STAT 327 Lab — March 9, 2009

Simulate the distribution of $\bar{X}_n$ for various n, when $X_1, X_2, \ldots, X_n \sim \text{Unif}\left[-\frac{1}{2}, \frac{1}{2}\right]$.

Minitab → Calc → random data → Uniform.

In the Uniform pop-up box, specify that you want the lower and upper values of the uniform range to be −0.5 and 0.5, resp. Also specify that the data be generated in N = 1000 rows, and 50 columns (C1 – C50).

Then go to Calc → Row statistics → mean of C1–C2, place result in C51. (This puts 1000 random values of $\bar{X}_2 = (X_1 + X_2)/2$ into column 51.) Similarly, place the mean of C1 – C20 into C52, and the mean of C1–C50 into C53. Then generate histograms of C51, C52, C53. These are approximations to the sampling distributions of $\bar{X}_2$, $\bar{X}_{20}$ and $\bar{X}_{50}$ based on N = 1000 replications.

You can also force all 3 histograms to be scaled with the same x and y axes; to see how the variance $\frac{\sigma^2}{n}$ goes down as n increases.

You can also use the "basic statistics" package to calculate the mean and ~~vari~~ std. dev. of each of columns C51, C52, C53. Note that the means are not exactly 0, due to sampling error of using N=1000 replications.

Repeat the whole exercise using larger value of n and N (until you hit the Minitab array storage limits).

Then replace the Uniform distribution by some of the other distributions (both continuous and discrete) on the Minitab "random distribution" menu. Note that the Central Limit Theorem works for the distribution of $\bar{X}_n$ from any distribution (when n is set high enough).