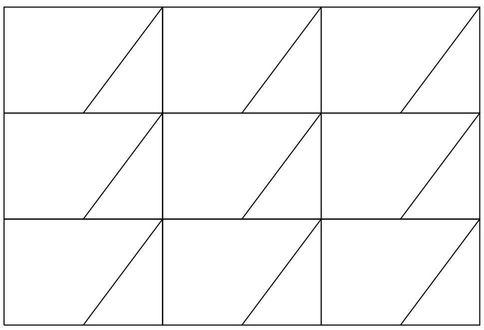
Writing Assignment - Math 381 A - Dr. Matthew Conroy

Consider a variation of Buffon's needle experiment.

For this version, suppose the plane is crossed with two sets of equally-spaced parallel lines. For the first set, the spacing between the needles is two units of length. The lines in the second set are perpendicular to the lines in the first set, and the spacing between the lines is three units of length. This results in the plane being cut into rectangles of equal size and shape. Finally, suppose that there is a line segment in each rectangle connecting the midpoint of one long side to a far corner, so the plane looks like the following figure, tesselated infinitely.



1. Estimate the probability that a randomly thrown needle of one unit length will cross any of the lines or line segments. Do this by writing and running a Monte Carlo simulation.

   Include code and code output. Plot the estimate of the probability versus the number of iterations for at least ten (the more the better!) runs of each simulation (each run should be long enough that you can see some asymptotic behavior: at minimum, there should be at least 10^5 throws in each run: the more the better!).

   Give an interval in which you think the actual probability lies and explain why you think so. **The shorter this interval, and the better your explanation, the better!**

   If you use the statistics concept of confidence intervals, be sure to justify its application here.

2. Next, experimentally estimate the length of the needle for which the probability of crossing a line or line segment is 0.5. Give plenty of experimental support for your conclusions, give an interval which you are confident includes the needle length, and explain why you feel confident in this interval. Appropriate graphs should be included.

   If you use the statistics concept of confidence intervals, be sure to justify its application here.

   Once again, the shorter the interval and the better your justification, the better!

Include the code in your writeup, what machine you ran it on, and how long it took to run the simulations.