Name _____

Chapter 3 Averages and Variation

Section 3.1 Measures of Central Tendency: Mode, Median, and Mean

Objective: In this lesson you learned how to compute, interpret, and explain mean, median, and mode.

Important Vocabulary					
Average	Mode	Median	Mean	Trimmed Mean	Weighted Average

Important Notation		
$\sum x$	$\bar{x}$	μ

What is an average used to describe?

I. Mode

The **mode:**

What are some disadvantages to using mode?

What are some advantanges to using mode?

Focus Points:

- Compute mean, median, and mode from raw data
- Interpret what mean, median, and mode tell you
- Explain how mean, median, and mode can be affected by extreme data values
- What is a trimmed mean? How do you compute it?

II. Median

The **median:**

How to find the median

1.

2.

3.

What are some advantages to using median?

III. Mean

The **mean:**

What does the following notation mean and when is it used?

- $\sum x$

- $\bar{x}$

- μ

How to find the mean

1.

2.

What do averages tell us?

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-
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What is a major disadvantage to using mean?

What is a *trimmed mean*?

How to compute a 5% trimmed mean

1.
2.
3.

In general, when a data distribution is mound-shaped symmetrical, the values for mean, median, and mode are:

IV. Weighted Average

Focus Point:

- Compute a weighted average

$$Weighted\ Average =$$

Section 3.1 Examples – Measures of Central Tendency: Mode, Median, Mean

(1) Belleview College must make a report to the budget committee about the average credit hour load a full-time student carries. (A 12-hour credit load is the minimum requirement for full-time students. For the same tuition, students may take up to 20 credit hours.) A random sample of 40 students yielded the following information (in credit hours):

17	12	14	17	13	16	18	20	13	12
12	17	16	15	14	12	12	13	17	14
15	12	15	16	12	18	20	19	12	15
18	14	16	17	15	19	12	13	12	15

a. Organize the data from smallest to largest number of credit hours.

____	____	____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____	____	____
____	____	____	____	____	____	____	____	____	____

b. Since there are a(n) _____ (odd, even) number of values, we add the two middle values and divide by 2 to get the median. What is the median credit hour load?

c. What is the mode of this distribution? Is it different from the median?

d. If the budget committee is going to fund the college according to the average student credit hour load (more money for higher loads), which of these two averages do you think the college will report?

(2) *Barron's Profiles of American Colleges,* 19^{th} Edition, lists average class size for introductory lecture courses at each of the profiled institutions. A sample of 20 colleges and universities in California showed class sizes for introductory lecture courses to be

14	20	20	20	20	23	25	30	30	30
35	35	35	40	40	42	50	50	80	80

a. Compute the mean for the entire sample.

b. Compute a 5% trimmed mean for the sample.

c. Find the median of the original data set.

d. Find the median of the 5% trimmed data set. Does the median change when you trim the data?

e. Is the trimmed mean or the original mean closer to the median?

(3) Suppose your midterm test score is 83 and your final exam score is 95. Using weights of 40% for the midterm and 60% for the final exam, compute the weighted average of your scores. If the minimum average for an A is 90, will you earn an A?

Section 3.2 Measure of Variation

Objective: In this lesson you learned to find range, variance, and standard deviation; to compute the coefficient of variation; and to apply Chebyshev's theorem to raw data.

Important Vocabulary

Range	Variance	Standard Deviation	Sum of Squares	Sample Variance
Sample Standard Deviation		Population mean		Population Variance
Population Standard Deviation		Coefficient of Variation		Chebyshev's Theorem

Important Notation

s^2	s	μ	σ^2	σ	CV

The **range** is:

Focus Point:
- Find the range, variance, and standard deviation

I. Variance and Standard Deviation

What are two measures that will measure the distribution or spread of data around an expected value (either $\bar{x}$ or μ)?

Quantity	Formula	Description
Mean	**Formula**	**Description**

Sum of Squares	Formula	Description

Sample Variance	Formula	Description

Sample Standard Deviation	Formula	Description

FORMULAS - SAMPLE STATISTICS		
	Sample Variance	Sample Standard Deviation
Defining		
Computation		

What do measures of variation tell us?

-
-
-

Population Parameters

II. Coefficient of Variation

What is a disadvantage of the standard deviation as a unit of measure?

How is the *coefficient of variation* expressed?

Focus Point:
- Compute the coefficient of variation from raw data. Why is the coefficient of variation important?

If $\bar{x}$ and s represent:

III. Chebyshev's Theorem

Chebyshev's Theorem

Focus Point:
- Apply Chebyshev's theorem to raw data. What does a Chebyshev interval tell us?

Results of Chebyshev's Theorem

What does Chebyshev's Theorem tell us?

-
-

Section 3.2 Examples – Measures of Variation

(1) Big Blossom Greenhouse gathered another random sample of mature peak blooms from Hybrid B. The six blossoms had the following widths (in inches):

5 5 5 6 7 8

a. Again, we will construct a table so that we can find the mean, variance, and standard deviation more easily. In this case, what is the value of n? Find the sum of Column I in the table, and compute the mean.

b. Complete Column II in the table.

c. What is the value of n? of $n-1$? Use the computation formula to find the sample variance s^2. *NOTE:* Be sure to distinguish between $\sum x^2$ and $(\sum x)^2$.

I	II
x	x^2
5	
5	
5	
6	
7	
8	

$\sum x =$ _____ $\sum x^2 =$ _____

d. Use a calculator to find the square root of the variance. Is this the standard deviation?

(2) Cabela's in Sindey, Nebraska, is a very large outfitter that carries a broad selection of fishing tackle. It markets its products nationwide through a catalog service. A random sample of 10 spinners (a type of fishing reel) from Cabela's extensive spring catalog gave the following prices (in dollars):

1.69 1.49 3.09 1.79 1.39 2.89 1.49 1.39 1.49 1.99

a. Use a calculator with sample mean and sample standard deviation keys to compute $\bar{x}$ and s.

b. Compute the CV for the spinner prices at Cabela's.

(3) The *East Coast Independent News* periodically runs ads in its classified section offering a month's free subscription to those who respond. In this way, management can get a sense about the number of subscribers who read the classified section each day. Over a period of 2 years, careful records have been kept. The mean number of responses per ad is $\bar{x} = 525$ with standard deviation $s = 30$.

Determine a Chebyshev interval about the mean in which at least 88.9% of the data fall.

Section 3.3 Percentiles and Box-and-Whisker Plots

Objective: In this lesson you learned to interpret percentile scores; compute five-number summaries; and make, interpret, and describe box-and-whisker plots.

Important Vocabulary		
Percentile	Quartiles	Interquartile Range (IQR)
Five-Number Summary	Box-and-whisker Plot	

I. Percentiles

Focus Point:
- Interpret the meaning of percentile scores
- Compute the median, quartiles, and five-number summary from raw data

General definition of the Pth percentile:

How to compute quartiles:

1.

2.

3.

4.

What is the interquartile range (IQR)? How is it calculated?

II. Box-and-Whisker Plots

Five-Number Summary

Focus Point:

- Make a box-and-whisker plot. Interpret the results.
- Describe how a box-and-whisker plot indicates spread of data about the median

What is a box-and-whisker plot?

How to make a box-and-whisker plot:

1.

2.

3.

4.

What does a box-and-whisker plot tell us:

-
-
-
-

Section 3.3 Examples – Percentiles and Box-and-Whisker Plots

(1) You took the English achievement test to obtain college credit in freshman English by examination.

a. If your score is at the 89th percentile, what percentage of scores are at or below yours?

b. If the scores range from 1 to 100 and your raw score is 95, does this necessarily mean that your score is at the 95th percentile?

(2) Many people consider the number of calories in an ice cream bar as important as, if not more important than, the cost. The *Consumer Reports* article also included the calorie count of the rated ice cream bars (see table). There were 22 vanilla-flavored bars rated. Again, the bars varied in size, and some of the smaller bars had fewer calories. The calorie counts for the vanilla bars follow.

Calories in Vanilla-Flavored Ice Cream Bars

342	377	319	353	295
234	294	286	377	182
310	429	111	201	182
197	209	147	190	151
131	151			

a. Order the data.

Ordered Data

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____			

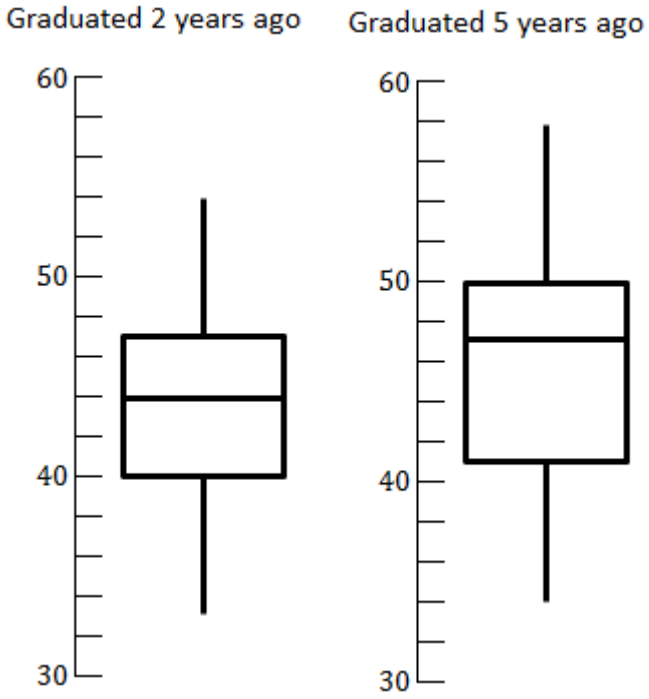
b. There are 22 data values. Find the median.

c. How many values are below the median position? Find Q_1.

d. There are the same number of data above as below the median. Use this fact to find Q_3.

e. Find the interquartile range (IQR) and comment on its meaning.

(3) The Renata College Development Office sent salary surveys to alumni who graduated 2 and 5 years ago. The voluntary responses received are summarized in the box-and-whisker plots shown below.



a. From the plots shown, estimate the median and extreme values of salaries of alumni graduating 2 years ago. In what range are the middle half of the salaries?

b. From the plots shown, estimate the median and extreme values of salaries of alumni graduating 5 years ago. What is the location of the middle half of the salaries?

c. Compare the two box-and-whisker plots and make comments about the salaries of alumni graduating 2 and 5 years ago.