

PHYS 301

HOMEWORK #9

Due : 21 March 2014

Buffon' s Needle Simulation

In honor of π day, we consider the problem of determining the value of π by throwing needles onto lined paper. As Buffon (1777) showed, it is possible to relate the value of π to the probability that a needle of length L will intersect lines with spacing D . (See the write - up on Wolfram MathWorld at : [http : // mathworld.wolfram.com/BufonsNeedleProblem.html](http://mathworld.wolfram.com/BufonsNeedleProblem.html)).

If we restrict our attention to cases where $L < D$, the value of π can be expressed as :

$$\pi = \frac{2 (L / D)}{\text{probability of intersection}}$$

Using Mathematica' s random number generators, simulate the tossing of a needle of length L onto a grid of lines of width D . For simplicity, assume the spacing is 1 unit apart, so that your value of L will be $0 < L < 1$.

Write a program in Mathematica that will simulate the probability of the needle intersecting a line, and from this determine the probability of intersection and thus your value of π .

You should submit your program via email (using your Loyola email account); you should also submit a write - up including : the meaning of each variable and a prose description of your logic. You may do this as comments within the body of your program, or on a separate sheet which must either be turned in at the beginning of class on 21 March or emailed to me from your Loyola account.

This assignment is worth 200 points.