7.3 SAMPLE MEANS FROM NONNORMAL POPULATIONS

SAMPLE MEANS FROM NONNORMAL POPULATIONS

What is the distribution of sample means from NonNormal populations? Return to the website http://onlinestatbook.com/stat_sim/sampling_dist/.

1. Click the "*Begin*" button on the left side. Use the dropdown menu at the top of the page to change the population distribution to "*Skewed*." Record the values of the population mean and population standard deviation in the top of the table below. Also, record the shape of the population.

2. Use the "*Animated*" button to watch a sample of size 5 be drawn from the population. Notice that the sample mean is calculated and plotted on its own number line. Click "*Animated*" a few more times, watching the animation. Click the "*10,000*" button to generate 10,000 sample means. Record the mean, standard deviation, and shape of the sampling distribution of $\bar{x}$ in the n = 5 row of the table below.

3. Repeat #2 above for to simulate the sampling distribution of $\bar{x}$ for samples of size 10, 20, and 25. Fill in the appropriate rows of the table.

	Population Mean μ =	Population SD σ =	Population Shape:
Sample Size	**Mean of $\bar{x}$ distribution**	**Std. Dev. of $\bar{x}$ distribution**	**Shape of $\bar{x}$ distribution**
n = 5			
n = 10			
n = 20			
n = 25			

4. Use the dropdown menu at the top of the page to change the population distribution to "*Uniform*." Run simulations as before, recording the characteristics of each sampling distribution in the appropriate row of the table.

	Population Mean μ =	Population SD σ =	Population Shape:
Sample Size	**Mean of $\bar{x}$ distribution**	**Std. Dev. of $\bar{x}$ distribution**	**Shape of $\bar{x}$ distribution**
n = 5			
n = 10			
n = 20			
n = 25			

5. Use the dropdown menu at the top of the page to change the population distribution to "*Custom*." Paint a new population of your own creation by clicking and dragging with your cursor. Run simulations as before, recording the characteristics of each sampling distribution in the appropriate row of the table.

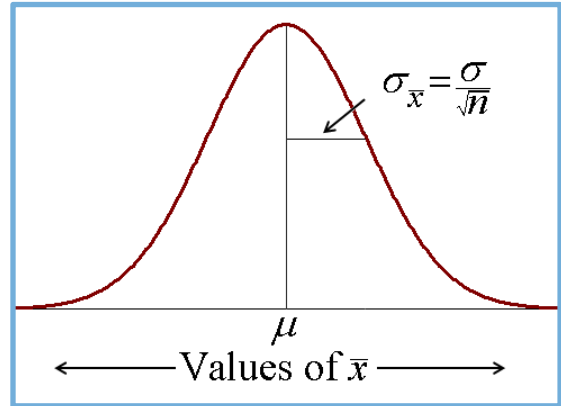|	Population Mean μ =	Population SD σ =	Population Shape:
Sample Size	**Mean of $\bar{x}$ distribution**	**Std. Dev. of $\bar{x}$ distribution**	**Shape of $\bar{x}$ distribution**
n = 5			
n = 10			
n = 20			
n = 25			

6. Based on all the simulations you've completed so far, what do you suspect to be true about the shape of the sampling distribution of $\bar{x}$?

Central Limit Theorem (CLT) – Draw an SRS of size n from any population with mean μ and standard deviation σ. The Central Limit Theorem states that as n increases, the sampling distribution of the sample mean $\bar{x}$ approaches a Normal distribution.

THE SAMPLING DISTRIBUTION OF A SAMPLE MEAN

Suppose we take an SRS of size n from a population of size N with mean μ and standard deviation σ. Then if $\bar{x}$ is the sample mean, the sampling distribution of $\bar{x}$ has these characteristics:

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

$$\mu$$

$$\longleftarrow \text{Values of } \bar{x} \longrightarrow$$

- The **mean** of the sampling distribution of $\bar{x}$ is $\mu_{\bar{x}} = \mu$.

- The **standard deviation** of the sampling distribution of $\bar{x}$ is $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$. **Note:** when sampling without replacement, we must satisfy the 10% condition: $n \leq \frac{1}{10} N$.

- The **shape** of the sampling distribution is:
  - If the population is exactly Normal, the sampling distribution of $\bar{x}$ is exactly Normal.
  - If the population is not Normal, the sampling distribution of $\bar{x}$ is approximately Normal when n is "large," according to the CLT. (As a rule of thumb, we require the sample size to be $n \geq 30$.)

7. Turn to p.462 in your textbook and complete Exercise 60.