Monte Carlo Methods

Programers swiss army knife

10th McGill Physics Hackathon

What are they?

“Using repeated random sampling to compute results”

What are they?

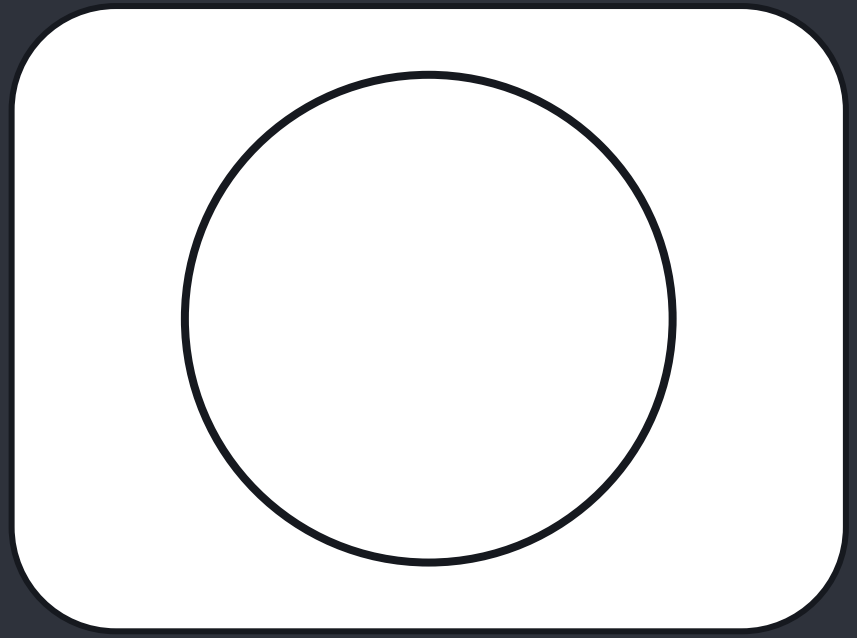
“Using repeated random sampling to compute results”

What are they?

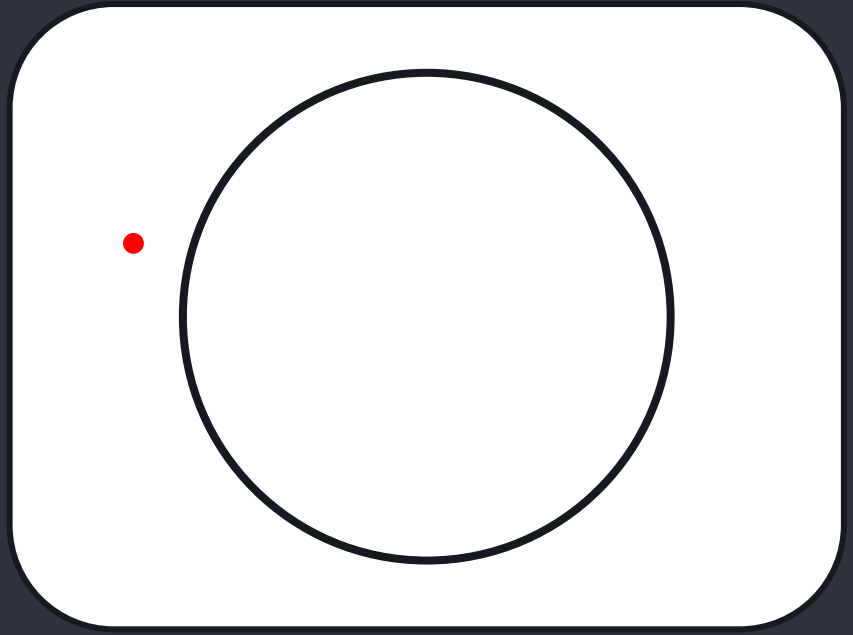
“Using repeated random sampling to compute results”

How is this useful?

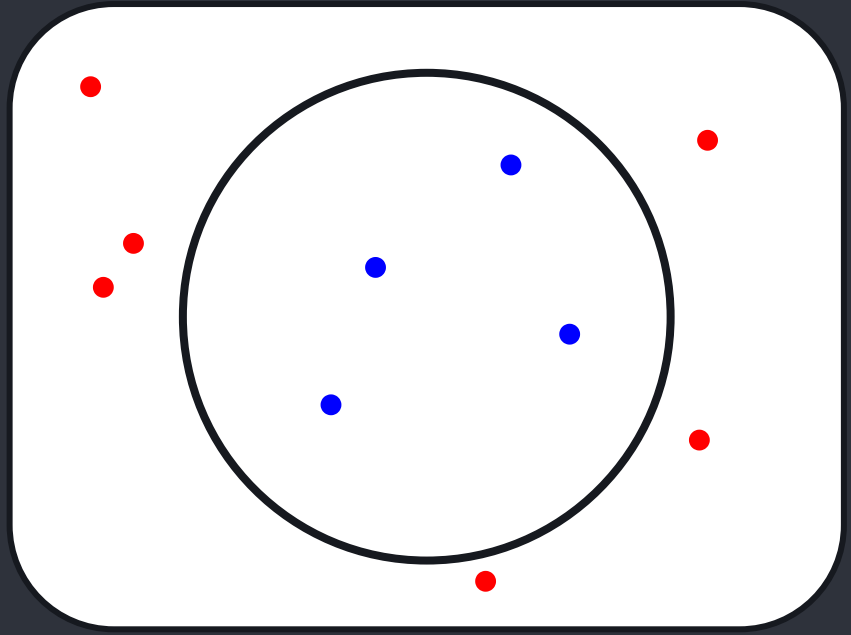
How can we use this to find π?



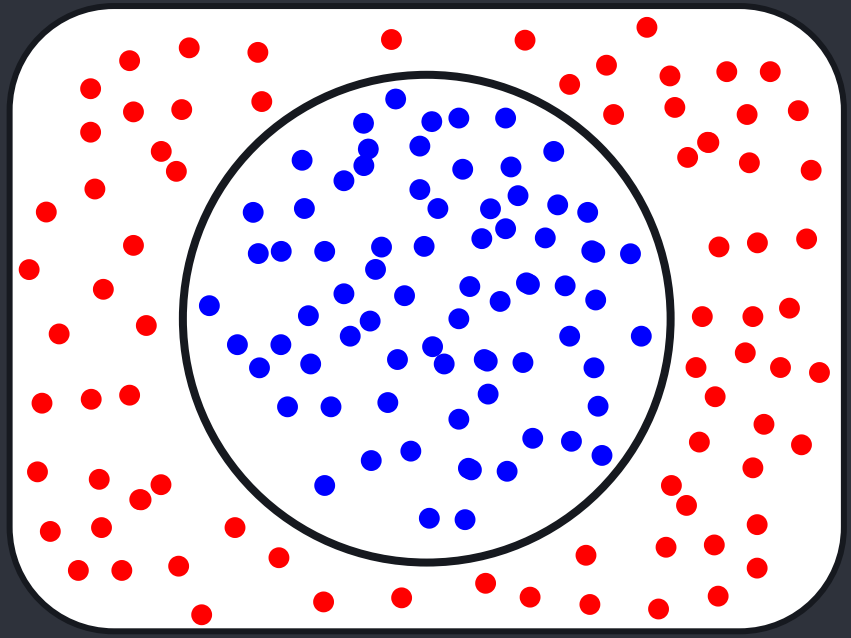
How can we use this to find π?



How can we use this to find π?

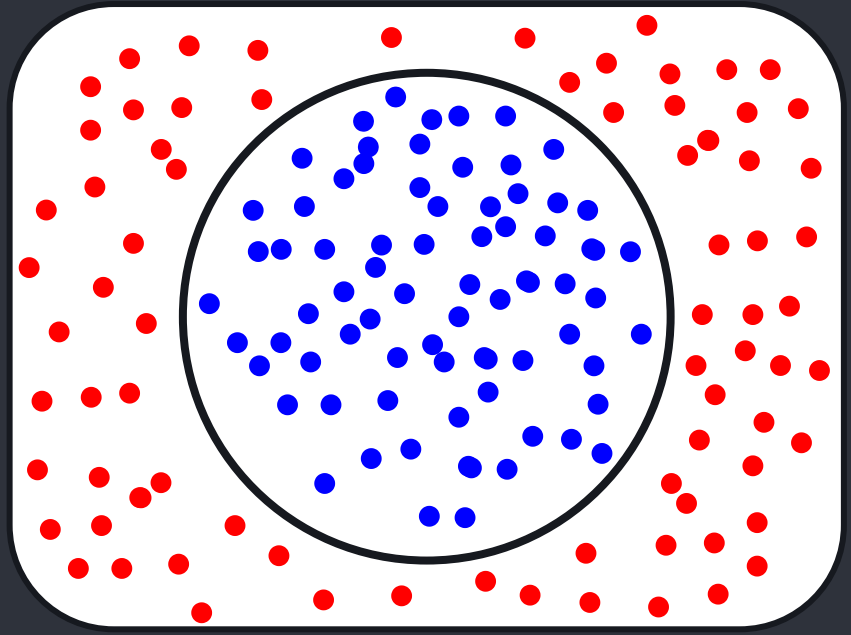


How can we use this to find π?



How can we use this to find π?

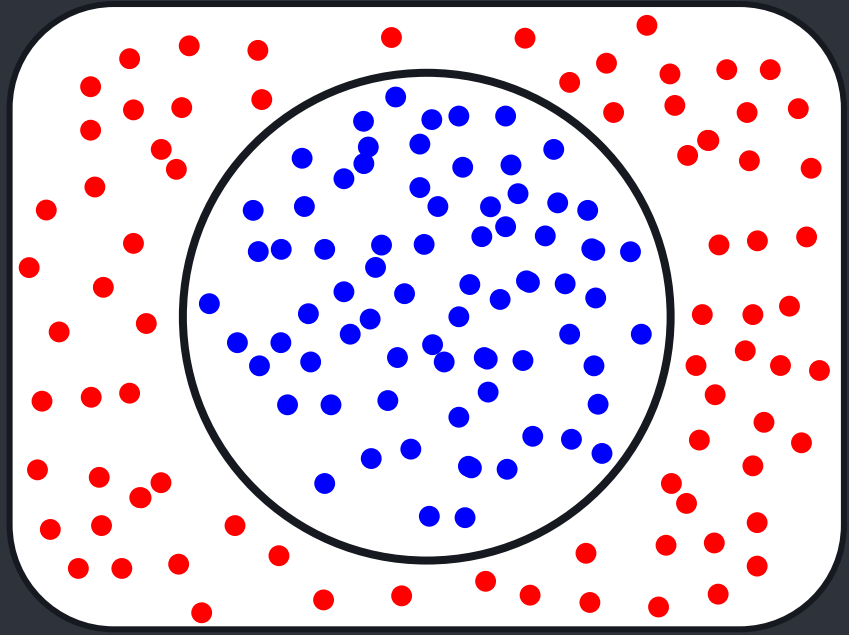
$$\frac{A}{A} = \frac{\text{\# of dots in circle}}{\text{\# of dots outside circle}}$$



How can we use this to find π?

$$\frac{A}{A} = \frac{\text{\# of dots in circle}}{\text{\# of dots outside circle}}$$

$$\frac{\pi r^2}{4r^2} = \frac{355}{452}$$

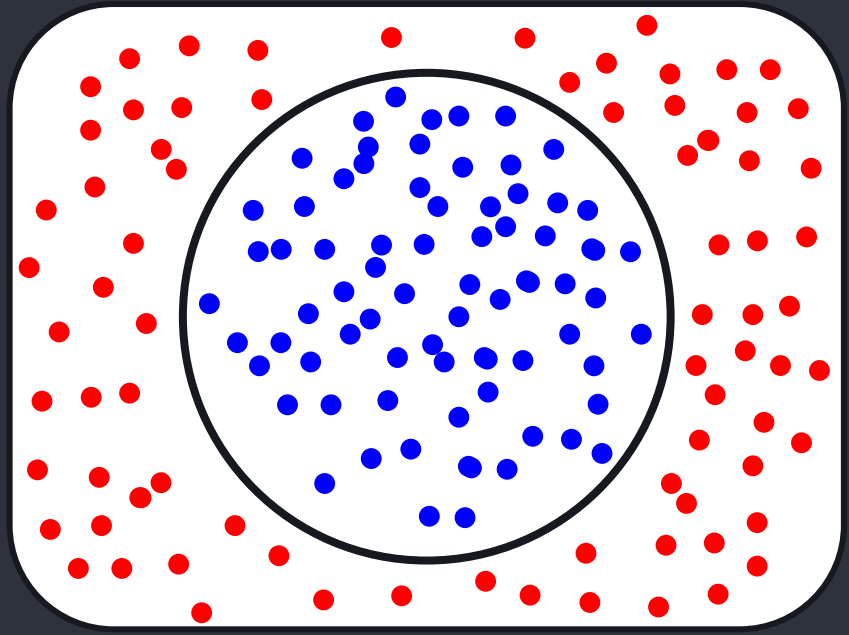


How can we use this to find π?

$$\frac{A}{A} = \frac{\text{\# of dots in circle}}{\text{\# of dots outside circle}}$$

$$\frac{\pi r^2}{4r^2} = \frac{355}{452}$$

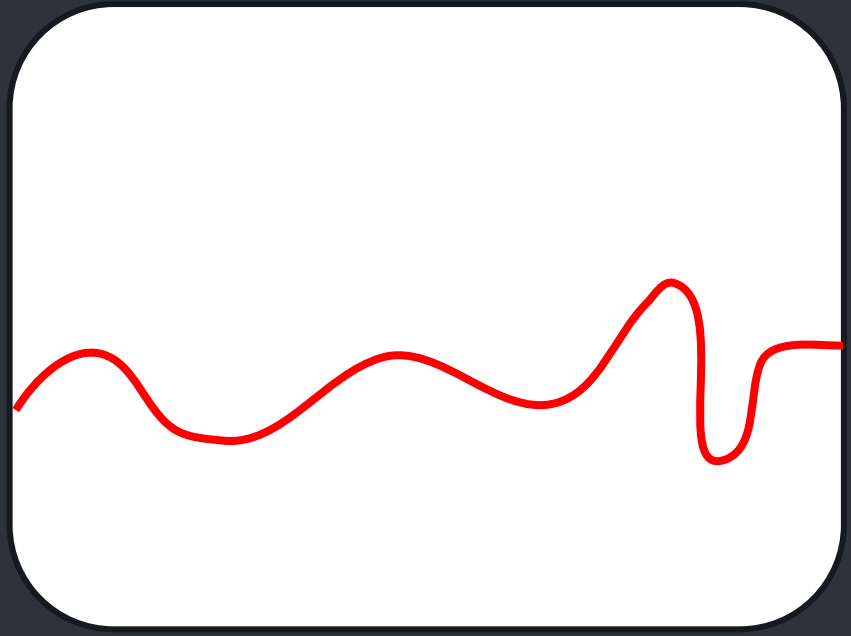
$$\frac{\pi}{4} = \frac{355}{452}$$



Okay that was cool, but not useful?

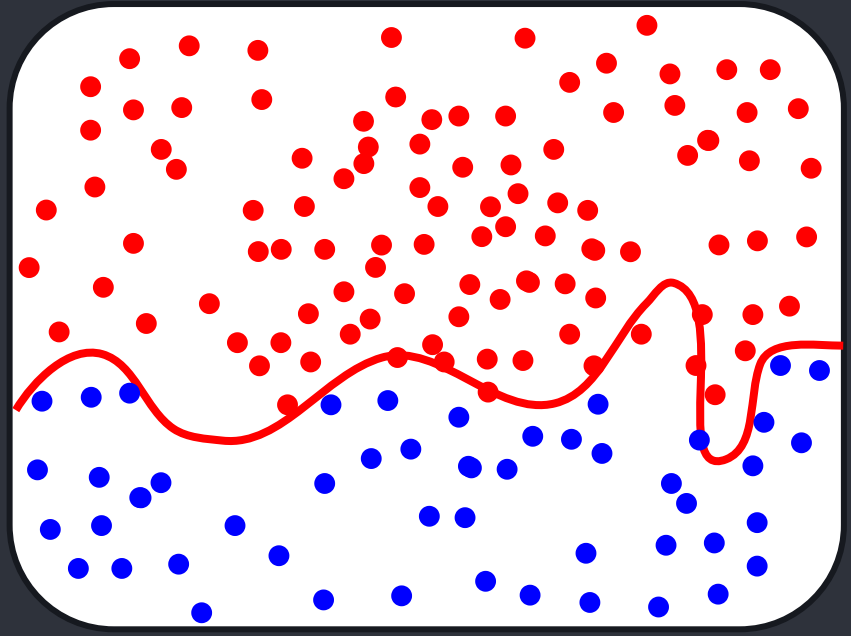
How can we use this to integrate?

How can we use this to integrate?



How can we use this to integrate?

$$\frac{A}{A} = \frac{\text{\# of dots under}}{\text{\# of dots over}}$$

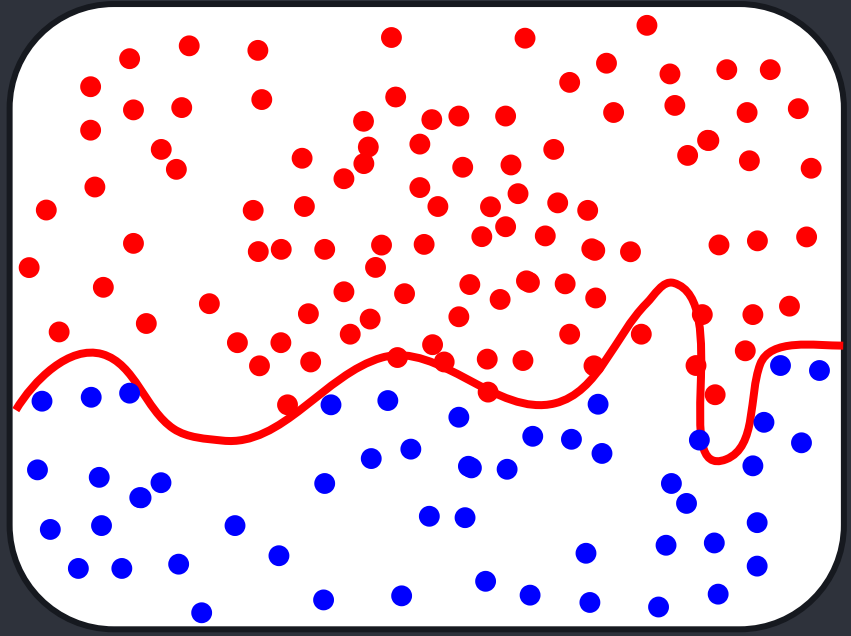


How can we use this to integrate?

$$\frac{A}{A} = \frac{\text{\# of dots under}}{\text{\# of dots total}}$$

$$\frac{\text{Area}}{1} = \frac{352}{500}$$

$$\text{Area} = \frac{352}{500}$$



Alright, any other uses?

Monte Carlo is used in

Geant 4

Used for simulating particles

ANSYS

Engineering simulations

OpenFOAM

Turbulence simulations

OpenMC

Neutron/photon simulator

A parting exercise

Exercises

Pi

Just Calculate Pi

Integrate

Find some bound function and integrate it

Populate a circle

Uniformly populate a circle using cylindrical coordinates.