Physics 314
Classical and Computational Mechanics
Computer Exercise
Monte Carlo Method and the Area of a Circle

In this problem, you will be finding the area of a unit circle using the Monte Carlo Method. (Hint: the answer is π. I know because today is Pi-Day.)

1. Write a MATLAB routine to find the area of a circle using the Monte Carlo Method. Your function should take in a parameter that is the number of iterations to try and should return the estimate for the value of the area of the circle.

2. Comment your beautiful code so that someone else can read it. Or so that you can in 3 weeks.

3. You have a value for the area, but how accurate is it? OK, sure, you know that the answer is π. Which makes the entire exercise a bit silly, I suppose, But say you didn't. How would you determine how accurate your result was?

   I'll tell you how: you'd try it with n random points and then try $2n$ to see how much if the value changed. That change is a reasonable empirical estimate of the uncertainty in your result. (Use the $2n$ value when you report, by the way.)

4. So now write a routine that *calls* your previous function and tries to get the value of the area of the unit circle accurate to some passed-in parameter. (So that I, a user, could specify what kind of precision I wanted and it would try values of n until it got it.) Have the function report back the value of n that worked, the value of the area, and the precision it actually thinks it found.

5. Comment up this code nicely and email it and the supporting function, above, to John. He will judge your code while nibbling chocolates. Circular chocolates.