Physics 326a-2011
Assignment 5

Due: Friday 10-7-11 at 4 pm

Part 1:

Go to www.KhanAcademy.org, scroll down to the lectures on Statistics, and watch the following lectures (each averages about 12 minutes long):

Confidence Interval 1 Note that the "z score" is defined as the number of standard deviations you are away from the mean. The *z*-score table that he uses is the same as using the CDF for a normal distribution with a mean of zero and a standard deviation of 1.

Small sample size confidence intervals

You can use the CDF function in Mathematica with the t-distribution:

CDF[StudentTDistribution[μ, σ, degrees of freedom], x]

Where μ and σ are the mean and standard deviation of your sample (in Khan's example, these would be μ = 2.34 and σ = 1.04), and x is the value at which you wish to evaluate the CDF.

I was unable to find the CDF function in Excel; perhaps he's working with an older version. However, NORMDIST (x, μ, σ, TRUE) performs the same function as CDF, and (1-TDIST(x, degrees of freedom, 2) gives the probability under the t-distribution curve between –x and +x. To use this, you must convert your x-value to a z-scale, i.e. the function assumes μ = 0 and σ = 1.

Part 2:

Problem 5.1 (group problem): (Adapted from "Practical Physics, 4th Ed., by G. L. Squires) Consider a highly non-Gaussian distribution, which consists of only two values, namely -1 with probability 0.9 and +9 with probability 0.1. Calculate the standard deviation of the population σ, and the standard deviation of the mean $\sigma_{\bar{x}}$ for a sample size of $n = 3$, and show that even in this circumstance, $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$. *Hint: You will need to consider all the possible sets of three samples, find the probability of each one, and use this to calculate* $\sigma_{\bar{x}}$. *Recall that* $\sigma_{\bar{x}}$ *is the standard deviation for a plot made for a very large number experiments in which, for each experiment, you take three samples, calculate their average, then plot the average.*

Part 3:

Devise a problem relating to the material covered in the Khan lectures. You should note which lecture it is related to. This can be a conceptual problem (similar to the conceptests we do in class) or a more quantitative problem. Also, write up a complete solution for your problem, in a form that can be understood by your fellow students; this means that you must explain your reasoning especially clearly. (I will probably use some of these problems in future years.) You may consult with other students, but each of you must submit your own problem and solution.