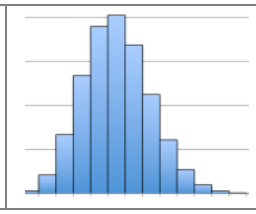
Sampling Distributions and CLT



Chapter 17 **Statistics**

Why are we doing this?

We know how to collect a good data sample and how to describe and analyze it. In this unit, we will study how information from samples relates to information about populations. We will look at what happens if we collect all possible samples of a given size, and how unusual (statistically significant) any particular sample is.

What do I need to know?

Check off the items as you feel that you have mastered them!

	Skills	1	2	3	4
Chapter 17. Sampling Distributions	**17. I am learning to analyze sampling distributions so I can determine how unusual a sample is.**				
	17.1 I can create a sampling distribution using all possible samples from a small population.				
	17.2 I can describe the relationship between sample size and the variability of a statistic.				
	17.3 I can calculate mean, standard deviation, and probabilities for a sampling distribution of a sample proportion.				
	17.4 I can calculate mean, standard deviation, and probabilities for a sampling distribution of a sample mean.				
	17.5 I can use a Normal distribution to calculate probabilities involving the sample means and proportions.				

How will I get there?

When	What
Week 1	• "Is This Coin Fair?" <Video> • Checking for Understanding • "Reese's Pieces" <Video> • Sampling Distribution for Proportions WS

	Remind Text 81010	3st Period Message: @dd33bf	6nd Period Message: @6cd9g2	7th Period Message: @794b7h
	Ms. Kolomenskaya Mr. Jefferies-Wilmore	E-Mail: kolomenskayao@luhsd.net E-Mail: wilmorej@luhsd.net		
	For Help with understanding these assignments, two videos have been made. One for "Is this Coin Fair" and "Reeses Pieces". They are here: **Is this coin Fair?:** https://www.loom.com/share/387b01ee40ea4d5f92ff99999ac2cd2a **Reeses Pieces:** https://www.youtube.com/playlist?list=PLqynh7d3GBoM73Zzcu65qIhuO9T_gYtjh			

Is this a fair coin?

How many heads would we have to get out of 30 tosses in order for us to be worried that a coin is unfair?

1. If X is the number of heads, then X is a binomial random variable:

B –

I –

N –

S –

Formula for mean of binomial:_____ Find the mean of X: _____

Interpret the mean:_____

Formula for SD of binomial:_____ Find the SD of X: _____

Interpret the SD:_____

2. Use your calculator to "toss" a coin 30 times and record the number of heads. Do this 4 times.

heads:_____ # heads:_____ # heads:_____ # heads:_____

3. Record your data on the dotplot at the front of the room. Copy down the dotplot here.

4. What does each dot represent?

5. Why do we call it “sampling distribution”?

6. What is the approximate shape of the sampling distribution?

7. Let’s think of the sampling distribution as being a normal distribution. Using the mean and SD from #1, sketch the Normal curve.

8. Using your model, find the probability of getting 19 or more heads.

9. With 19 heads out of 30, would we have convincing evidence that the coin is unfair? Explain.

Checking for Understanding

1. What is a population? Give three examples.

-
-
-

2. What is a population parameter? Give three examples.

-
-
-

3. What is a sample statistic? Give three examples.

-
-
-

4. What is a sampling distribution?

5. What is the formula for z-score?

6. The heights of the people if the planet Ixx are normally distributed with a mean of 40 inches and a standard deviation of 5 inches. [They are a vertically diverse people.]

a) Draw and label the Normal curve from the information.

b) What percent of Ixxians are over 40 inches tall?

c) What percent of Ixxians are between 30 and 50 inches tall?

d) What percent of Ixxians are over 4ft (48 inches) tall?

A small class of five statistics students received the following scores on a test: 5, 4, 4, 3, and 1.
a) Calculate the mean and the standard deviation of these five scores.

Part I

b) List all possible sets of size 2 that could be chosen from this class (There are ${}_5C_2 = 10$ such sets)

c) Calculate the mean of each of these sets of 2 scores and make a dot plot of the sampling distribution of the sample mean.

d) Calculate the mean and the standard deviation of this sampling distribution. How do they compare to those of the individual scores?

Part II

b) List all possible sets of size 3 that could be chosen from this class (There are ${}_5C_3 = 10$ such sets)

c) Calculate the mean of each of these sets of 3 scores and make a dot plot of the sampling distribution of the sample mean.

d) Calculate the mean and the standard deviation of this sampling distribution. How do they compare to those of the individual scores? How do they compare to the mean and the standard deviation of the sampling distribution from part I?

What's the proportion of orange Reese's Pieces?



If we take a sample of Reese's Pieces, what proportion of the candies will be orange?

Suppose a large bag of Reese's Pieces has 10,000 pieces. The manufacturer says that exactly 40% of the candies are orange. If we select a sample of 50 pieces, how many will be orange? Let X = the number of orange candies in the sample.

1. What type of probability distribution does X have? Justify.

B –

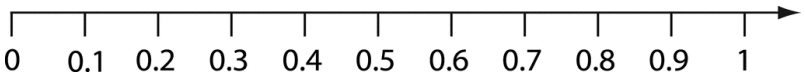
I –

N –

S –

2. Draw a sample of 50 Reese's Pieces using the applet. What proportion of them are orange? Repeat this 5 times. Write the values below.

a) Add your data to the dot plot on the board. Sketch the dot plot below.



b) What does each dot represent?

c) What is the mean and the standard deviation for the distribution? Show work.

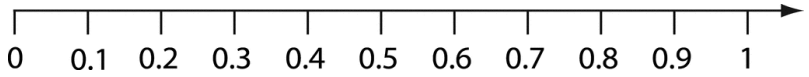
d) What is the approximate shape of the sampling distribution? Explain and sketch it below.

3. Repeat step 2 for a sample of 200 Reese's Pieces.

Mean =

St. Deviation =

Shape -

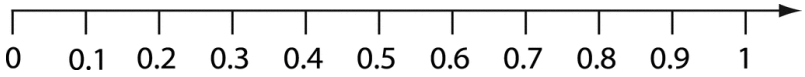


4. Repeat step 2 for a sample of 500 Reese's Pieces.

Mean =

St. Deviation =

Shape -



5. What did you notice? Write 2-3 sentences comparing the three sampling distributions.

6. We know that bags of Reese's Pieces contain exactly 40% that are orange. If we select a random sample of 50 candies, what is the probability that the sample proportion will be 50% or greater?

Sampling Distributions for Proportions

1. About 10% of people in the United States are left handed. Suppose we take a sample of 120 U.S. residents, and let $\hat{p}$ = the proportion of residents who are left-handed.

a. Calculate the mean and the standard deviation of the sampling distribution of $\hat{p}$.
Interpret the standard deviation.

0.1, 0.027

b. Justify that the distribution of *X* is approximately normal. (Check the Large Counts conditions)

c. Calculate the probability that 16 or more individuals in the sample of 120 are left handed. Show your work.

N (0.1, 0.027), 0.1112

2. Suppose that 75% of young adult Internet users (ages 18 to 29) watch online videos. A polling organization contacts an SRS of 1000 young adult Internet users and calculates the proportion $\hat{p}$ in this sample who watch online videos.

a. Calculate the mean and the standard deviation of the sampling distribution of $\hat{p}$.

0.75, 0.0137

b. Check that the 10% condition is met.

c. Is the sampling distribution of $\hat{p}$ approximately Normal? Check that the Large Counts condition is met.

d. If the sample size were 9000 rather than 1000, how would this change the sampling distribution of $\hat{p}$?

3. Based on past experience, a bank believes that 7% of the people who receive loans will not make payments on time. The bank has recently approved 200 loans.

a. Describe the shape, center, and spread of the sampling distribution of the proportion of clients in this group who may not make timely payments.

b. What is the probability that over 10% of these clients will not make timely payments?

N (0.07, 0.018), 0.0475

4. A USA Today Poll asked a random sample of 1012 U.S. adults what they do with the milk in the bowl after they have eaten the cereal. Of the respondents, 70% said that they drink it. Let $\hat{p}$ be the proportion of people in the sample who drink the cereal milk.
a. What are the mean and the standard deviation of the sampling distribution of $\hat{p}$?

0.7, 0.014

b. Check that the conditions is met.

c. Find the probability of obtaining a sample of 1012 adults in which 67% or fewer say they drink the cereal milk.

N (0.7, 0.014), 0.0162

5. Your mail-order company advertises that it ships 90% of its orders within three working days. You select an SRS of 100 of the 5000 orders received in the past week for an audit.

a. What are the mean and standard deviation of the sampling distribution?

0.9, 0.3

b. Check that the conditions are met.

c. The audit reveals that 86 of these orders were shipped on time (that is 86%). What is the probability that the proportion of on time orders is 86% or less?

N (0.9, 0.3), 0.4483

6. A random sample is to be selected from a population that has a proportion of successes p = .65. Determine the mean and standard deviation of the sampling distribution of $\hat{p}$ for each of the following sample sizes and determine if the distribution is Normally distributed:

a. n = 20

0.65, 0.107

b. n = 50

0.65, 0.067

c. n = 200

0.65, 0.034

7. In a study of pet owners, it was reported that 24% celebrate their pet's birthday. Suppose that this estimate was based on a random sample of 200 pet owners. Is it reasonable to conclude that the proportion of all pet owners who celebrate their pet's birthday is less than 0.25? Make sure to check the conditions.

N (0.24, 0.03), 0.9996

8. Suppose that we know for a fact that 37% of Kutztown University students that play Pokémon Go. Suppose we seek to take a sample of KU students of size n = 175. What is the probability that this sample yields a sample proportion $\hat{p}$ less than 0.30? Make sure to check the conditions.

N (0.37, 0.036), 0.0262