Assignment 2 STATS 707 Computational introduction to statistics Due 4:00pm Friday 1 April

1. During the two previous decades, the number of earthquakes in an area average 1.4 per year. In the current 5 year period, the number of earthquakes in this area have been 0,1,1,0,1.
   (a) With $\alpha \leq 0.1$, formulate a test of the null hypothesis that the current earthquake rate is the same in the last 5 years as it was before against the alternative that the rate is different.
   (b) What conclusion can you draw from the above data?
   (c) Graph the power curve of your test.
2. Suppose that the serious accidents along a certain stretch of highway follow a Poisson distribution with a mean of 1.2 accident per week. After a reduction in the speed limit along this stretch of highway, it is hoped that this average has decreased. Construct a test for reduction based on a five-week count with $\alpha \leq 0.07$.
3. Suppose that the moisture content per pound of a dehydrated protein concentrate is normally distributed with a mean of 3.5 and a standard deviation of 0.5. A random sample of 16 specimens, each consisting of one pound of this concentrate, is to be tested. Letting $\bar{X}$ denote the sample mean of these measurements of moisture content:
   (a) What is the distribution of $\bar{X}$? Is it the exact or an approximate distribution?
   (b) What is the probability that:
      i. $\bar{X}$ will exceed 3.7?
      ii. $\bar{X}$ will between 3.34 and 3.66?
4. **Quality control**: A shoe factory owns a machine that cuts pieces from slabs of compressed rubber to be used as soles on a certain brand of men's shoe. The thickness measurement of these soles are normally distributed with the standard deviation $\sigma = 0.2$ millimeters. Occasionally, for some unforeseeable reason, the mean changes from its target setting of $\mu = 25$ millimeters. To be able to take timely corrective measures, such as readjusting the machine's setting, it is important to monitor product quality by measuring the thickness of a random sample of soles taken periodically from the machine's output. Suppose that the following plan is used to monitor the product quality. The thickness measurement for a random sample of 5 soles are observed, and the sample mean $\bar{X}$ is recorded. If $\bar{X} < 24.8$ or $\bar{X} > 25.2$, the machine is considered to be out of control. Production is then halted and the machine is readjust.
   (a) When the true mean is $\mu = 25$ millimeters, what is the probability that a sample will indicate "out of control"?
   (b) Suppose that the true mean has changed to $\mu = 25.3$ millimeters. What is the probability that a sample will indicate "out of control"?
   (*Note: In practical operations, control charts are plotted to show the $\bar{x}$ values at successive points of time to detect any drift in the process mean.*)
5. A computer is programmed to make 100 draws at random with replacement from $\{0, 0, 0, 0, 1\}$, and take their sum. It does this 144 times; the average of the 144 sums is 21.13. The program is working fine. Or is it?