FINAL REVIEW
Probability and Statistics

Name Key Period_____ Date_____

LT 1.1 - I understand how to list the outcomes in a sample space for an event by making a list, creating a tree diagram, or by creating a table or grid and calculate simple probabilities using my sample space.

Use either a tree diagram or matrix to display all possible outcomes (the sample space) in the space provided then find the probabilities.

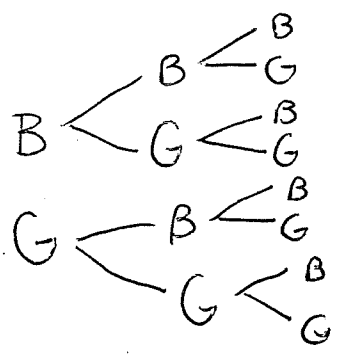
1. A family has three children,

   a. Draw a tree diagram to the right and list the outcomes. $2 \times 2 \times 2 = 8$ outcomes

   b. What is the probability that they are all boys? $P(\text{all Boys}) = 1/8$

   c. What is the probability of at least one girl? $1 - P(\text{none}) = 1 - \frac{1}{8} = \frac{7}{8}$

   d. What is the probability of two boys in a row? $\frac{2}{8}$ $(3/8)$

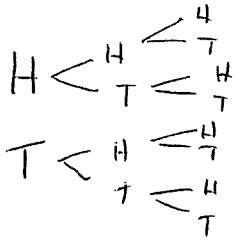


BBB ✓
BBG ✓
BGB
BGG
GBB ✓
GBG
GGB
GGG

2. A coin is flipped 3 times.

   a. Draw a tree diagram to the right and list the possible outcomes.

$2 \times 2 \times 2 = \text{outcomes}$



HHH
HHT
HTH
HTT
THH
THT
TTH
TTT

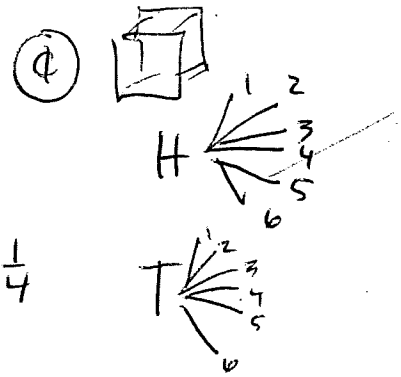
   b. Find the probability if getting exactly 2 heads in ANY order. $3/8$

   c. Find the probability of getting at least 2 tails in any order. meaning 2 or more

3. You are playing a game that involves flipping a coin and rolling a 6-sided die.

   a. Make a table below to list the possible outcomes.

{H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6}



	1 2 3 4 5
H	H1 H2 H3 H4
T	T1 T2 T3 T4 T

   b. What is the probability that you will roll an even number and get tails on the coin? $P(\text{Even and Tails}) = \frac{3}{12} = \frac{1}{4}$

$\frac{1}{2} \times \frac{3}{6} = \frac{3}{12}$

4. You roll 2 6-sided dice.

   a. Create a matrix (table) below to list the possible sums of the two dice.

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

(SUM)

   b. What is the probability that you will roll a sum of 8 or more? $15/36 = 5/12$

   c. What is the probability that you will roll an even sum? $\frac{18}{36} = 1/2$

Learning Target 1.2: I understand when and how to use the Fundamental Counting Principle, Combinations, or Permutations to find the number of outcomes for an event.

Evaluate each COMBINATION. If you used a calculator, be sure to record what you plugged into the calculator.

1. How many ways can a student select 5 questions from an exam containing nine questions?

$_9C_5$

2. How many ways can a committee of four people be selected from a group of ten people?

$_{10}C_4$

3. How many different ways can you select 2 meats, 1 veggie, and 1 cheese for a sandwich from a menu that offers 5 meats, 6 veggies, and 3 cheeses?

2 1 1 $\quad _5C_2 \times 6 \; 3 = 180$

4. There are 7 women and 5 men in a department.

a. How many ways can a committee of 4 be selected if it must contain 2 men and 2 women?

$_7C_2 \cdot {}_5C_2 = 210$

Evaluate each PERMUTATION. If you use a calculator, be sure to record what you plugged into the calculator.

5. How many different four-letter permutations can be formed from the letters in the word *decagon*?

$_7P_4 = 840$

6. An inspector must select three tests to perform in a certain order on a manufactured part. He has a choice of seven tests. How many ways can he perform three different tests?

$_7P_3 = 210$

7. How many ways can 6 people stand in line?

$6! = 720$

Decide which method (Permutation, Combination, Fundamental Counting Principle) to use to find the number of possible outcomes.

8. How many ways can are there to select three bracelets from a box containing ten bracelets if order does NOT matter?

$_{10}C_3 = 120$

9 In a board of directors composed of eight people, how many ways can a CEO, a vice president, and a treasurer be selected?

$_8P_3 = 336$

10. A license plate has 2 letters and 4 digits. If the first letter must be a "W" and no digits can be repeated, how many license plates can be produced?

1 $\times$ 26 10 9 8 7 $= 131,040$

11. How many ways can 3 cards be selected from a standard deck of 52 cards if the order does not matter?

$_{52}C_3 = 22,100$

12. How many ways can seven different types of soaps be displayed on a shelf in a grocery store?

$7! = 5,040$

13. How many license plates can be made using 2 letters and 4 digits if no digit may be used twice?

26 25 10 9 8 7 $\quad 3,407,040$

14. How many 4-digit PINs can be generated if the first number may not be a 1 or a 0 and no digit may be used twice?

8 9 8 7 $\quad 4,032$

15. How many 4-digit PINS can be generated if any digit may be used and repetitions are allowed?

$10 \times 10 \times 10 \times 10 = 10,000$

Learning Target 1.3 - I understand how to calculate the probability of compound events that are either dependent on each other or independent of each other.

1. A national survey found that 48% of all teenagers have an iPhone. You decide to survey 3 teenagers in your school at random. **Draw a tree diagram to illustrate the possible outcomes.**

P = 0.48

a. P(all 3 own an iPhone) = .48 x .48 x .48 = .110592

b. P(none own an iPhone) = .52 x .52 x .52 = .140608

c. P(at least one owns an iPhone) = P(none) = .140608 1 − P(none) = 1 − .140608 = .859392

Learning Target 2.1: I understand how to calculate the probability of compound events that are either dependent on each other or independent of each other.

1. Ana has an 80% free-throw average. What is the probability she will make the next two free-throws she takes?

.8 x .8 = .64

2. In a bag there are 15 golf balls. Suppose 5 are white, 7 are orange, and 3 are yellow. If you select 3 golf balls, replacing each one before selecting the next, what is the probability that you will select 3 orange in a row?

$\frac{7}{15} \times \frac{7}{15} \times \frac{7}{15} =$ (0.1016)

3. If a student guessed on five questions on a multiple choice exam, with each question having options A,B, and C, what is the probability that he or she would get them all right? $\frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} \times \frac{1}{3} \frac{1}{3} = 1/243 = .004$

4. In your locker you have ten mechanical pencils. Three of the pencils don't have any more lead. If you bring two pencils to class each day, what is the probability that you pick two of the pencils that don't have any lead?

$\frac{3}{10} \cdot \frac{2}{9} = \frac{6}{90} = 1/15$ or 0.0667...

5. There is a 75% chance for rain over the next three days. Find the probability that it does not rain at all during the next three days. What is the probability that is will rain at least one of the days?

Learning Target 2.2 - I understand when two or more events are mutually exclusive or not and how to use a Venn Diagram or an mathematical equation to calculate probabilities for those events.

1. Give an example of 2 outcomes from a situation that are mutually exclusive. Draw a King or Queen
Roll an odd or even
etc...

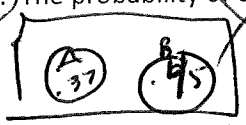
2. Give an example of 2 outcomes from a situation that are not mutually exclusive.
Draw a Red or Queen
Roll a number less than 4 or odd

3. Determine whether the following events are mutually exclusive.
   a. Roll a die: Get an even number, and get a number less than 3.
   Not (Joint at 2)
   b. Roll a die: Get a prime number (2, 3, 5), and get an odd number.
   Not mutually exclusive odd → 3, 5 Joint and prime
   c. Roll a die: Get a number greater than 3, and get a number less than 3.
   No outcomes in common Yes (disjoint)
   d. Select a student in your class: The student has blond hair, and the student has blue eyes.
   Not mutually exclusive (Joint blonde can have blue eyes)

4. P(A) = 0.56, P(B) = 0.23 and P(A and B) = 0.12. Find P(A or B).

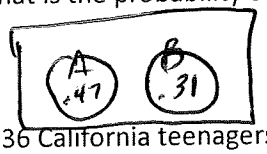
$P(A \text{ or } B) = P(A) + P(B) - P(A \cap B) = .56 + .23 - .12 = .67$

5. The probability of event A is 0.37. The probability of event B is 0.45. If the two events are mutually exclusive, what is the probability of A and B?



$P(A \cap B) = 0$

6. The probability of event A is 0.47. The probability of event B is 0.31. If the two events are mutually exclusive, what is the probability of A **and** B? What is the probability of A **or** B?



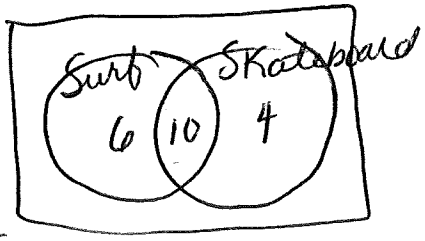
$P(A \cap B) = 0$ (Empty set)

$P(A \text{ or } B) = .47 + .31 = .78$

7. Given a random sample of 36 California teenagers, 16 of the California teenagers owned a surfboard, 14 owned a skateboard, and 10 owned both. If a California teenage is selected at random, find the probability that he or she owns a surfboard or a skateboard.

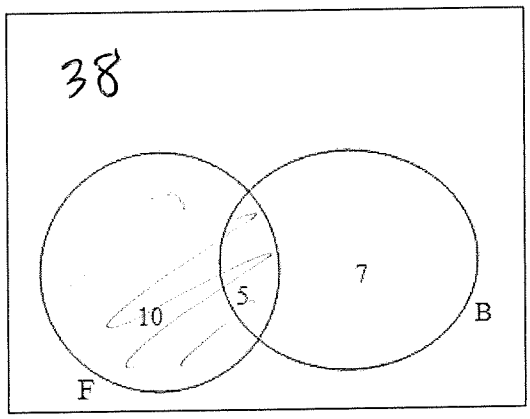
$P(\text{surf or skate}) =$

$P(A) + P(B) - P(A \cap B) \quad \frac{16}{36} + \frac{14}{36} - \frac{10}{36} = \frac{20}{36}$



$\approx 0.555\ldots$

A group of 60 students were asked if they played football (F) or basketball (B) The diagram below displays the results.



$60 - 10 - 5 - 7 = 38$

8. Using the Venn diagram, if a student is chosen at random find the following probability:

a. P(Football) $15/60$
b. P(basketball) $12/60$
c. P(Football and Basketball) $5/60$
d. P(Football or Basketball) $22/60$
e. P(Neither Football nor basketball) $38/60$

9. A single card is drawn from a deck. Find the probability of selecting the following:

a. 4 or a diamond $P(4 \text{ or } \diamondsuit) = P(4) + P(\diamondsuit) - P(4 \cap \diamondsuit) =$

b. club or a diamond $P(\clubsuit \text{ or } \diamondsuit) = \frac{13}{52} + \frac{13}{52} = \frac{26}{52} \left(\frac{1}{4}\right) \quad \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} = \frac{4}{13}$

c. jack or a black card

$P(\text{Jack or Black}) = \frac{4}{52} + \frac{26}{52} - \frac{2}{52} = \frac{28}{52} \text{ or } \frac{7}{13}$

Learning Target 2.3: I understand how to create and use a table to calculate probabilities and/or conditional probabilities.

1. Here are the counts (in thousands) of earned degrees in the United States in a recent year, classified by level and by the sex of the degree recipient.

	Bachelor's	Master's	Professional	Doctorate	
Female	616	194	30	16	856
Male	529	171	44	26	770
	1145	365	74	42	1626

a. If you choose a degree recipient at random, what is the probability that the person you choose is a female?

$P(\text{Female}) = 856/1626 = 0.526$

b. What is the probability that a randomly chosen degree recipient is a male?

$P(\text{Male}) = 770/1626 = .47$

c. What is the probability that a randomly chosen person is a female or has a master's degree?

$P(F \text{ or } M) = P(F) + P(\text{Masters}) - P(F \cap \text{Masters}) = \frac{1027}{1626}$

$\frac{856}{1626} + \frac{365}{1626} - \frac{194}{1626}$

d. What is the probability that a randomly chosen person has a professional degree and is a male?

$P(\text{M and Prof}) = 44/1626 = 0.027$

e. $P(\text{bachelor's degree}|\text{male}) =$

↑given Male only $\frac{529}{770} = 0.687$

f. $P(\text{female}|\text{bachelor's degree}) =$

↑only Bde degree $\frac{616}{1145} = 0.54$

Learning Target 3.1 - I understand how the Law of Large Numbers relates to expected value for games and other applications.

1. A scratch lottery ticket has the following probabilities of winning:

Amount Won	0	5	20
Probability	.95	.04	.01

$1 - .05 = .95$

(a) What is the missing probability for winning nothing? .95

.95

(b) What is the expected winning value for this game?

$E_X = 0(.95) + 5(.04) + 20(.01) = 0.40$

(c) If the tickets cost $1 each, how much are you winning or losing on average per play?

$0.4 - 1 = -0.60$ Loss of $0.60

2. A container contains ten $1 bills, five $2 bills, three $5 bills, one $10 bill, and one $100 bill.

a. Create a probability model.

$10 + 5 + 3 + 1 + 1$

Type of $ b.	1	2	5	10	100
P(X) b.	$10/20$	$5/20$	$3/20$	$1/20$	$1/20$

b. Find the **expected value** of the game.

$E_X = 1(10/20) + 2(5/20) + 5(3/20) + 10(1/20) + 100(1/20)$

$E_X = 7.25$

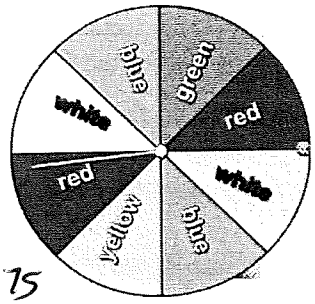
3. A spinner has 8 wedges: 1 green, 1 yellow, 2 white, 2 blue, and 2 red. Landing on green wins $20, yellow wins $15, blue wins $10, white wins $5 and red wins nothing.

a. Create a probability model

$	20	15	10	5	0
P(X)	1/8	1/8	2/8	2/8	2/8

b. What are the **expected** winnings for the player?

$E_X = 6.25$



c. The player is charged $10 to play.
How much will the player win or lose in the long run?

$6.25 - 10 = -3.75$ Lose $3.75 on average

4. Megan wants to play a carnival game that involves dropping a coin in a slot at the top of a board where pegs bounce the coin around so that it randomly drops into one of 7 spaces below, much like PLINKO on "The Price is Right". She quickly determines that the expected value for this game is $8.76. The games costs $10 to play. Explain to Megan whether or not she should play this game. Use the Law of Large Numbers to determine if the game is fair or not.

$8.76 - 10 = -1.24$ On average if Megan plays many PLINKO games she will lose 1.24 on each game (in the long run)

Learning Target 3.2: I understand how to use known probabilities to construct a probability model, carry out probability simulations, and make conclusions about long-run behavior.

Consider the following probability model used to describe the weather in Minnesota.

Television	Sunny	Cloudy	Rainy
Probability	0.65	0.15	0.20

Simulation
Sunny 4/10 = 40%
Cloudy 1/10 = 10%
Rainy 5/10 = 50%

(a) Give a valid assignment of digits for this model. Always start at 0 or 00. Sunny 00 to 64
Cloudy 65 to 79
Rainy 80 to 99

(b) Use the line below to simulate the mode of 10 different days of the weather. Be sure to clearly mark your results

Use Book page 325 line 111
81486 69487 60513 09297
00412 71238 27649 39950

2. Consider the following assignment of digits for a simulation regarding the type of juice purchased at a local shop.

S	C	R
1111	1	11111

digits 00, 01, 02, ..., 27 = Orange Juice

digits 28, 51, 52, ..., 60= Apple Juice

digits 61, 71, 72, ..., 99 = Cranberry Juice

In repeated simulations, what would you expect the proportion of Cranberry Juice purchases to approach?

Cranberry juice → 39%

99 - 61 (+1) →

3. A recent survey found that 73% of all adults prefer Caribou Coffee compared to Starbucks Coffee.

(a) Assign digits to represent a randomly choosing adult who prefer Caribou Coffee to Starbucks Coffee.

00 to 72 like Caribou Coffee 73 to 99 like Starbucks Coffee

(b) Simulate asking 5 people whether they prefer Caribou Coffee over Starbucks Coffee. Run this simulation 5 times and record your results.

Line 120 35476 56972 39421 65850 04266 35435 43742 11937
Line 121 71487 09984 29077 14863 61683 47052 62224 51025

Caribou | Starbuck
35 47 65
59 72

In the 5 simulations
22/25 = 88% Caribou Coffee

39, 47, 16, 58, 56, 74, 43 21 19, 71 48, 70, 99 84, 29 07, 71 48, 63

Learning Target 4.1: I understand the different ways how data is collected (SRS, census, observational study, experiment,Simple Random Sample, Stratified, Systematic,etc.) and can determine which method is appropriate in a given situation and can explain sampling method bias.

1. The administration wants to survey 4 math teachers about what they did in their classes to prepare students for the MCA test.

Aune, Matt 01
Carda, Penny 02
Griess, Tracey 03
Henderson, Matt 04
Johnson, Ernie 05
McArdle, Chad 06
Raatikka, Lori 07
Smith, Ben 08
Twerberg, Kate 09
Voss, Brandon 10

a) Assign Digits

b) Starting at line 104, select the four math teachers.

only 3 work

Line 104 52711 38889 93074 60227 40011 85848 48767 52573
Line 105 95592 94007 69971 91481 60779 53791 17297 59335

2. The principal at AndHS would like to see what the schools favorite lunch is, so he decides to take a sample size of 450 students and have them vote on their favorite lunch. What data method was being used?

SRS Simple Random Sample

3. At the bottom of all Cub Foods receipts is a website is listed. This website will lead the customers to an online survey, asking questions about their shopping trip. What sampling method was being used?

Voluntary Response

4. Your teacher wants to know if playing rock music during a test will help students do better on the test. In one class she plays rock music and in the other class she doesn't play any music. At the end she will compare her results. What data method is being used?

Random Comparitive experiment

5. All students apart of a fall sport at Andover were given a survey on how their season went, and if there were any issues that occurred during the season. What data method was being used?

Census

Learning Target 4: I calculate the margin of error and construct a 95% Confidence Interval

I am 95% confident the true proportion of employees who falsified is between .07 to .288

A company's human resources department investigates the application materials submitted by 84 applicants for an entry level position over a six month period. One finding is that 15 of the applicants falsified information in the application materials. Assume that the 84 applicants are a random sample from a larger pool of similar applicants.

a. Find the Margin of Error $MOE = \frac{1}{\sqrt{n}} = \frac{1}{\sqrt{84}} = 0.109$

b. Construct a 95% Confidence Interval $\hat{p} = 15/84 = .179$ $.179 \pm .109 \rightarrow .288$ to 0.07 .07 to .288

2. A random sample of 212 adoptive parents finds that 85 of them stated "No Preference" for their child's gender. Use this sample data to construct a 95% confidence interval estimate for the proportion of adoptive parents who state "No Preference." Explicitly identify the following:

$\hat{p} = \frac{85}{212} = .40$

a. Find the Margin of Error $\frac{1}{\sqrt{n}} = \frac{1}{\sqrt{212}} = 0.07$

b. Construct a 95% Confidence Interval $.40 \pm .07$ .33 to .47

I am 95% confident the true proportion of parents who adopt have No Preference in gender is between .33 to .47.

3. A major metropolitan newspaper selected a simple random sample of 1,600 readers from their list of 100,000 subscribers. They asked whether the paper should increase its coverage of local news. Forty percent (40%) of the sample wanted more local news. What is the 95% confidence interval for the proportion of readers who would like more coverage of local news?

a. .35 to .45
b. .375 to .425
c. .32 to .48
d. .39 to .41

$\frac{1}{\sqrt{1600}} = 0.025$ $.40 \pm 0.025$

Learning Target 4.3: I understand the effects of lurking variables on data and can design effective experiments that reduce the effects of potential lurking variables.

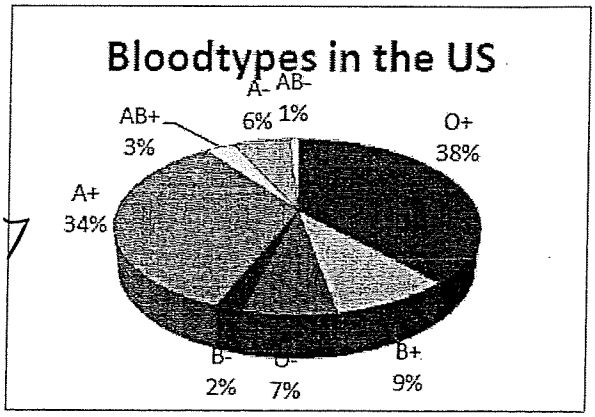
A group of 2000 people signed up for a study that measured the effects of a new weight lose medication. The study noted that the medication might work differently in men than in women. The study planned to use an established weight loss medication, the new medication, and a fake treatment that contained no medication.

1. What is the name for the fake treatment? Placebo
2. Identify the Response and Explanatory variables in this experiment. Explanatory → medication placebo; Response → weight loss
3. What would have to happen for this experiment to be called "double blind"? Neither the subject nor the doctor is informed on which treatment is being used
4. What type of experiment design should they make? Block or Randomized Comparative? Explain your answer.

Block on gender
Since this medication may work differently for men and women then the study should separate the genders into blocks

Learning Target 5.1: I understand how to choose, construct, and interpret an appropriate data display for categorical data and I can tell when displays are misleading or distorted.

The pie chart below shows the breakdown of blood types in the US. There are approximately 307,006,550 people in the US.



1. How many people have blood type A+?

.34 x 307,006,550 = 104,382,227

2. What is the angle measurement for B+?

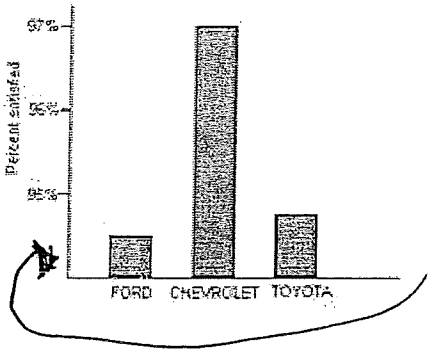
9% of 360° = 32.4° degrees

3. Ms. Olson is going back to school to get her Master's Degree in Education. This will raise her salary from $38,000 to $46,000. What is Ms. Olson's percent increase from Bachelor's Degree to Master's Degree?

46,000 - 38000

$$\frac{8000 \text{ difference}}{38,000 \text{ original}} = \text{about } 21\% \text{ increase}$$

4. The following bar graph gives the percent of owners of three brands of trucks who are satisfied with their truck.



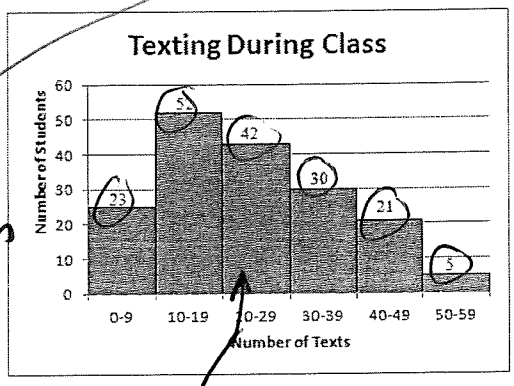
Misleading don't start at 0

From this graph we may legitimately conclude that:

(a) Owners of other brands of trucks are less satisfied than the owners of these three brands. False
(b) Chevrolet owners are substantially more satisfied than Ford or Toyota owners.
(c) There is very little difference in the satisfaction of owners for the three brands.
(d) Chevrolet has triple the value of owners that are satisfied.
(e) A pie chart would have been a better choice for displaying this data.

Learning Target 5.2: I understand how to choose, construct, and interpret an appropriate data display for numerical data; how to compare two displays; and tell when displays are misleading or distorted.

1.State the shape, estimate the median, and describe whether the mean will be higher, lower, or about the same as the median for the following historgrams.



Shape: Skewed right

Median: Between 20 to 29

Mean: will be higher than the median value

Mode: between (10-19)

Which is greater the mean or the median? Why?

mean is greater than the median because the shape is skewed right

n=173

$\frac{173}{2} \approx 87$ in median value

3. Describe the SOCS for the stem and leaf plot below.

0	9
1	225
2	013335889
3	00135679
4	02244478
5	0

Shape
Symmetric
Median 30.5
Spread 9 to 50
Center
Outliers appear to be no outliers

The stem and leaf plot below is very crowded. Split the stems and then describe the SOCS.

4.

Stem	Leaves
6	4 7 8 9
7	0 2 2 2 2 2 3 3 3 4 4 4 5 5 6 6 6 7
8	0 0 0 1 1 2 2 2

6	4
6	7 8 9
7	0 2 2 2 2 2 3 3 3 4 4 4
7	5 5 6 6 6 7
8	0 0 0 1 1 2 2 2
8	

The distribution of values is skewed to the left with a center at 74 The spread is from 64 to 82

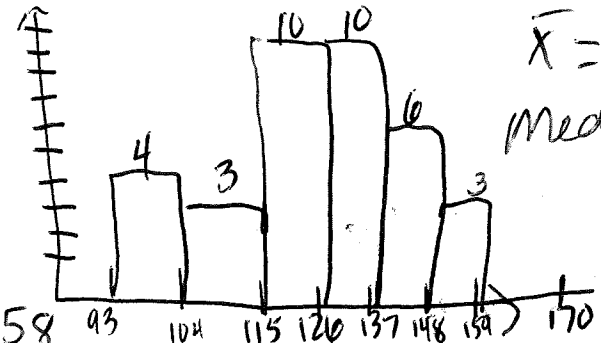
5. A supervisor wishes to check the miles her commuter busses are driven each day. Her findings are below:

138	107	136	128	148	118	99	142	129	115	123	133
123	103	121	128	122	144	126	135	107	125	98	117
153	141	126	139	134	115	93	127	118	158	143	108

93 to 158

a. On a separate sheet of graph paper, create a frequency distribution and then make a histogram. Be sure to include labels and titles.

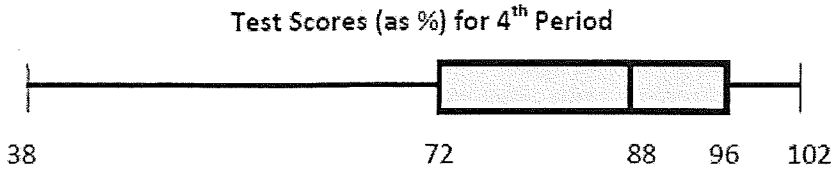
b. Describe the graph with SOCS.



$\bar{x} = 125.6$

Median 126

The distribution is roughly symmetric with no outliers. The median is 126 and the spread is from 93 to 158



5. What was the high score on the test? 102

6. What percent of the class scored above a 72? 75%

7. What was the median score on the test? 88

8. What percent of the class scored between 88 & 96? 25%

9. Do you think that this test was too hard for the students? Explain.
No, 50% of the students scored at 88 or higher 75% scored above 72.

10. What is the Shape of the distribution?
Skewed left

11. Would the mean be greater or less than the median?
mean would be less than the median

12. A company wanted to determine health care costs for their employees. A sample 0f 25 employees were interviewed and their medical expenses for the previous year were determined. The five number summary for the medical expenses were {$1000, $2300, $4600, $7800, $15,000}. Which of the following describes the shape of the distribution medical expenses?

a. Roughly symmetric
b. Skewed to the right
c. Skewed to the left
d. Bimodal
e. can't be determined

Min 1000 | Q_1 2300 | Med 4600 | Q_3 7800 | Max 15,000
(1300) (7200)
skewed right
longer whisker (tail)

13. Using the five number summary from question 12, SHOW the Calculation for finding OUTLIERS.

IQR x 1.5

$(Q_3 - Q_1) \times 1.5$

NO OUTLIERS present

$(7800 - 2300)(1.5) =$

upper limit 16050

$8250 + Q_3 = 7800 + 8250$

lower limit -5450

$Q_1 - 8250 =$

Target 5.3: I understand how to use mean, median, or mode as a measure of center, calculate it and describe how outliers and changes in the data will affect each measure

1. Becky needs to earn an average of 85% on her Stats tests in order to maintain her current GPA. If she has gotten the following scores so far, what does she need to get on her next test to maintain at least an 85% average?
   85, 78, 92, 84, 93

$\frac{85+78+92+84+93+x}{6} = 85$

$\frac{432+x}{6} = 85$

$432+x = 510$ $x = 78$

2. After 5 tests, Susan's test average in her History class is 88%. Her teacher has misplaced one of her tests. She knows four of her scores are 76%, 92%, 85%, and 89%. What is Susan's missing test score?

$\frac{76+92+85+89+x}{5} = 88$ $x = 98$

Target 6: I understand how to describe the relationship between two variables by constructing and/or interpreting a scatterplot or in terms of a correlation coefficient ("r") and describe the effects of outliers on the correlation.

I understand how to use and interpret a Least-Squares-Regression Equation for the line of best fit to make predictions within my data and I can describe the effects of outliers on the LSRL equation

For the remaining questions, label each as either positively associated, negatively associated, or as having little or no association.

1. As miles driven increases, the amount of gas in your tank decreases. negative association
2. As hours spent studying increases, so does your expected test grade. positive assoc.
3. Years of Education and Annual Income positive assc.
4. Age and height positive
5. Eye Color and IQ no
6. Amount of exercise and weight negative

7. Suppose the following information was collected, where X = diameter of tree trunk in inches, and Y = tree height in feet.

X	4	2	8	6	10	6
Y	8	4	18	22	30	8

If the LSRL equation is $y = -3.6 + 3.1x$, what is your estimate of the average height of all trees having a trunk diameter of 7 inches?

(a) 18.1 (b) 19.1 (c) 20.1 (d) 21.1 (e) 22.1

$y = -3.6 + 3.1(7)$

During a long storm, Dr. Doolittle measured the rain that fell at various time intervals. The data he obtained is given below.

Time (hours)	Rainfall (inches)
0.25	0.6
0.5	1.1
1	1.9
1.25	2.45
1.5	3.0
2	3.85

1. Make a scatter plot for the data (Sketch it below)

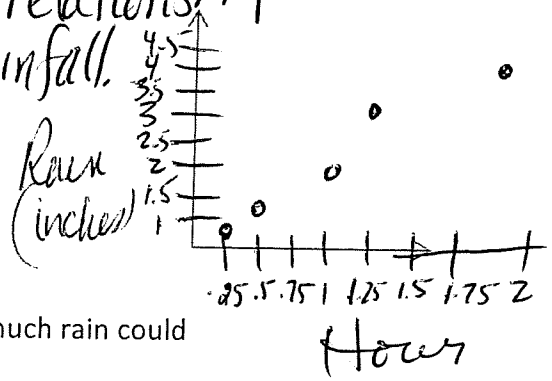
2. Which variable is the **explanatory variable** and which is the **response variable**?
Hour rainfall

3. Calculate r and the LSRL (line of best fit) using your calculator.

r = 0.9989 LSRL: $\hat{y} = 0.1285 + 1.866x$

4. Describe the relationship between the two variables and put the relationship into context. There is a strong positive linear relationship between the time and amount of rainfall.

5. Identify the **slope** of the equation. Interpret the slope in context.
For each additional hour the rain increases by 1.866 inches



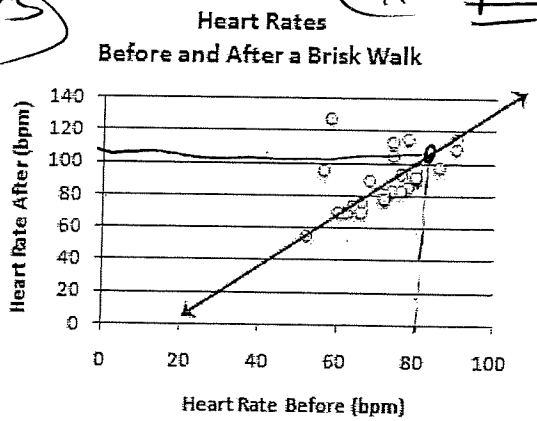
7. Using the LSRL: If the rainfall continued for a total of 4 hours, how much rain could Dr. Doolittle expect?
$\hat{y} = 0.1285 + 1.866(4)$
$\hat{y} = 7.5925$ inches

7. Using the LSRL: How much rain would fall after 24 hours? Is this a valid prediction?
$\hat{y} = 0.1285 + 1.866(24) = 44.9125$ inches
does not seem plausible (Extrapolated)

8. Using the LSRL: How many hours would it take to predict a rainfall of 3.5 inches?
$3.5 = 0.1285 + 1.866x$
$x = 1.8$ hours

9. Using the Least-Squares-Regression equation from the graph to the right predict the "after" heart rate for a particular students, the one whose "before" heart rate was 80 beats per minute.

a. 80 beats per minute
b. 100 beats per minute
c. 70 beats per minute
d. 120 beats per minute



Learning Target 7.1: I understand when data fits a normal distribution and how to display, interpret, and compare data on a normal curve.

1. Nate got a 75% on his last History test and was in the 66th percentile for his class. Explain the difference between percent and percentile. Nate earned 75 percent correct on the exam putting him with a score that's better than 66% of his class

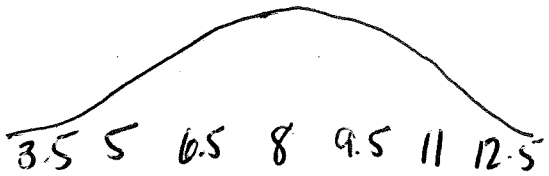
2. Lindsey got a 79% on her last math test. The mean score of the class was 67% and the standard deviation was 3.1%. What is her z-score?

$$z = \frac{x-\mu}{\sigma} = \frac{79-67}{3.1} = 3.87$$

Use the 68-95-99.7 Rule to answer each of the following questions.

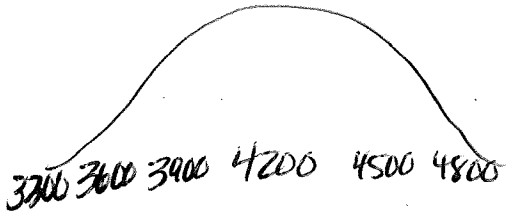
3. State the 68-95-99.7 Rule below. 68 → 1 Standard dev. from mean
95 → 2 standard dev. from the mean
99.7 → 3 Standard dev. from the mean

4. Sketch a normal curve with 3 deviations marked each direction, for data with a mean of 8 and a standard deviation of 1.5.



Use the following information to answer questions 3-6. The number of cells in a sample of kidney tissue is normally distributed with a mean of 4200 and a standard deviation of 300 to answer the following questions:

5. Sketch the normal curve for this data below.



6. What proportion of samples would have 4800 cells or more? 0.025 or 2.5%

7. What proportion of samples would have less than 3200 cells? $P(x<3200) = .000429$ .043% $z = \frac{x-\mu}{\sigma} = \frac{3200-4200}{300} = -3.33$

8. What proportion of samples would have from 3700 to 4400 cells?

normalcdf(3700, 4400, 4200, 300)

0.6997

9. Sam took a history test where the mean was 74, standard deviation was 5, and she scored an 87. In Spanish she took a test where the mean was 78, standard deviation was 6.5, and she scored an 82. Which test did she do better on? Use mathematics to justify your answer.

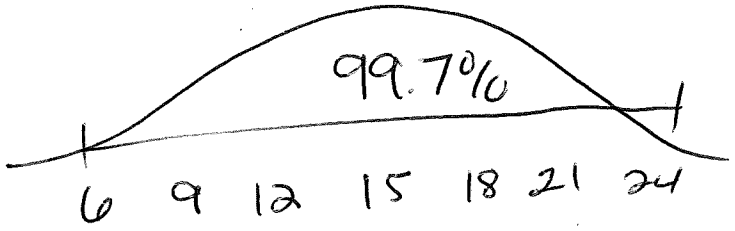
History Sam (74, 5)

$z = \frac{87-74}{5} = 2.6$

Spanish (78, 6.5)

$z = \frac{82-78}{6.5} = 0.615$

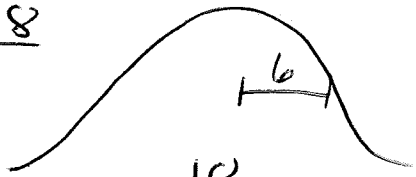
10. For a normal distribution with mean 15 and standard deviation 3, approximately what percent of the observations will be between 6 and 24?



11. Scores on the American College Testing (ACT) college entrance exam follow the normal distribution with mean 18 and standard deviation 6.

a. What is the probability that a person will score higher than 24? $z = \frac{24-18}{6}$

0.159 normalcdf(24, ∞, 18, 6) = 0.159



b. What is the probability that a person will get a 30 or better?

0.02 normalcdf(30, ∞, 18, 6) $z = \frac{30-18}{6}$

c. What percent of test takers will score between 12 and 30?

.819 normalcdf(12, 30, 18, 6) $z_{12} = \frac{12-18}{6} = -1$ $z_{30} = \frac{30-18}{6} = \frac{12}{6} = 2$

d. What percent of test takers will score higher than 18?

0.5 50%

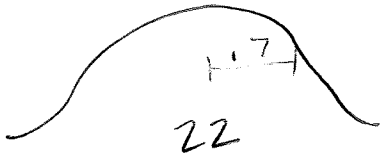
$z = \frac{18-18}{6} = \frac{0}{6}$ $z = 0$ at mean 50%

e. What must be a student's ACT score to be in the top 5%?

invnorm(.95, 18, 6)

$x = 27.87 \approx$ 28 on ACT

12. The weight of 18 month olds is normally distributed with a mean of 22 lbs and a standard deviation of 0.7 lbs. Mrs. Dorsing's son weighed 23.5 lbs at his 18 month check up. What percentile is he in for his weight?

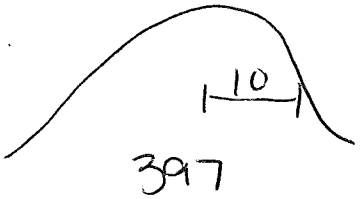


$z = \frac{23.5-22}{0.7} = 2.14$

98th percentile

13. Joe Mauer's average home run distance last year was 397 feet with a standard deviation of 10 feet.

a. What percent of his home runs were longer than 420 feet?



$z = \frac{420-397}{10} = 2.3$ $P(x > 420) = 0.01$

b. What percent of Mauer's home runs were less than 380 feet?

$z = \frac{380-397}{10} = -1.7$ $P(x < 380) = 0.045$

c. What percent of Mauer's home runs were between 380 and 420 feet?

normalcdf(380, 420, 397, 10) = 0.945

d. What home run distance is at the 80th percentile?

$z = \frac{x-\mu}{\sigma}$ 80th percentile is $z = 0.84$

$.84 = \frac{x-397}{10}$

$x = 405.4$ feet