3-1 Exercise **MATH 241** **THOMPSON**

1. The U.S. Department of Housing and Urban Development (HUD) uses the median to report the average price of a home in the United States. Why do you think HUD uses the median?

Choose the correct answer below.

- A. HUD uses the median because the data are symmetrical.
- B. HUD uses the median because the data are skewed left.
- C. HUD uses the median because the data are bimodal.
- ✔ D. HUD uses the median because the data are skewed right.

2. A histogram of a set of data indicates that the distribution of the data is skewed right. Which measure of central tendency will likely be larger, the mean or the median? Why?

Choose the correct answer below.

- A. The median will likely be larger because the extreme values in the right tail tend to pull the median in the direction of the tail.
- B. The mean will likely be larger because the extreme values in the left tail tend to pull the mean in the opposite direction of the tail.
- C. The median will likely be larger because the extreme values in the left tail tend to pull the median in the opposite direction of the tail.
- ✔ D. The mean will likely be larger because the extreme values in the right tail tend to pull the mean in the direction of the tail.

3. True or False: A data set will always have exactly one mode.

Choose the correct answer below.

- True
- ✔ False

The **mode** of a variable is **the most frequent** observation of the variable that occurs in the data set. A set of data can have no mode, one mode, or more than one mode.

4. Find the population mean or sample mean as indicated.

Sample: 23, 8, 3, 5, 11

$\bar{x}$ = =10

μ if is a populatuon

STATCRUNCH (MEAN)

STAT- SUMMARY STATS-COLUMNS
highlight var1
STATISTICS – mean

COMPUTE

The arithmetic mean of a variable is computed by determining the sum of all the values of the variable in the data set, divided by the number of observations. The population arithmetic mean, μ, is computed using all the individuals in a population. The sample arithmetic mean, $\bar{x}$, is computed using sample data.

5. For a large sporting event the broadcasters sold 63 ad slots for a total revenue of $136 million. What was the mean price per ad slot?

The mean price per ad slot was $ 2.2 million.
(Round to one decimal place as needed.)

$\frac{136}{63}$

6 The median for the given set of six ordered data values is 27.5.

~~9 12~~ 23 _ ~~41 49~~

Median $\frac{x+23}{2} = 27.5$ solve for x:

x+23 = 2(27.5)

x + 23 = 55

x = 32

What is the missing value?

The missing value is 32 .

7.

STATCRUNCH

STAT- SUMMARY STATS-COLUMNS
highlight var1
STATISTICS – hold Ctrl and click on
mean, media then mode

An insurance company crashed four cars of the same model at 5 miles per hour. The costs of repair for each of the four crashes were $447, $448, $459, and $206. Compute the mean, median, and mode cost of repair.

Compute the mean cost of repair. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. The mean cost of repair is $ 390 . (Round to the nearest cent as needed.)
B. The mean does not exist.

Compute the median cost of repair. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. The median cost of repair is $ 447.5 . (Round to the nearest cent as needed.)
B. The median does not exist.

Compute the mode cost of repair. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. The mode cost of repair is $. (Round to the nearest cent as needed.)
B. The mode does not exist.

8. The following data represent the amount of time (in minutes) a random sample of eight students took to complete the online portion of an exam in a particular statistics course. Compute the mean, median, and mode time.

64.2, 72.1, 86.9, 104.3, 128.4, 103.1, 94.7, 117.6

Compute the mean exam time. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. The mean exam time is 96.41 .

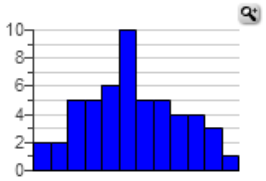
Compute the median exam time. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. The median exam time is 98.9
(Round to two decimal places as needed.)

Compute the mode exam time. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

B. The mode does not exist.

9. For the histogram on the right determine whether the mean is greater than, less than, or approximately equal to the median. Justify your answer.



Which of the following is correct?

A. $\bar{x} = M$ because the histogram is skewed left.

B. $\bar{x} > M$ because the histogram is symmetric.

C. $\bar{x} < M$ because the histogram is skewed left.

D. $\bar{x} < M$ because the histogram is skewed right.

E. $\bar{x} > M$ because the histogram is skewed right.

F. $\bar{x} = M$ because the histogram is symmetric.

x<M when skewed left x>M when skewed right

10. The acidity or alkalinity of a solution is measured using pH. A pH less than 7 is acidic; a pH greater than 7 is alkaline. The accompanying data represent the pH in samples of bottled water and tap water. Complete parts (a) and (b).

Click the icon to view the data table.

(a) Determine the mean, median, and mode pH for each type of water. Comment on the differences between the two water types.

Select the correct choice below and fill in any answer boxes in your choice.

A. For tap water, the mean pH is 7.547.
(Round to three decimal places as needed.)

B. The mean does not exist.

STATCRUNCH (MEAN)

STAT- SUMMARY STATS-COLUMNS
hold CTRL and highlight both columns
hold CTRL and highlight – mean, media and mode

Compute!

Select the correct choice below and fill in any answer boxes in your choice.

A. For tap water, the median pH is 7.505.
(Round to three decimal places as needed.)

B. The median does not exist.

Select the correct choice below and fill in any answer boxes in your choice.

A. For tap water, the mode pH is 7.490.
(Round to three decimal places as needed. Use a comma to separa as needed.)

B. There is no mode.

Tap	Bottled	var3	var4	var5
7.64	5.15			
7.45	5.09			
7.49	5.33			
7.52	5.2			
7.68	4.78			
7.93	5.23			
7.45	5.4			
7.34	5.33			
7.56	5.13			
7.49	5.33			
7.52	5.21			
7.49	5.24			

Options

Summary statistics:

Column	Mean	Median	Mode
Tap	7.5466667	7.505	7.49
Bottled	5.2016667	5.22	5.33

Select the correct choice below and fill in any answer boxes in your choice.

A. For bottled water, the mean pH is 5.202.
(Round to three decimal places as needed.)

B. The mean does not exist.

Select the correct choice below and fill in any answer boxes in your choice.

A. For bottled water, the median pH is 5.220.
(Round to three decimal places as needed.)

B. The median does not exist.

Select the correct choice below and fill in any answer boxes in your choice.

A. For bottled water, the mode pH is 5.330.
(Round to three decimal places as needed. Use a comma to separate answers as needed.)

B. There is no mode.

Let $\bar{x}_T$ represent the sample mean pH of the tap water. Let $\bar{x}_B$ represent the sample mean pH of the bottled water. Determine the value of $\bar{x}_T - \bar{x}_B$, the sample mean difference in pH of the two types of water.

mean for TAP is 7.547 mean for BOTTLED is 5.202

$\bar{x}_T - \bar{x}_B$ = 2.345 7.547 – 5.202 = 2.345
(Round to three decimal places as needed.)

What can be said about the differences between the two types of water?

A. Bottled water is more acidic than tap water.

(b) Suppose the pH of 7.34 in tap water was incorrectly recorded as 3.74. How does this affect the mean? the median? What property of the median does this illustrate?

CLICK Options Edit then change 7.34 to 3.74 STAT- SUMMARY STATS-COLUMNS- TAP find mean

If the pH of 7.34 in tap water was incorrectly recorded as 3.74, the mean pH would be 7.247.
(Round to three decimal places as needed.)

If the pH of 7.34 in tap water was incorrectly recorded as 3.74, the median pH would be 7.505.
(Round to three decimal places as needed.)

What property of the median does this illustrate?

D. It illustrates the resistance of the median.

11. The following data represent the pulse rates (beats per minute) of nine students enrolled in a statistics course. Treat the nine students as a population. Complete parts (a) through (c).

Student	**Pulse**
Perpectual Bempah	68
Megan Brooks	83
Jeff Honeycutt	83
Clarice Jefferson	63
Crystal Kurtenbach	75
Janette Lantka	88
Kevin McCarthy	89
Tammy Ohm	79
Kathy Wojdya	72

STATCRUNCH

STAT- SUMMARY STATS-COLUMNS
highlight var1
STATISTICS – mean

Compute!

(a) Determine the population mean pulse.

The population mean pulse is approximately 77.8 beats per minute.
(Round to one decimal place as needed.)

(b) Determine the sample mean pulse of the following two simple random samples of size 3. Make two new columns for the two samples

Sample 1 is var3 and Sample 2 is var4

Sample 1: {Clarice, Megan, Crystal}
Sample 2: {Jeff, Tammy, Janette}

Columns – mean for var3 & var4

Student	Pulse	var3	var4
Perpectual Bem	68	63	83
Megan Brooks	83	83	79
Jeff Honeycutt	83	75	88
Clarice Jefferso	63		
Crystal Kurtenb	75		
Janette Lantka	88		
Kevin McCarth	89		
Tammy Ohm	79		
Kathy Wojdya	72		

The mean pulse of sample 1 is approximately 73.7 beats per minute.
(Round to one decimal place as needed.)

The mean pulse of sample 2, is approximately 83.3 beats per minute.
(Round to one decimal place as needed.)

(c) Determine if the means of samples 1 and 2 overestimate, underestimate, or are equal to the population mean.

The mean pulse rate of sample 1 underestimates the population mean.

The mean pulse rate of sample 2 overestimates the population mean.

Compare the means with each sample to the population mean *answers may vary

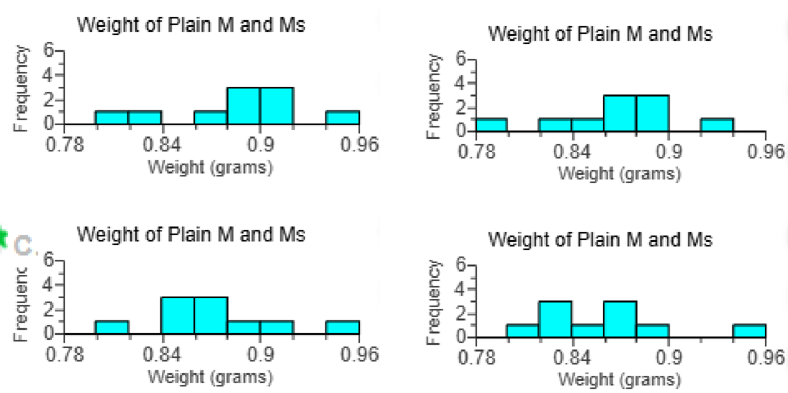
12. The accompanying data represent the weights (in grams) of a simple random sample of 10 M&M plain candies. Determine the shape of the distribution of weights of M&Ms by drawing a frequency histogram. Find the mean and median. Which measure of central tendency better describes the weight of a plain M&M?

Click the icon to view the candy weight data.

STATCRUNCH

GRAPH – HISTOGRAM

Compute!



STATCRUNCH

STAT- SUMMARY STATS-COLUMNS
highlight var1
hold CTRL for mean and median

Compute!

The mean is $\bar{x}$ = 0.871 gram(s).
(Type an integer or a decimal. Do not round.)

The median is M = 0.865 gram(s).
(Type an integer or a decimal. Do not round.)

If the distribution is **symmetrical**, the **mean** is the best measure of central tendency.
If the distribution is **skewed** either positively or negatively, the **median** is more accurate

Which measure of central tendency better describes the weight of a plain M&M?

The mean better describes the weight because the distribution is symmetric.

13) A random sample of 15 college students were asked "How many hours per week typically do you work outside the home?" Their responses are shown on the right.

Determine the shape of the distribution of hours worked by drawing a frequency histogram and computing the mean and median. Which measure of central tendency better describes hours worked?

5	32	3
7	5	13
19	12	18
18	12	25
11	9	14

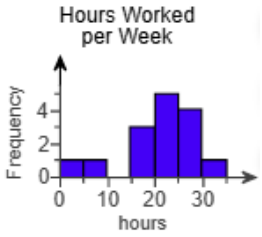
STATCRUNCH

GRAPH – HISTOGRAM

Compute!

A. 

B. 

C. 

skewed right

STATCRUNCH

STAT- SUMMARY STATS-COLUMNS
highlight var1
hold CTRL for mean and median

Compute!

The mean number of hours worked by college students outside the home is approximately 13.533 hours.
(Type an integer or decimal rounded to three decimal places as needed.)

The median number of hours worked by college students outside the home is 12 hours.

Which measure of central tendency better describes hours worked?

median

If the distribution is **symmetrical**, the **mean** is the best measure of central tendency.
If the distribution is **skewed** either positively or negatively, the **median** is more accurate

14. SUMMARY STATS – COLUMNS for each sample

Each of the following three data sets represents the IQ scores of a random sample of adults. IQ scores are known to have a mean and median of 100.

Full data set

Sample of Size 5					
108	99	91	112	91	

Sample of Size 12					
108	99	91	112	91	98
104	115	115	118	91	103

Sample of Size 30					
108	99	91	112	91	98
104	115	115	118	91	103
101	95	119	115	107	116
102	109	102	106	96	107
94	107	117	119	94	107

For each data set, compute the mean and median.

What is the mean of the sample of size 5?

100.2
(Type an integer or decimal rounded to one decimal place as needed.)

What is the mean of the sample of size 12?

(Type an integer or decimal rounded to one decimal place as needed.)

For each sample size, the mean increases, and the median remains mostly constant.

change 108 to 180 in all columns and find mean and median again

As the sample size increases, the impact of the misrecorded data on the mean decreases.

15. A professor has recorded exam grades for 40 students in his class, but one of the grades is no longer readable. If the mean score on the exam was 82 and the mean of the 39 readable scores is 84, what is the value of the unreadable score?

$40 \cdot 82 - 39 \cdot 84 = \mathbf{4}$

16. A man surveyed a sample of 36 high school students and asked, "How many days in the past week have you consumed an alcoholic beverage?" The results of the survey are shown to the right. Use these results to answer parts (a) through (f).

0	1	0	0	0	0
1	0	0	0	0	4
1	5	1	2	0	1
1	0	0	1	0	1
2	0	1	0	1	0
0	1	1	2	3	2

STATCRUNCH

GRAPH – HISTOGRAM

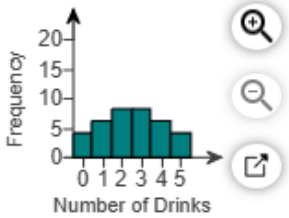
Compute!

(a) Is this data discrete or continuous?

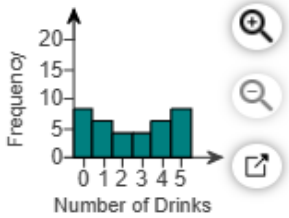
Discrete Because they are countable numbers

(b) Draw a histogram of the data and describe its shape. Choose the histogram below that correctly depicts the given data.

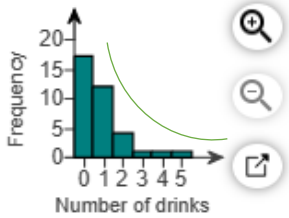
A.



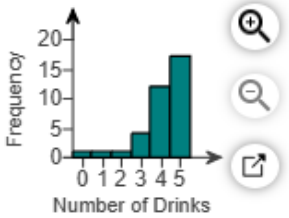
B.



C.



D.



C. The distribution is skewed right.

B. The mean should be substantially larger than the median.

Mean should be substantially larger than the median if the graph is skewed right.
Mean should be substantially smaller than the median if the graph is skewed left

(d) Compute the mean and median. What does this tell you?

STATCRUNCH

STAT- SUMMARY STATS-COLUMNS
highlight var1
hold CTRL for mean, median, mode

Compute!

The mean is 0.89.
(Type an integer or decimal rounded to two decimal places as needed.)

The median is 1.00.
(Type an integer or decimal rounded to two decimal places as needed.)

What do the computed mean and median tell you? Fill in the blanks below. (Use a 25% difference as the criterion for a "substantial" difference between the mean and median.)

The prediction was incorrect because the mean is less than the median in this distribution.

(e) Determine the mode.

The mode is 0.00.
(Type an integer or decimal rounded to two decimal places as needed.)

(f) Do you believe that the survey suffers from bias? If so, what type and why?

A. Yes, the survey suffers from response bias because it would be difficult to achieve truthful responses to this type of question unless the identity of the respondents is anonymous.