**Central Limit Theorem (Lab 4 replacement)**   name_____

Central Limit Theorem for Sample Mean

The lifetime of optical scanning drives follows a skewed distribution with $\mu = 100$ and $\sigma = 100$. Data is repeatedly sampled from this distribution and sample means are calculated for different sample sizes.

1. Here are dot plots of all 5 sample sizes using the Multiple Y's Simple option of Minitab. Each dot represents a single calculation of a sample mean.
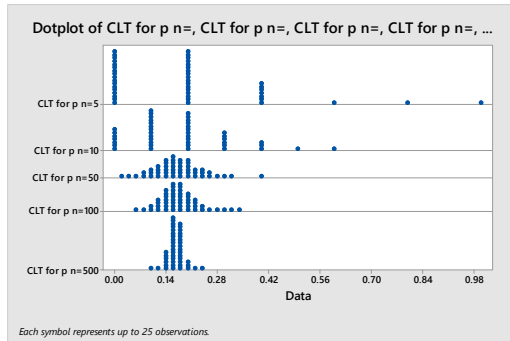

Dotplot of CLT n=1, CLT n=5, CLT n=10, CLT n=30, CLT n=100
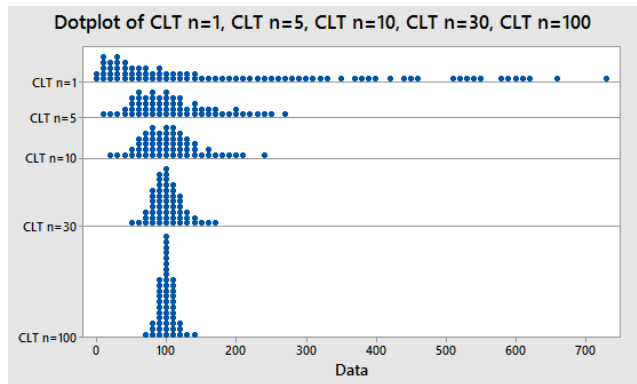
   a. As the sample size changes, describe the change in center.

   b. As the sample size changes, describe the change in spread.

   c. As the sample size changes, describe the change in shape.

2. Using the command STAT>DISPLAY DESCRIPTIVE STATISTICS, here are the mean and standard deviation for each of the five groups. Paste the results here.

```
Variable      Mean    StDev
CLT n=1      97.66   102.37
CLT n=5     100.10    44.42
CLT n=10    100.01    31.19
CLT n=30    100.29    18.07
CLT n=100   100.34    10.24
```

   a. As the sample size changes, describe the change in mean.

   b. As the sample size changes, describe the change in standard deviation.

Central Limit Theorem for the Sample Proportion

3. First, let's identify the **population proportion.** If you roll a six-sided die, what proportion would you expect to come up 6? Write this as a fraction **and** a decimal.

4. The dotplots labeled "CLT for p n=##" represent 1000 trials of rolling a six-sided die 5, 10, 50, 100 or 500 times. Each dot represents the **sample proportion** of times a 6 was rolled for each of the sample sizes. We know that the sample proportion is a random variable that we want to investigate.

Dotplot of CLT for p n=, CLT for p n=, CLT for p n=, CLT for p n=, …

CLT for p n=5
CLT for p n=10
CLT for p n=50
CLT for p n=100
CLT for p n=500

0.00   0.14   0.28   0.42   0.56   0.70   0.84   0.98
Data

Each symbol represents up to 25 observations.

   a. How has the center changed as the sample size increased?

   b. How has the spread (range) changed as the sample size increased?

   c. How has the shape changed as the sample size increased?

5. What you have observed in this worksheet are the **three** important parts of the Central Limit Theorem for the distribution of the sample mean $\overline{X}$ and the sample proportion $\hat{p}$. In your own words, describe these three important parts.