**Lab 03**

Monte Carlo Approximation of pi

CS140

Description:

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| The "Monte Carlo Method" is a method of solving problems using statistics. Given the probability, P, that an event will occur in certain conditions, a computer can be used to generate those conditions repeatedly. The number of times the event occurs divided by the number of times the conditions are generated should be approximately equal to Pi. |  |

How this program works:

Imagine we have a circle of radius R inscribed inside of a square with side length 2R. This will mean that the circles top, bottom and sides intersect with those of the square in the middle of the square, as shown above. Thus the area of the circle will be \*R^2 and the area of the square will be (2R)^2. So the ratio of the area of the circle to the area of the square will be /4.

This means that, if you pick N points at random inside the square, approximately

of those points should fall inside the circle.

**Your program should follow the procedure outlined below:**

The program should pick points at random inside the square. Then it checks to see if the point is inside the circle (it knows it's inside the circle if x^2 + y^2 < R^2, where x and y are the coordinates of the point picked and R is the radius of the circle). The program should keep track of how many points it has picked so far (N) and how many of those chosen points fell inside the circle (M). With these numbers we can use the following equation.

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is then approximated as follows:

4\*M  
pi = -----  
 N

In a comment block at the bottom of the program, place a note that indicates the approximate amount of points needed to get an accurate approximation of pi to 4 decimal places.

Although the Monte Carlo Method is often useful for solving problems in physics and mathematics which cannot be solved by analytical means, it is a rather slow method of calculating pi. However it is interesting to solve this problem because it involves the topics we have discussed so far, combines them in a new way, and gives practice with programming statistical problems.