9.4: Central Limit Theorem Demonstration

Learning Objectives

- Develop a basic understanding of the properties of a sampling distribution based on the properties of the population

Instructions

This simulation demonstrates the effect of sample size on the shape of the sampling distribution of the mean.

Depicted on the top graph is the population which is sometimes referred to as the parent distribution. Two sampling distributions of the mean, associated with their respective sample size will be created on the second and third graphs.

For both the population distribution and the sampling distributions, their mean and the standard deviation are depicted graphically on the frequency distribution itself. The blue-colored vertical bar below the X-axis indicates where the mean value falls. The red line starts from this mean value and extends one standard deviation in length in both directions. The values of both the mean and the standard deviation are also given to the left of the graph. Notice that the numeric form of a property matches its graphical form in color. In addition, the skew and the kurtosis of each distribution are also provided to the left. These two variables are determined by the shape of distribution. The skew and kurtosis for a normal distribution are both 0.

In this simulation, you need to first specify a population (the default is uniform distribution). Take note of the skew and kurtosis of the population. Then pick two different sample sizes (the defaults are $N = 2$ and $N = 10$), and sample a sufficiently large number of samples until the sampling distributions change relatively little with additional samples (about $50,000$ samples.) Observe the overall shape of the two sampling distributions, and further compare their means, standard deviations, skew and kurtosis. Change the sample sizes and repeat the process a few times. Do you observe a general rule regarding the effect of sample size on the shape of the sampling distribution?

You may also test the effect of sample size with populations of other shape (uniform, skewed or custom ones).

Illustrated Instructions

Central Limit Theorem Video Demo

The video below changes the population distribution to skewed and draws $100,000$ samples with $N = 2$ and $N = 10$ with the "$10,000$ Samples" button. Note the statistics and shape of the two sample distributions how do these compare to each other and to the population?