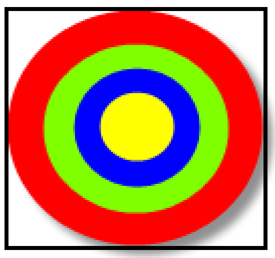
07.06 Virtual Lecture Notes

Imagine you have a dartboard like the one illustrated here; a unit circle inscribed inside a square whose sides are equal to the diameter of the circle. Assume that you throw darts at the dartboard while blindfolded, so in essence your throws are random and could land anywhere inside the square. This is somewhat analogous to Buffon's Needle.



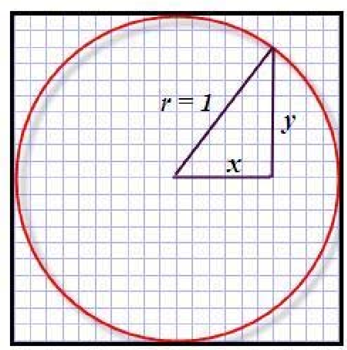
If you count how many times a dart hits within the circle (h) out of all attempts (n), the value of pi can be estimated with the following calculation.

$$\pi \approx 4\left(\frac{h}{n}\right)$$

As you have seen with other random simulations, the more trials of a random event, the greater the accuracy of the estimate.

This is a perfect situation in which to apply the Monte Carlo Method, which was used in module 5 to simulate a variety of random events (e.g., rolling dice, the lottery, etc.).

Since you already know how to generate random numbers, any pair the computer chooses can represent the (x, y) coordinate anywhere within the rectangle.



$r^2 = x^2 + y^2$

If a hit is defined as any point within the boundaries of the inscribed circle that satisfies the expression $x^2 + y^2 \leq 1$, then any point outside the circle does not count as a hit.

In lesson 07.01, you wrote a program to calculate the (x, y) coordinates of points on the circumference of a circle. If you assume that the circle has a radius of 1, then the sides of the square will be equal to the diameter of the circle.

Remember, it's just algebra!