PHYSICS 601

Homework Assignment 7

1. In a spinning factory, a worker watches over several hundred spindles. As each spindle turns, the yarn breaks at chance due to irregularities in the tension, evenness of yarn, and etc. For purposes of quality control, it is important to know how frequently breaks occur. Assume that a given worker watches 800 spindles, and that the probability of a break during a given time interval τ is 0.005 for each spindle.

   a) Find the most probable number of breaks during the time interval τ.

   b) Find the probability that no more than 10 breaks will occur during τ.
   [Use Poisson distribution.]

2. For a Gaussian distribution

$$p(x) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left[-\frac{1}{2} \frac{(x - \bar{x})^2}{\sigma^2} \right]$$

   centered at $\bar{x}$, compute

   a) The mean value $<x>$.

   b) The variance $<(x - \bar{x})^2>$.

   c) Show that $\sigma^2 = <x^2> - <x>^2$.

3. Starting with the binomial distribution, derive the Gaussian distribution. Make certain to clearly state all approximations that are made.