# Assignment 2.

Given Fri., Jan. 16, due Fri., Jan. 23.

**Objectives:** To learn to use MATLAB or another programming language; to try a simple Monte Carlo computation and to understand error estimation.

**(1)** Estimate the value of $\pi$ by generating unifromly distributed random points $(x, y)$ in the square $[-1, 1]\times[-1, 1]$ and seeing what fraction of these points lie in the disk $x^2+y^2 \leq 1$. This fraction should be an approximation to the area of the disk $(\pi)$ divided by the area of the square $(4)$, so 4 times this fraction should be an approximation to $\pi$. Try the experiment with $N = 100$, 1000, and 10000 points. Determine the error in each approximation by comparing with the "exact" value of $\pi$, returned by MATLAB when you type `pi`.

Turn in a listing of your code and a table showing the approximate solution and the error for each value of $N$ tested.

**(2)** In real problems, of course, the exact solution is not known, so one needs an error estimate to decide how much confidence to place in the approximate solution. For each case above, compute an error estimate based on the standard deviation. Explain how you computed this estimate. Suppose you ran the simulation with 10000 points ten thousand times, each time computing a new approximation to $\pi$. In how many cases would you expect the actual error to be less than or equal to your estimate?