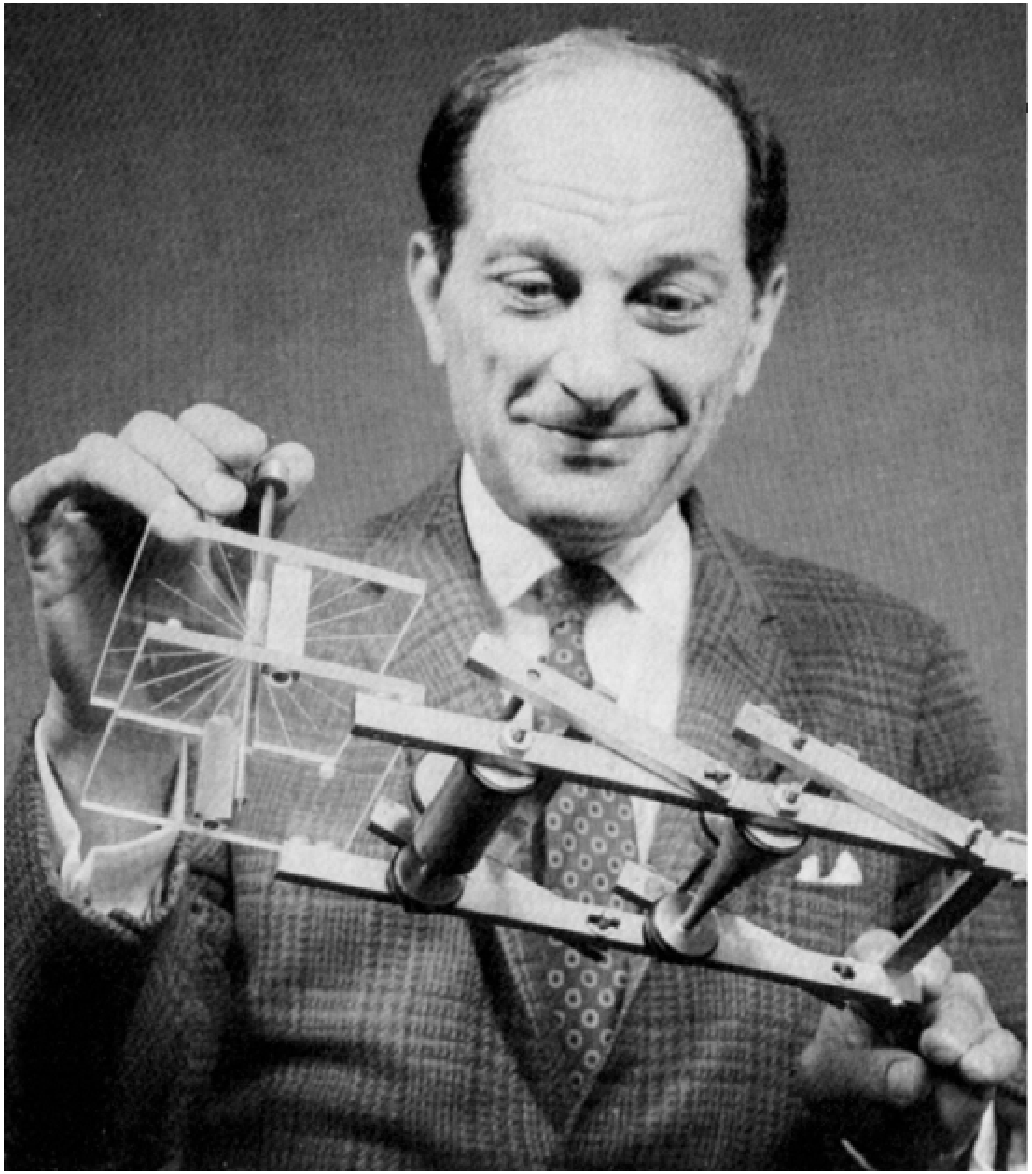
Monte Carlo Simulation

Photo by Sam Garza

Stanislaw Ulam



We've Been Doing this Already

- A method of estimating the value of an unknown quantity using principles of inferential statistics.
- Inferential statistics
  - Population: a set of examples
  - Sample: a proper subset of a population
  - Key fact: a random sample tends to exhibit the same properties as the population from which it is drawn.

Finding Pi

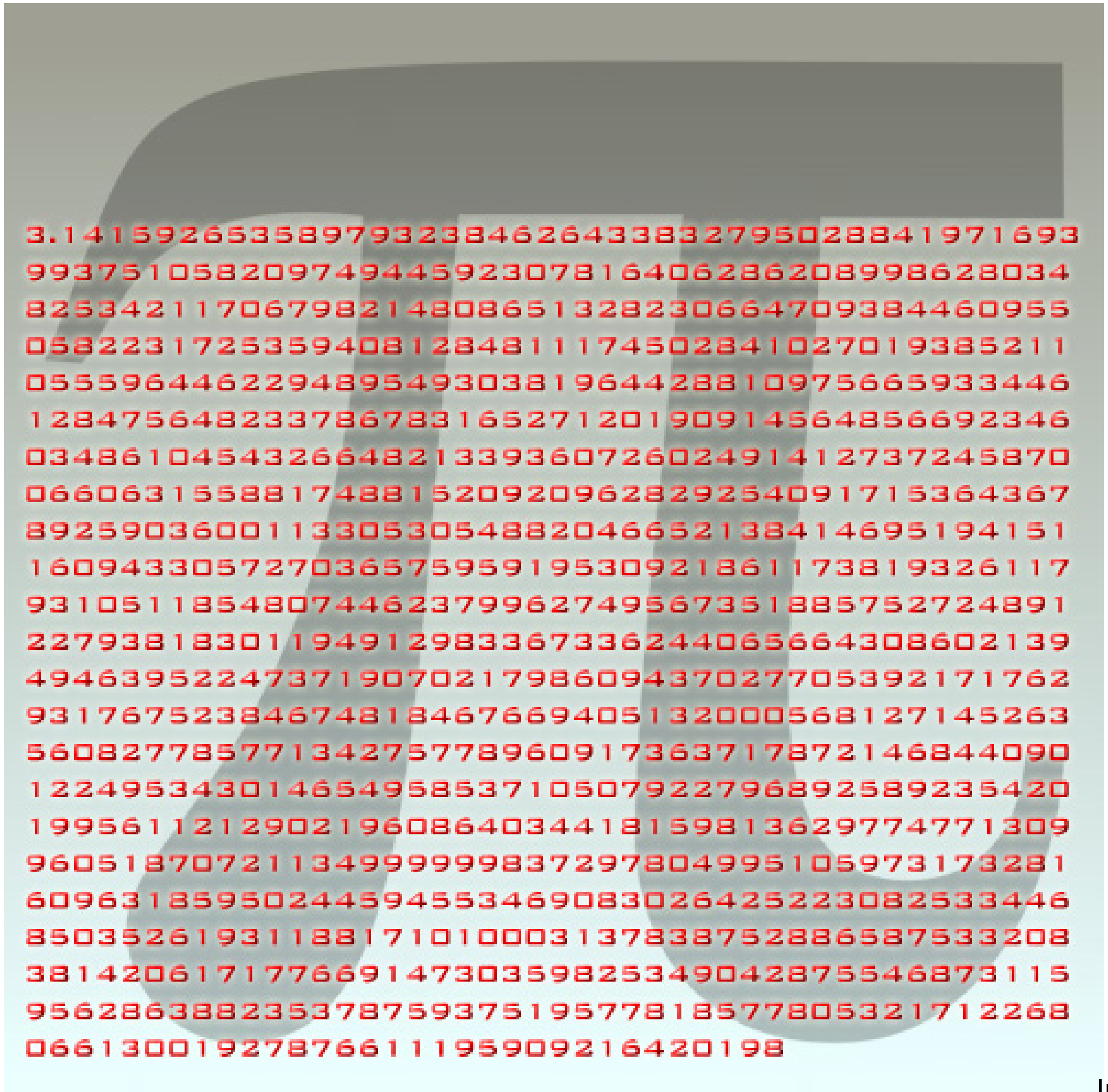
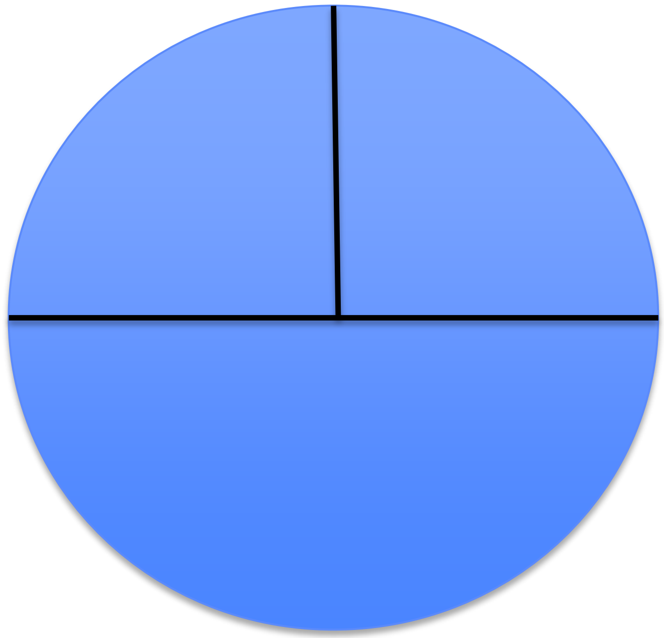


Image from Tom Murphy

Pi



$$\frac{circumference}{diameter} = \Pi \qquad area = \Pi * radius^2$$

Rhind Papyrus

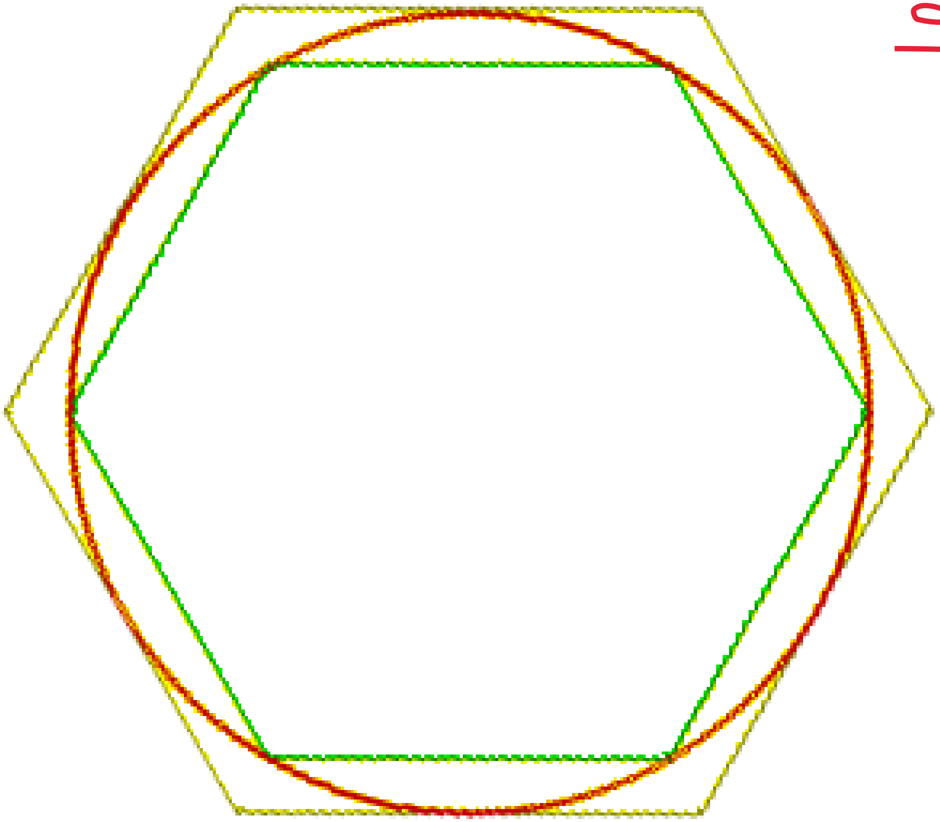
The Bible

"And he made a molten sea, ten cubits from the one brim to the other: it was round all about, and his height was five cubits: and a line of thirty cubits did compass it round about."

—1 Kings 7.23

Archimedes

upper and lower polygen



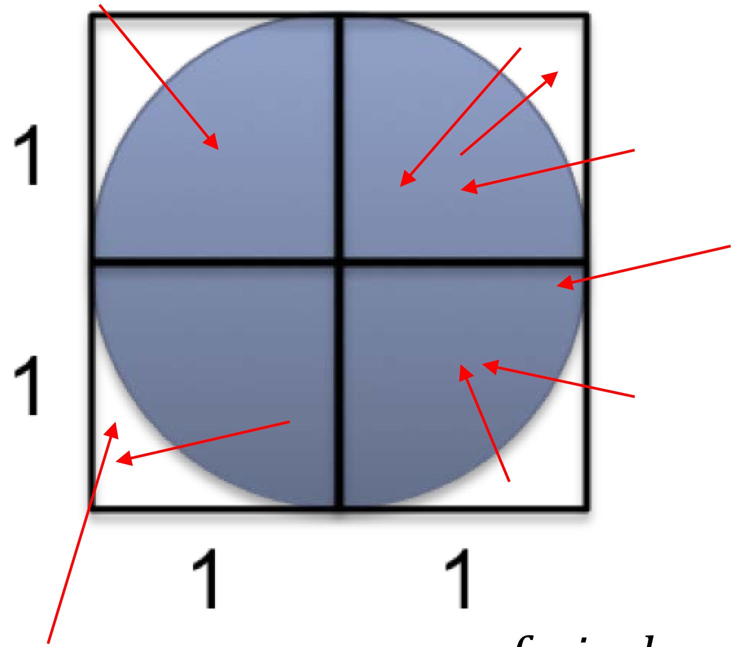
$$\frac{223}{71} < \pi < \frac{22}{7}$$

3.1418

Buffon-Laplace

French

monte carlo simulation



$A_s = 2*2 = 4$

$A_c = \pi r^2 = \pi$

dropping enough

$$\boxed{\frac{needles\ in\ circle}{needles\ in\ square} = \frac{area\ of\ circle}{area\ of\ square}}$$

$$area\ of\ circle = \frac{area\ of\ square * needles\ in\ circle}{needles\ in\ square}$$

$$\pi\ \cancel{area\ of\ circle} = \frac{4 * needles\ in\ circle}{needles\ in\ square}$$

Arrows Are More Fun than Needles

Photo Dharma

Not a Practical Method

- In the next segment, we take Ana's advice and build a simulation