Assignment 2

Scientific Computing with MATLAB
due: Oct 11, 2018

Estimate π using a monte carlo method

The Wikipedia article about π (here) describes a monte carlo method of estimating pi that involves repeated sampling from a random distribution.

The basic idea is to imagine a circle of radius (r) inscribed inside a square with side length $2r$. Now imagine placing a dot at some random location within the square. Sometimes the dot will be inside the circle and sometimes it will not. If you count the number of dots that land inside the circle and divide that by the total number of dots, that ratio ought to equal $\frac{\pi}{4}$.

As an exercise, implement this method of estimating π. Write the program so that you can use any number of random dots n. Start with 1000 dots and then try larger numbers. See how close you can get to the actual value of π. Here are the first 100,000 digits of π.

Note that this algorithm is not a very efficient or fast way of getting the digits of π, but it's a fun programming exercise nevertheless and a way to get you coding.

Hint: you will need a function that generates random numbers.

In MATLAB the $rand()$ function samples from a uniform (pseudo)random distribution over the interval $(0, 1)$. Typing rand will return a single random value.

Hint: to determine whether each point is inside or outside of the circle you can compute the distance between the point and the centre of the circle. If this distance is greater than the radius of the circle, it must be outside of the circle. Using the Pythagorean theorem you can easily show that the equation for the distance d between two points (x_1, y_1) and (x_2, y_2) is:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \tag{1}$$