University of Kentucky, Physics 335
Laboratory #4, Rev. B, due Monday, 2024-09-30

This lab explores another example of the Poisson distribution, analyzed numerically in Python.

1. Random distribution of **primes**.

a) Write a Python function `is_prime(n)` to determine if the number n is a prime. Use this function inside another function `count_primes(k,d)` to count the number of primes with the interval $kd \leq n < (k+1)d$.

b) Histogram the number of primes in $N = 1000$ sucessive intervals of $d = 100$ integers starting at $kd = 1,000,000$, ie. $10,000 \leq k < 10,000 + N$ and plot the distribution with error bars for each bin.

c) Calculate the mean $\bar{x}$ and standared deviation s of this sample. What is the probability that a number in the vicinity of kd is a prime?

d) Estimate λ of the corresponding Poisson distribution, and plot this distribution as a stair plot.

e) Estimate μ and σ of the corresonding Gaussian distribution and graph it as a continuous curve. From these two values, is the distribution approximately Poisson?

f) Calculate χ^2 assuming a Poisson distribution. [*bonus*: What is the likelihood of these data following the Poisson distribution?]