Name: _____ Hour:_____ Date: _____

Who will win the Last Banana?

Suppose that you're on a desert island playing dice with another castaway. The winner's prize will be the last banana. Here are the rules of the game:

- Each player rolls a die
- If the largest value shown is a 1, 2, 3, or 4, then Player 1 wins
- If the largest value shown is a 5 or 6 then Player 2 wins

1. Who do you think has advantage in this game: Player 1, Player 2, or neither? Make your **best guess** and explain your choice.

   Player A, they have more #'s to win.

Experimental Probability

2. Play the game 20 times with your partner and record the winner of each game by tallying in the table below.

Player	1	2
Tally/Count of Wins		
Percentage of Wins		

   a. How many times did Player 1 win? _____ Write this as a proportion. _____

   b. How many times did Player 2 win? _____ Write this as a proportion. _____

Probabilities add to 1

3. Who won more often? Maybe this was only true for your group. Let's see how the rest of the class did. Write the number of wins for Player 1 in the table on the board.

   a. Find the total proportion of wins for Player 1 for the whole class.

   b. Find the total proportion of wins for Player 2 for the whole class.

Complements
$P(2) = 1 - P(\text{Not } 2)$

4. To determine the true probability of Player 1 winning, we should list out all possible rolls that we could get. Complete the table below to show all possible rolls.

	1	2	3	4	5	6
1	1,1	1,2	1,3	1,4	1,5	1,6
2	2,1	2,2	2,3	2,4	2,5	2,6
3	3,1	3,2	3,3	3,4	3,5	3,6
4	4,1	4,2	4,3	4,4	4,5	4,6
5	5,1	5,2	5,3	5,4	5,5	5,6
6	6,1	6,2	6,3	6,4	6,5	6,6

Sample Space: List of all possible outcomes

Theoretical Probability

   a. Use your table to find the probability of Player 1 winning.

   $16/36 = 4/9 = 0.\overline{44}$

   b. Which was closer to the probability you found in #4a, your group data or the whole class data? Why do you think that is?

   The class data. The more trials you do the closer you get to the true probability.

Name: _____ Hour:_____ Date: _____

Lesson 1.1– Probability Models and Rules

Important ideas:

LT#1 Probability

Long run frequency:
- Short term → unpredictable
- Long term → predictable

Theoretical Prob: what we expect to happen

Experimental Prob: what actually happens.

LT#2 Probability Rules

$P(\text{Event A}) = \frac{\#\text{ of ways A occurs}}{\text{Total \# possible outcomes}}$

Complement:

$P(\text{Not A}) = 1 - P(A)$

$P(A \text{ or } B) = P(A) + P(B)^*$

* For now...

$P(\text{At least 1}) = 1 - P(\text{None})$

LT#3 Probability Models

- List all possible outcomes
- All prob. are between 0 & 1.
- All prob. add up to 1.

Check Your Understanding:

What is your favorite color Skittle? Based on a very large sample, here is the distribution of color for Skittles that come in fun-sized bags.

Color	Green	Purple	Orange	Red	Yellow
Probability	0.171	0.214	0.204	???	0.214

1. Explain what the probability of 0.214 for purple means in this setting.

If we pick a skittle many, many times, we expect the proportion of skittles that are purple to be 0.214.

2. Find the probability for red.

$P(\text{Red}) = 1 - (.171 + .214 + .204 + .214)$
$= 1 - .803$
$= 0.197$

3. What is the probability that a randomly selected Skittle is green or purple?

$P(\text{Green or Purple}) = P(\text{Green}) + P(\text{Purple})$
$= 0.171 + 0.214$
$= 0.385$

4. What is the probability that a randomly selected Skittle is not yellow?

$P(\text{Not yellow}) = P(\text{yellow}^c) = 1 - 0.214$
$= 0.786$

Name: _____ Hour: _____ Date: _____

Can You Taco Tongue and Evil Eyebrow?

Some people believe that the ability to taco tongue and evil eyebrow is something that you are born with. Is this true? Are the two abilities somehow related?

1. Collect class data to fill in the following two-way table.

Answers vary

		Evil Eyebrow: No	Sort of	Yes	Totals
Taco Tongue	Yes	5	8	7	20
	No	7	2	1	10
	Totals	12	10	8	30

2. Suppose that we randomly choose a student from class. Find the following probabilities.

P(No Evil Eyebrow) = $12/30$

P(Sort of Evil Eyebrow) = $10/30$

$P(A) + P(B) = P(A \text{ or } B)$

P(No Evil Eyebrow OR Sort of Evil Eyebrow) = $\frac{12}{30} + \frac{10}{30} = \frac{22}{30}$ Mutually Exclusive

3. Suppose that we randomly choose a student from class. Find the following probabilities.

P(Yes Taco Tongue) = $\frac{20}{30}$

P(Yes Evil Eyebrow) = $\frac{8}{30}$

Not mutually exclusive

$P(A) + P(B) - P(A \text{ and } B) = P(A \text{ or } B)$

P(Yes Taco Tongue OR Yes Evil Eyebrow) = $\frac{20}{30} + \frac{8}{30} = \frac{28}{30} - \frac{7}{30} = \frac{21}{30}$

4. Suppose that we randomly choose a student from class. Find the following probabilities.

P(Yes Evil Eyebrow) = $\frac{8}{30}$

P(Yes Evil Eyebrow, given the person is Yes Taco Tongue) = $7/20$

P(Yes Evil Eyebrow, given the person is No Taco Tongue) = $1/10$

Conditional Probability

5. What do your results from #4 tell you about the ability to Taco Tongue and the ability to Evil Eyebrow?

If a person can do the Taco Tongue, they are more likely to be able to Evil Eyebrow than if they couldn't Taco Tongue.

Name: _____ Hour: _____ Date: _____

Lesson 1.2: Probability using Two-Way Tables

Important Ideas:

LT#1 Mutually Exclusive

Events are mutually exclusive if they cannot occur together.

Ex: Can't be a Junior and Senior at the same time.

LT#2 "OR" Problems

$P(A \text{ OR } B) = P(A) + P(B) - P(A \text{ and } B)$

"Overlap"

If events A and B are mutually exclusive then $P(A \text{ and } B) = 0$

LT#3 Conditional Probability

$P(A \mid B)$ = "Probability of A given B has occurred."

- Cover up the sections you no longer need then answer the question.

Check Your Understanding:

Students at a small high school in Michigan were asked, "Which subject area do you prefer: Math or English?" For each student, their grade level and response were recorded.

	Freshman	Sophomores	Juniors	Seniors	Total
Math	20	25	34	40	119
English	44	35	31	21	131
Total	64	60	65	61	250

(a) If a student is randomly selected, what is the probability that are a Senior who prefers Math?

$P(\text{Senior and Math}) = 40/250$

(b) If a student who prefers Math is randomly chosen, what is the probability they are a Freshman?

$P(\text{Freshman} \mid \text{math}) = \frac{20}{119}$

(c) If a Freshman student is randomly chosen, what is the probability they prefer Math?

$P(\text{math} \mid \text{Freshman}) = \frac{20}{64}$

2. Suppose a student from this high school is randomly selected, find the following:

(a) P(Math and Freshman) $\frac{20}{250}$

(b) P(English, given they are a Junior or Senior) $\frac{31+21}{65+61} = \frac{52}{126}$

(c) P(Sophomore or Senior) $\frac{60}{250} + \frac{61}{250} = \frac{121}{250}$

(d) P(Sophomore or Math) $\frac{60}{250} + \frac{119}{250} - \frac{25}{250} = \frac{154}{250}$

Name: _____ Hour: _____ Date: _____

How many hours do you watch Netflix? Day 2

In the last lesson we talked about how many hours of Netflix students watch on average. A group of 6 students reported the number of hours watched. The mean of the number of hours watched for the group was 5 hours.

1. If the mean number of hours watched was 5 hours, does that mean each of the 6 students **must** have each watched 5 hours? Why?

   NO, you can have an average of 5 without each number being a 5.

2. With your partner, make a possible set of 6 values that have a mean of 5 hours.

   Example: 4, 4, 5, 5, 6, 6

Range: Distance between minimum and maximum.

3. Compare your list with another pair of students. Find the range of each list. Who's list is more spread out?

   Example: 1, 3, 5, 6, 6, 9

   Your range: $6-4=2$ Their range: $9-1=8$

4. The actual set of values for these 6 students was 2, 3, 5, 6, 6, and 8. Calculate the range.

   Range $= 8-2=6$

STOP

5. Finding range is helpful but it does not tell us how spread out the data is between the minimum and maximum. How can we find the ***average distance of the values from the mean***?

Standard Deviation: Average distance from the mean.

   a. Find the mean of the data. mean = 5

   b. Find the distance of each piece of data from the mean. $(-3)^2$ $(-2)^2$ 0^2 1^2 1^2 3^2

   c. Square the differences to make them positive.

   d. Find the average. $\frac{9+4+0+1+1+9}{6}$

   e. Square root to undo the squares. $=\sqrt{4}$

6. Interpret the standard deviation. $=2$

   The number of hours watched by each person is, on average, 2 hours from the mean of 5 hours.

Name: _____ Hour: _____ Date: _____

Lesson 2.3 – Measures of Spread

Important ideas from the text:

LT#1 Range: Distance between the minimum and maximum data values.

Range = max - min

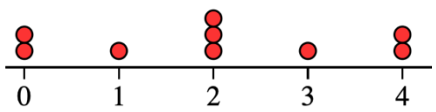
LT#2 Standard deviation: Average distance from the mean.

Ex:

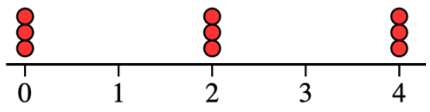
Low SD High SD

Check Your Understanding

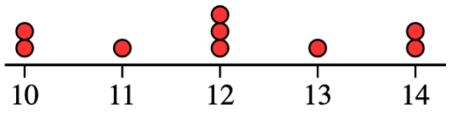
Use the dotplots for the given data sets to make comparisons. Explain.



Data Set A



Data Set B



Data Set C

1. Fill in the blanks with <, >, or = to create a true statement.

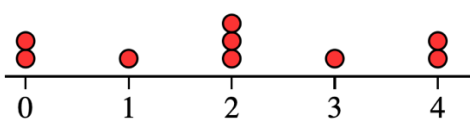
   a. Mean of Data Set A __<__ Mean of Data Set C

   b. Standard Deviation of Data Set A __<__ Standard Deviation of Data Set B

   c. Standard Deviation of Data Set A __=__ Standard Deviation of Data Set C

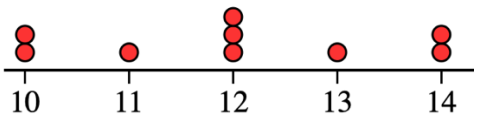
   d. Range of Data Set B __=__ Range of Data Set C

2. If we add a value at 12, how will that affect the standard deviation of this data set. Explain.



The standard deviation will increase because 12 is very far from the center so the average distance from the mean will increase.

3. If we add a value at 12, how will that affect the standard deviation of this data set. Explain.



The standard deviation will decrease because 12 is the center (mean) so it would be 0 away making the average distance decrease.

Name: _____ Hour: _____

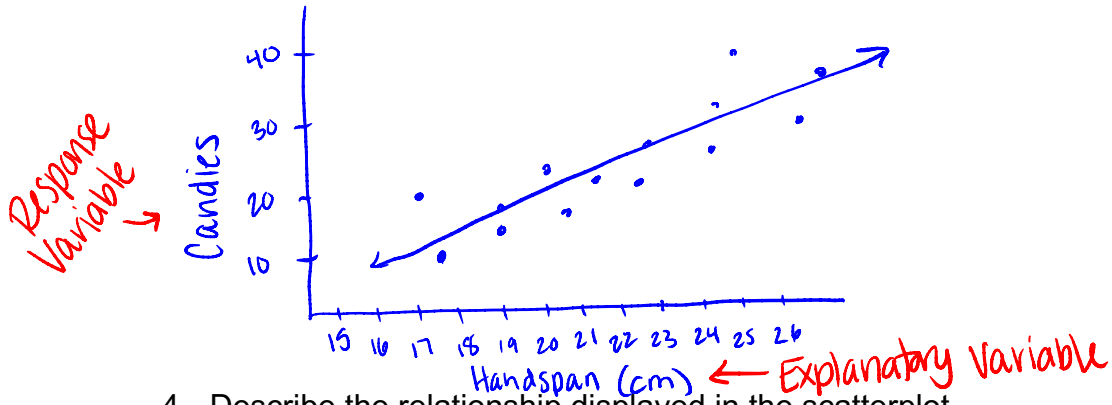
How much candy can you grab?

Can students with a larger handspan grab more candy than those with smaller handspans? Today we will investigate this question.

1. Measure the span of your dominant hand to the nearest half centimeter (cm). Handspan is the distance from the tip of the thumb to the tip of the pinkie finger on your fully stretched-out hand. Handspan = _____ cm

2. Use the same hand to grab as many candies as possible from the container. You must grab the candies with your fingers pointing down (no scooping!) and hold the candies for 2 seconds before counting them. After counting, put the candy back into the container. Record your data in the spreadsheet.

3. Use the applet at www.statsmedic.com/applets (2 Quantitative Variables) to make a scatterplot. Sketch below.



4. Describe the relationship displayed in the scatterplot.

As the handspan increases, the number of candies goes up. linearly.

5. Use the applet to find the line of best fit. Record it below.

"predicted y"

Example. Answers vary.

$\hat{y} = -45 + 3.5x$ Candies $= -45 + 3.5$(Handspan)

6. What is the slope of the line? Interpret the slope in context.

Predicted

3.5, with each additional cm of handspan, the number of candies grabbed goes up by 3.5 candies.

7. What is the y-intercept of the line? Interpret the y-intercept in context.

-45, if the handspan is 0 cm, the number of candies grabbed is -45.

Predicted

This has no meaning in this context.

STATS MEDIC

Name: _____ Hour: _____

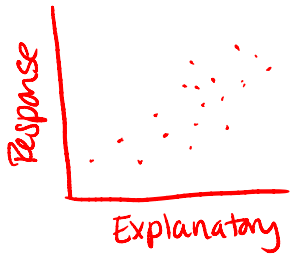
Lesson 3.1– Scatterplots and Line of Best Fit

Important ideas:

LT#1 Scatterplot

Explanatory → Used to predict. (input)

Response → Outcome, responds to explanatory (output)



Describe: Direction & Form

LT#2 Line of Best Fit

$\hat{y} = a + bx$

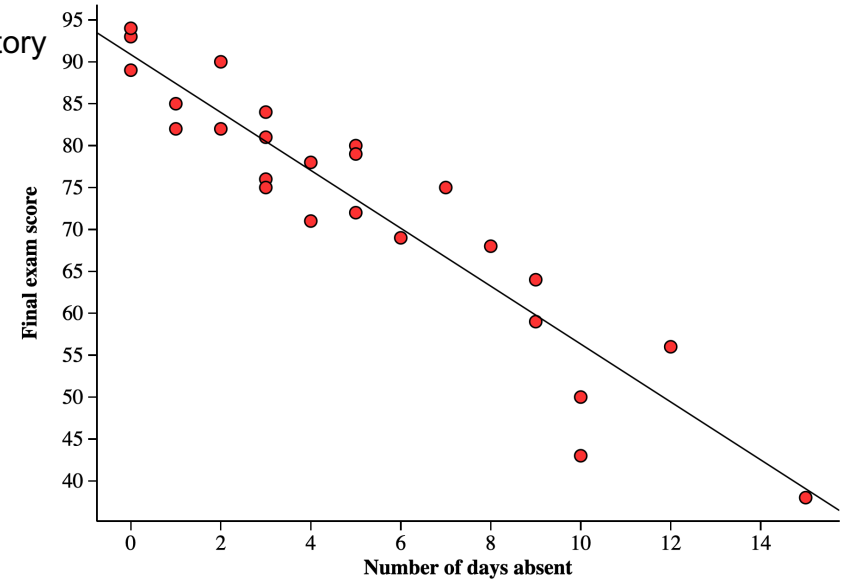
$\hat{y}$: predicted; a: y-int; b: slope

y-int: When x=0 context the predicted y-context is y-int.

slope: With each additional x-context the predicted y-context increases/decreases by slope.

Check Your Understanding

At the end of a semester, a math teacher wonders if student attendance has an impact on final exam scores. Here is a scatterplot that shows the number of days absent and final exam score for a class or 25 students.



1. Identify which variable is the explanatory and which is the response.

Explanatory: Number of days absent.

Response: Final Exam Score

2. Describe the relationship.

As the number of days absent increases, the final exam score decreases linearly.

3. The line of best fit is $\hat{y} = 90.9 - 3.5x$, where x = number of days absent and y = final exam score.

(a) Interpret the slope of the line of best fit.

For each additional day absent, the predicted final exam score decreases by 3.5.

(b) Interpret the y-intercept of the line of best fit.

When a student has 0 days absent, the predicted final exam score is 90.9.

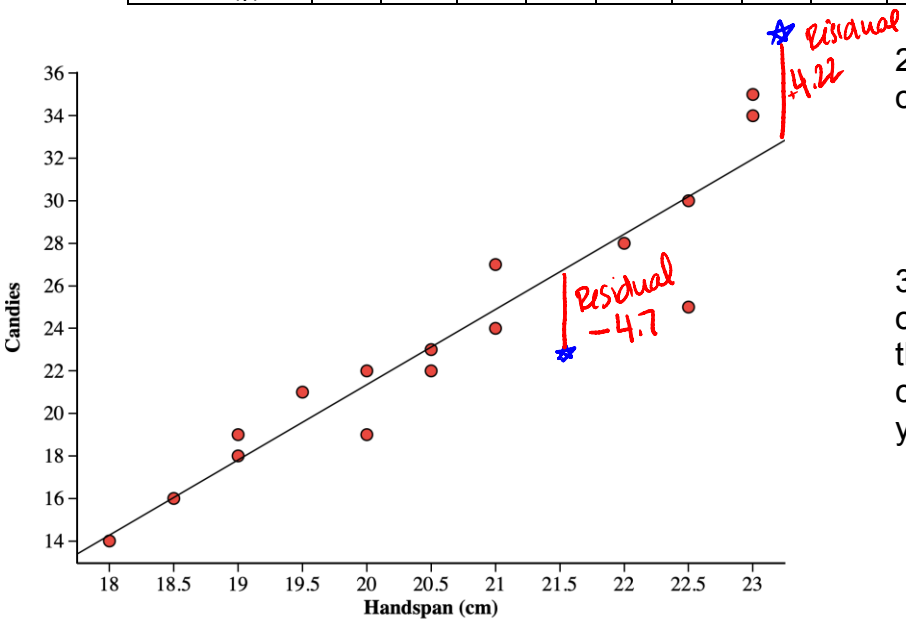
Name: _____ Hour: _____

How much candy can LeBron grab?

LeBron James has four NBA MVP Awards, three NBA Finals MVP Awards, and two Olympic Gold Medals. But how many candies can he grab?

1. One of the Algebra classes collected the following data:

Handspan (x)	18	18.5	19	19	19.5	20	20	20.5	20.5	21	21	22	22.5	22.5	23	23
Candies (y)	14	16	19	18	21	19	22	23	22	24	27	28	25	30	34	35



2. Use the applet to find the line of best fit. Record it below.

$\hat{y} = -49.41 + 3.54x$

Candies $= -49.41 + 3.54$ (Handspan)

3. LeBron James has a handspan of 23.5 cm. Use the equation of the line to predict how many candies Lebron can grab. Show your work?

$-49.41 + 3.54(23.5) = 33.78$ Candies

4. When LeBron visited East Kentwood High School, he attempted the candy grab and was able to grab 38 candies.

   a. Add this point to the scatterplot
   b. Was this value higher or lower than what you predicted?
   c. By how much? Show your work.

$38 - 33.78 = 4.22$ Candies

5. Your teacher will now measure their handspan. Handspan = 21.5

6. Predict how many candies your teacher can grab. Show your work.

$-49.41 + 3.54(21.5) = 26.7$ Candies

7. Your teacher will now attempt the candy grab. Number of candies = 22

8. Using the data for your teacher:

   a. Add this point to the scatterplot
   b. Was this value higher or lower than what you predicted?
   c. By how much? Show your work.

$26.7 - 22 = 4.7$ Candies

$22 - 26.7 = -4.7$

Residual = Actual − Predicted

Name: _____ Hour: _____

Lesson 3.2 – Predictions and Residuals

Important ideas:

LT#1 Predictions

$\hat{y} = a + bx$

Plug in value for x to get prediction for y.

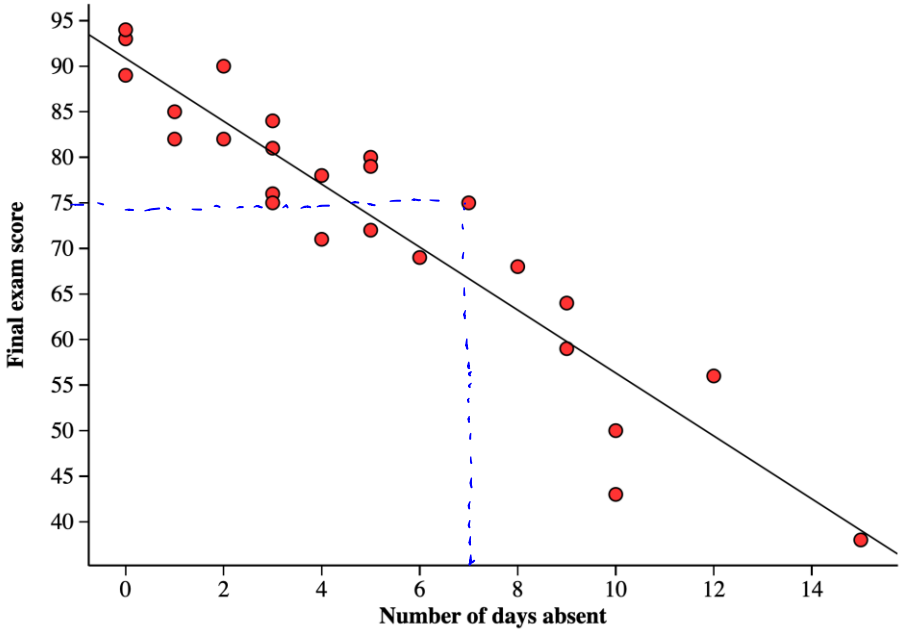
LT#2 Residuals

Residual = Actual - Predicted

- The actual y-context was residual higher / lower than predicted for x = #.
- If point is above the line of best fit then the residual is positive.

Check Your Understanding

At the end of a semester, a math teacher wonders if student attendance has an impact on final exam scores. Here is a scatterplot that shows the number of days absent and final exam score for a class or 25 students. The line of best fit is $\hat{y} = 90.9 - 3.5x$, where x = number of days absent and y = final exam score.



1. Find the predicted final exam score for a student 7 absences. Show your work.

   $\hat{y} = 90.9 - 3.5(7) = 66.4$

2. According to the scatterplot, what did the student with 7 absences actually score on the final exam?

   75

3. Calculate the residual for the student with 7 absences. Interpret the residual.

   Residual = 75 − 66.4 = 8.6 The actual final exam for the student with 7 absences is 8.6 points higher than the amount predicted for x = 7.

4. For how many students was the predication greater than the actual?

   13 students, there are 13 points below the line.

Name: _____ Hour: _____ Date: _____

Lesson 4.1: Does Beyoncé write her own lyrics?

1. Quickly circle a random sample of 5 words. Write them below. How many letters are in each word?

2. What is the average word length of your sample of 5 words? _____. = Sample mean

Sampling Variability

3. What was your partner's sample average? Was it the same as yours? Why?
   It's not the same. They chose 5 different words.

4. Do you think your sample average is exactly the same as the true average word length of all of the words in Crazy in Love? Why?
   Probably not. Every time I take sample, I'd get a different sample and average.

5. Write your **sample mean** on a sticker dot and add it to the class dotplot. What do you think the true mean word length is? Why?
   Answers vary. That's the center of the dots.

6. Did you really choose your words **randomly**? Find a new sample of 5 words using a random number generator. Put your new sample mean a sticker dot and add it to the new class dotplot. Sketch the class dotplot below.

Answers vary

7. How is the dotplot from #6 different than the dotplot for #5? Which do you think is a better estimator of the true mean word length of Crazy in Love?
   The dotplot in #6 has dots with lower averages.
   The dotplot in #6 is a better estimator because it was random.

8. What do you think the true mean word length is for Crazy in Love?
   Average = = Population mean
   True mean = 3.53

9. It is known that Beyoncé wrote the lyrics for all of the Destiny's child songs. The average word length for these songs is 3.64 letters. Based on your samples, do you have good evidence that Beyoncé did not write the lyrics for Crazy in Love. Explain.
   No, the true mean of Crazy in Love (3.53) is close to the mean of Destiny's child songs (3.64).

Name: _____ Hour: _____ Date: _____

Lesson 4.1 – Random Sampling

Important ideas:	LT#2 Sampling Variability	LT#3 Random Sampling
LT#1 Population vs. Sample • Population: entire group of individuals we want information about. • Sample: subset of individuals in the population from which we collect data.	• Each sample chosen produces different estimates. • A sample estimate is not expected to be exactly the same as the population.	• Using random process to choose sample so every group have an equal chance • Allows us to generalize to the population.

Check Your Understanding

A curious student wants to know the average height for all students in the school. She selects a random sample of 40 students, measures their heights, and calculates the man height to be 65.2 inches.

1. If she were to take a *different* random sample of 40 students, do you think she would get exactly the same result? Explain.

   No, every time we take a sample we get a different set of 40 students so we get a different mean.

2. Do you think her sample mean of 65.2 inches is exactly the same as the true mean height for all students at the school? Why?

   No. This is just one sample of students. We don't expect it to be exactly the same. Every sample gives different results.

3. Would it be reasonable for the student to make each of the following claims? Explain.

   a. *I am confident that the mean height for the **sample of students** is 65.2 inches.*

      Yes, the sample mean is the average for the sample of these students.

   b. *I am confident that the mean height of **students at my school** is close to 65.2 inches.*

      Yes, the sample mean should be close to the population mean.

   c. *I am confident that the mean height of **all high school students** is close to 65.2 inches.*

      No, we can only generalize to the students at this high school.