Math 324 Fall 2004
Assignment 4
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This goal of the first part of this assignment is use simulation to estimate a sampling distribution. In the second part the aim is that you will see empirically that the Central Limit Theorem is true.

You should submit your solutions to this assignment as a written report. In other words, it is not enough to submit pages of computer output with no interpretation. If you wish to submit your analysis code, please attach it as an appendix to your report. As this is the fourth assignment you are expected to take more care in the write-up form now on. For example, properly label plots, write clear paragraphs describing the results of your analysis and at the end of your report write a brief conclusion summarizing the main results.

You may need to write R functions or Minitab macros to carry out your analysis. Some code will be given on the website.

Simulating a sampling distribution

Simulate 10000 draws of size 10 from a normal distribution with mean 100 and standard deviation 15. For each draw of size 10 calculate the sample standard deviation. Use these to estimate the sampling distribution of the sample standard deviation in this example. Based on your estimated sampling distribution how likely is it that you will get a standard deviation of 10 or smaller. Explain how you worked this out.

Repeat the simulation, but now look at the sampling distribution of the variance. What is the probability of getting a variance of 600 or more?

Investigating the Central Limit Theorem empirically

The Central Limit Theorem (CLT) as discussed in class states that no matter what the distribution of the original data as the sample size increases the distribution of the sample

mean approaches a normal distribution. Clearly the uniform distribution is very non-normal so we will use this distribution for our original data.

Simulate 1000 random numbers from the Uniform distribution on [0,1]. Plot the distribution. What is the mean and standard deviation of your sample? How does this compare to the theory?

Simulate the mean of 2 Uniform random numbers 1000 times. Plot the distribution. What is the mean and standard deviation of your sample? How does this compare to the theory?

Simulate the mean of 4 Uniform random numbers 1000 times. Plot the distribution. What is the mean and standard deviation of your sample? How does this compare to the theory?

Simulate the mean of 8 Uniform random numbers 1000 times. Plot the distribution. What is the mean and standard deviation of your sample? How does this compare to the theory?

Simulate the mean of 16 Uniform random numbers 1000 times. Plot the distribution. What is the mean and standard deviation of your sample? How does this compare to the theory?

Simulate the mean of 32 Uniform random numbers 1000 times. Plot the distribution. What is the mean and standard deviation of your sample? How does this compare to the theory?

Simulate the mean of 128 Uniform random numbers 1000 times. Plot the distribution. What is the mean and standard deviation of your sample? How does this compare to the theory?

Make sure you summarize what you learned from this investigation. Empirically, does it seem that the central limit theorem holds? Was the mean of a sample of size 128 enough to see a reasonable shaped bell-curve?