The Central Limit Theorem

California Standards: 9.0

Students know the central limit theorem and can use it to obtain approximations for probabilities in problems of finite sample spaces in which the probabilities are distributed binomially.

Procedure:

1. Cut up four equal size slips and write the values 1, 3, 5, 7 on them and place in a box
2. Randomly choose two slips of paper, with replacement
3. List all the samples of size $n = 2$ and calculate the mean of each
4. Repeat trial for 5 samples, 10 samples, 20 samples and 30 samples
5. Create 4 Relative Frequency Histogram of sampling distribution of $\bar{x}$

Data and Histogram:

5 Samples

Samples		Sample Mean

10 Samples

Samples		Sample Mean

20 Samples

Samples		Sample Mean

30 Samples

Samples		Sample Mean

Calculation:

5 Samples:

Sample Mean	Frequency	Relative Frequency
1		
2		
3		
4		
5		
6		
7		
	Total:	

Mean of sample means:

Standard Deviation of sample means:

10 Samples:

Sample Mean	Frequency	Relative Frequency
1		
2		
3		
4		
5		
6		
7		
	Total:	

Mean of sample means:

Standard Deviation of sample means:

20 Samples:

Sample Mean	Frequency	Relative Frequency
1		
2		
3		
4		
5		
6		
7		
	Total:	

Mean of sample means:

Standard Deviation of sample means:

30 Samples:

Sample Mean	Frequency	Relative Frequency
1		
2		
3		
4		
5		
6		
7		
	Total:	

Mean of sample means:

Standard Deviation of sample means:

Conclusion:

Compare your results with the expected population mean $\mu = 4$, and population standard deviation $\sigma \approx 2.236$.

To verify Central Limit Theorem

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

For 5 samples,

$\mu_{\bar{x}} - \mu =$

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

For 10 samples,

$\mu_{\bar{x}} - \mu =$

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

For 20 samples,

$\mu_{\bar{x}} - \mu =$

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

For 30 samples,

$\mu_{\bar{x}} - \mu =$

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