

Homework Assignment #1

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Instructions: This assignment is due in class on Monday, September 8th. You are encouraged to work together on the problems but the final write-up that you submit must be done individually.

1. Using your favorite computer program, e.g. Maple, Mathematica, Matlab, etc., provide a sample of 500 independent values of the random vector $\vec{U} = (U_1, U_2, \dots, U_{20})$, where the U_k are independent, identically $U(0, 1)$ distributed. Use these vectors to provide a sample of 500 independent values of the random variable

$$S_{20} = \sum_{k=1}^{20} U_k.$$

Plot histograms of the values of $S_{20}/20$ and $\sqrt{12}(S_{20} - 10)/\sqrt{20}$, using "bins" of width 0.1 for each of these histograms, and explain which famous probability theorem each of these illustrates.

2. Use the 10,000 independent values from a $U(0, 1)$ distribution that you have found in question #1 to generate 5 samples of size 2000 each and the corresponding histograms of these samples from the distributions:
 - (a) of a random variable X which takes values $\{-1, 0, 1\}$ with probabilities $\{1/3, 1/2, 1/6\}$ respectively,
 - (b) of an exponentially distributed random variable X which has *mean* $= 1/2$ (or, equivalently, *rate* $= 2$). In this case you are free to design your own "bins" for the histograms.