

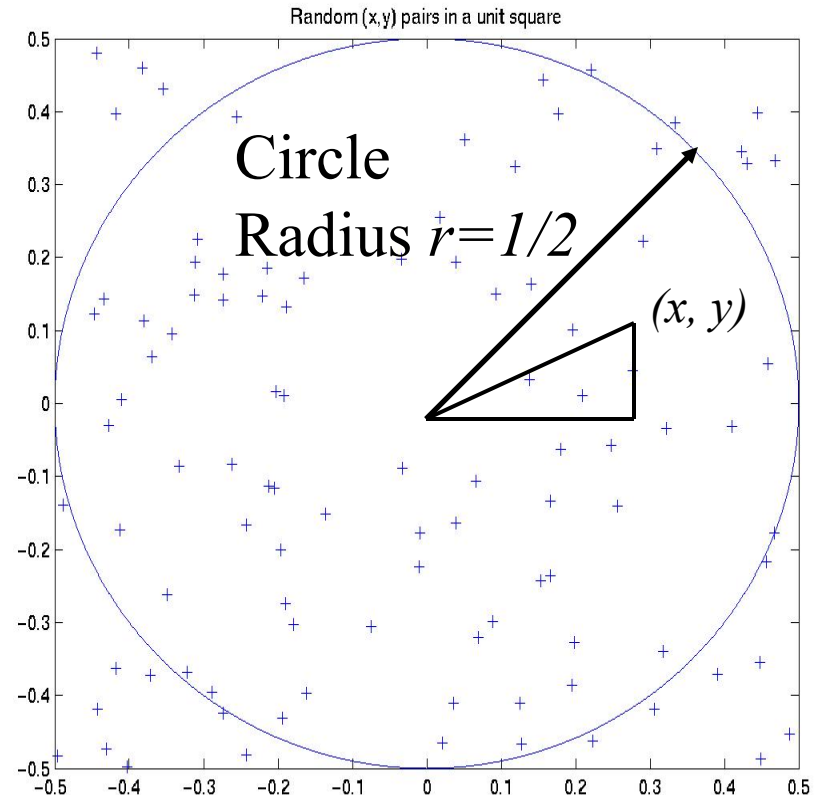
Approximating Pi using Simulations

CSCI 317

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Computing Estimate of Pi

- Area of circle C is $A_C = \pi r^2$.
- Area of square S is $A_S = s^2$.
- Pick random (x,y) pairs with x and y between $(-1/2, 1/2)$.
- Probability of (x, y) being inside C is A_C / A_S .
- In our case:
 - $A_C = \pi(1/2)^2 = \pi/4$.
 - $A_S = 1^2 = 1$.
 - $A_C / A_S = \pi/4$.



Algorithm to Estimate Pi

- Get n_{total} number random pairs (x, y) .
- For each pair:
 - Compute distance from center of circle:
 $d = \text{sqrt}(x*x+y*y)$.
- If $d < \text{radius of circle}$ ($d < 1/2$) increase count of points inside circle (n_{inside}) by 1.
- Theory tells us:
 $n_{\text{inside}} / n_{\text{total}} \approx \pi/4$.
- Multiplying both sides above by 4, we have:
 $\pi \approx 4 * (n_{\text{inside}} / n_{\text{total}})$.

Assignment

- Write a Java program to estimate Pi.
 - Input parameters:
 - Number of games
 - Number of darts “thrown” randomly per game
 - Output:
 - Estimate of Pi using the average (mean) value of all games.
 - Standard deviation (look this up).
- Write a brief report. Address:
 - How many darts did you need in a game in order to reliably compute Pi to 3 digits (3.14)?
 - What was the standard deviation in this case?