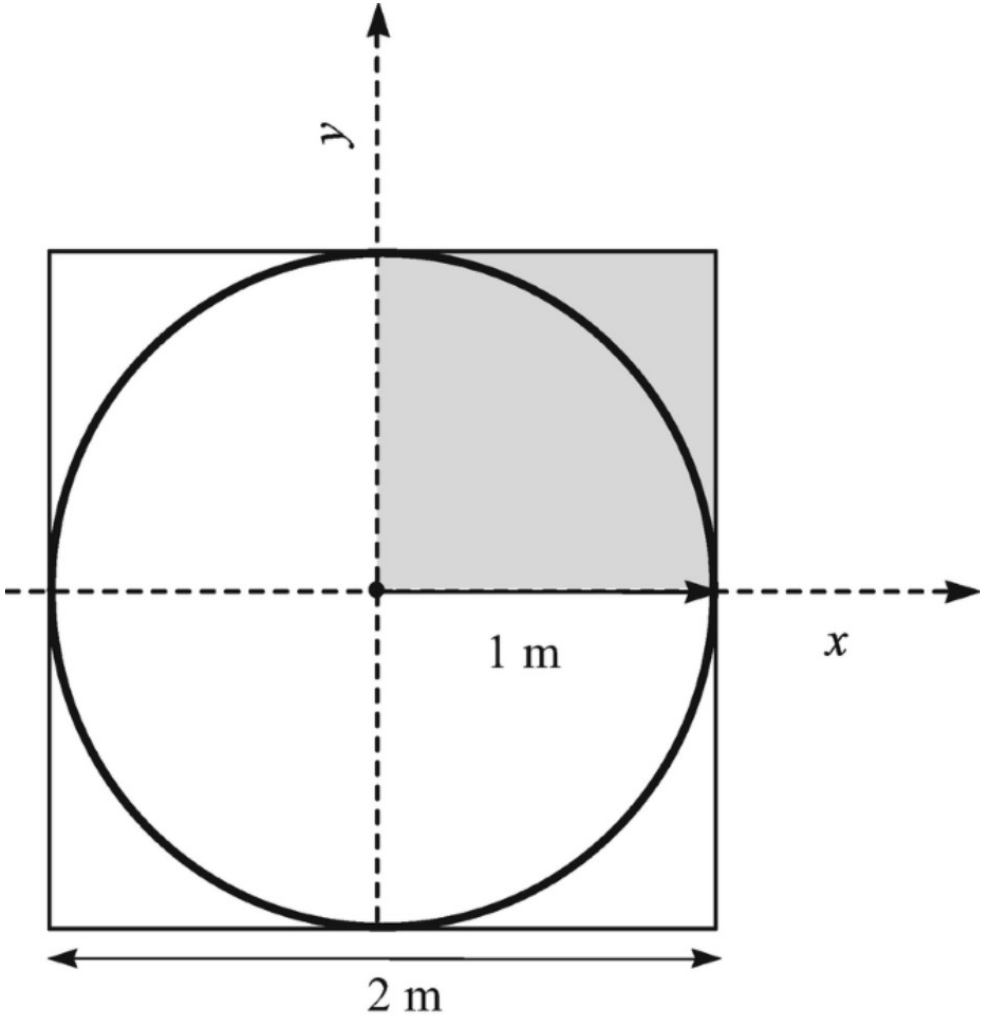


Area = ?

Idea #2

We will perform the simulation within the shaded area, quadrant of the square board

In a class activity you will be asked to repeat the simulation but targeting the whole square area!



Recap

- See monte-carlo-pdf

Are you ready to write some code?