Problem set 5, due Monday 10/5/2015

Note: Please submit Excel files to me by e-mail, before class on Monday

1. Graphing common probability distributions

Use Excel to create graphs of the PMFs (or PDFs, if continuous) and CDFs of the following distributions. You should do one PMF/PDF graph and one CDF graph per distribution. You can choose which parameters to use for your graphs.

a) Binomial
b) Negative binomial
c) Poisson
d) Discrete uniform
e) Continuous uniform
f) Normal

2. Central limit theorem exercise

The exponential distribution is a continuous analogue of the geometric distribution (which in turn is a special case of the negative binomial). The PDF is $f(x) = \lambda e^{-\lambda x}$, which is an ever-downward-sloping function of x; thus, it doesn't bear much resemblance to the normal PDF.

The CDF of this distribution is $F(x) = 1 - e^{-\lambda x}$. This gives the probability F that the variable will be less than each value x. But if we solve for x in terms of F, we get

$$x = -\frac{1}{\lambda}\ln(1 - F)$$

This tells us the value of x that corresponds to any given cumulative probability. Therefore, we can generate random draws from the exponential distribution in Excel with the code

```
= ( - 1 / λ ) * ln( 1 - rand( )  )
```

Here, `λ` is a parameter that you can set, and `ln( )` is the natural logarithm function.

Armed with this code, you can conduct a beautiful test of the central limit theorem: In each of 10,000 trials, generate d draws from the exponential distribution, and find the sum. Use the `frequency` function (remember to select the column you intend to fill before you start entering the function, and to hold down Ctrl and Shift as you press Enter) to count how frequently your sum falls into each of several evenly-spaced bins. (You can choose your own bin widths.) Use this to draw a function estimating the PDF of your sum, and compare this to a normal distribution with the same mean and standard deviation, preferably on a curved line scatter graph. Try this for each of the following values of d: 1, 2, 8, and 64.

3. Reading

Please read Chapter 4 of the textbook: "Foundations for Inference."