<u>Tuesday, January 3</u>: Activity: How Many Textbooks?

In this activity, our job is to develop a method to estimate the total number of Algebra books at our school based on a random sample of books and the assumption that the books are numbered sequentially starting from 1.

For example, suppose a random sample of $n = 7$ books gives the following numbers: 10, 38, 59, 61, 74, 90, 94. How can we use this information to estimate the total number of books (N)? One possible method would be to take the median value and double it. In this example, median • 2 = 61 • 2 = 122. Thus, our *estimate* for the total number of books is $\hat{N} = 122$.

Our job is to create several other methods to estimate the total number of books and decide which method is best. We can use any combination of the summary statistics we already know (mean, median, min, max, quartiles, *IQR*, standard deviation, etc.) or invent our own. The goal is to find a relatively *simple* method that reliably predicts the total number of books.

<u>Wed/Thurs, January 4/5</u>: 7.1 Sampling Distributions

Read 416–417

What is a parameter? What is a statistic? How is one related to the other?

Alternate Example: Identify the population, the parameter, the sample, and the statistic in each of the following: (a) A pediatrician wants to know the 75th percentile for the distribution of heights of 10-year-old boys, so she takes a sample of 50 patients and calculates $Q_3 = 56$ inches.

(b) A Pew Research Center Poll asked 1102 12- to 17-year-olds in the United States if they have a cell phone. Of the respondents, 71% said "Yes."

Read 417–420

What is sampling variability?

What is a sampling distribution?

What is the difference between the distribution of the population, the distribution of the sample, and the sampling distribution of a sample statistic?

Read 421–428

What is an unbiased estimator? What is a biased estimator? Provide some examples.

How can you reduce the variability of a statistic?

What effect does the size of the population have on the variability of a statistic?

What is the difference between accuracy and precision? How does this relate to bias and variability?

HW #1: page 428 (1–13 odd, 17, 19)

<u>Friday, January 6</u>: 7.2 Sampling Distribution of a Sample Proportion

Read 432–435

In the context of the Candy Machine Activity, explain the difference between the distribution of the population, the distribution of a sample, and the sampling distribution of the sample proportion.

Based on the Candy Machine Activity and the Penny Activity, describe what we know about the shape, center, and spread of the sampling distribution of a sample proportion.

When is it OK to say that the distribution of $\hat{p}$ is approximately Normal?

Read 436–437

What are the mean and the standard deviation of the sampling distribution of a sample proportion? Are these formulas on the formula sheet? Are there conditions that need to be met for these formulas to work?

Read 437–439

Alternate Example: The superintendent of a large school district wants to know what proportion of middle school students in her district are planning to attend a four-year college or university. Suppose that 80% of all middle school students in her district are planning to attend a four-year college or university. What is the probability that an SRS of size 125 will give a result within 7 percentage points of the true value?

HW #2: page 430 (18, 20, 21–24), page 439 (27, 29, 33, 35, 37, 41)

<u>Monday, January 9</u>: Meet in Computer Lab!

1. Go to the following website: onlinestatbook.com/rvls.html
   Choose: Simulations/Demonstrations
   Choose: Sampling Distribution Simulation
   Read instructions CAREFULLY!
   Press Begin

2. The display will show 4 graphs. The first graph shows the population. Currently, the population should be normal. The second graph is called "Sample Data." This will show the observations that are sampled from the population in the top graph. On the third and fourth graph, there are choices for sample statistics and sample sizes. Set graph 3 to "mean" with "n = 5" and set graph 4 to "none." Then click "Animated Sample" from graph 2 and clearly describe what is happening. You should animate a few samples to make sure you know what is going on.

3. Now, click on "1000 Samples" and clearly describe what is happening.

4. Now, in graph 3, change the sample size to "n = 2" and generate 10,000 samples. Record the mean, standard deviation, and shape of the sampling distribution of the sample mean when n = 2. Repeat this for each of the sample size choices (clear the bottom 3 graphs first!) and clearly describe what happens to the distribution's shape, center, and spread as the sample size increases (Note: the mean and standard deviation of the original population are listed to the left of graph 1).

5. Now, change the population from Normal to Uniform and repeat step #4.

6. Now, change the population from Uniform to Skewed and repeat step #4.

7. Now, change the population from Skewed to "Custom" and paint a bimodal (double-peaked) distribution. Repeat step #4.

8. Summarize your responses to questions 4-7. Do you see anything in common?

9. Statisticians generally prefer the mean as a measure of center instead of the median. To see why, choose a normal population in graph 1, choose mean in graph 3 and median in graph 4. Make sure the sample sizes are the same in graphs 3 and 4. Now, generate 10,000 samples. Compare the distributions. Do this for other populations and other sample sizes. Why do you think the mean is preferred?

HW #3: page 441 (36, 38, 39, 43–46)

<u>Tuesday, January 10</u>: 7.3 Sampling Distribution of a Sample Mean

Based on the penny activity and the applet activity, what do we know about the shape, center, and spread of the sampling distribution of a sample mean?

Read 444–445

What are the mean and standard deviation of the sampling distribution of a sample mean? Are these formulas on the formula sheet? Are there any conditions for using these formulas?

Read 445–448

What is the shape of the sampling distribution of a sample mean when the sample is taken from a Normally distributed population? Does the sample size matter?

Alternate Example: At the P. Nutty Peanut Company, dry-roasted, shelled peanuts are placed in jars by a machine. The distribution of weights in the jars is approximately Normal, with a mean of 16.1 ounces and a standard deviation of 0.15 ounces.
(a) Without doing any calculations, explain which outcome is more likely: randomly selecting a single jar and finding that the contents weigh less than 16 ounces or randomly selecting 10 jars and finding that the average contents weigh less than 16 ounces.
(b) Find the probability of each event described above.

Read 449–452

What is the shape of the sampling distribution of a sample mean when the sample is NOT taken from a Normally distributed population? Does the sample size matter? Does this concept have a name?

Alternate Example: Suppose that the number of texts sent during a typical day by a randomly selected high school student follows a right-skewed distribution with a mean of 15 and a standard deviation of 35. Assuming that students at your school are typical texters, how likely is it that a random sample of 50 students will have sent more than a total of 1000 texts in the last 24 hours?

HW #4 page 454 (49–63 odd, 65–68)

<u>Wed/Thurs, January 11/12</u>: Chapter 7 Review/FRAPPY

HW #5 page 458 Chapter Review Exercises

<u>Friday, January 13</u>: Chapter 7 Review

HW #6 page 459 Chapter 7 AP Statistics Practice Test

<u>Monday, January 16</u>: No School
<u>Tuesday, January 17</u>: Start Chapter 8
<u>Wednesday/Thursday, January 18/19</u>: Chapter 7 Test