

Name: _____

Per: _____

Stat 1: Measures of Central Tendency -- Mean, Median, Mode and Range

This section has information that you should have already seen a few times in your mathematical career. Mean, median, and mode are great ways to look at sets of information and compare groups of information together.

mean:

median:

mode:

range:

Although these vocabulary words should be familiar, we should practice how to find each. Let's look at a couple of examples.

Example: Ms. Lingle's first period class took a test and had the following scores:

81, 97, 92, 65, 77, 89, 84, 68, 74, 93, 91, 85, 79, 84, 86, 90, 91, 84, 78, and 80.

What were the mean, median, and mode for these test scores?

1. To find the mean, we add up all the numbers and divide by how many numbers there are in the set.

So the mean or average test score of this first period class is _____%.

2. To find the median, we have to list the numbers in order from smallest to largest and find the middle number. If there are two middle numbers, then you find the average of the two middle numbers by adding them together and dividing by two.

65, 68, 74, 77, 78, 79, 80, 81, 84, 84, 84, 85, 86, 89, 90, 91, 91, 92, 93, 97

So the median of this first period class is _____%.

3. To find the mode, we have to determine which number occurs the most often. If there are two numbers that occur the most, then the set is **bimodal**, or having two modes.

So the mode of this first period class is _____%.

4. One last piece that can be compared is the range. To find the range, we take the largest number and subtract the smallest number.

So the range of this first period class is _____%.

NOW YOU TRY!! Ms. Lingle's first period class took a test and had the following scores: 79, 95, 90, 63, 75, 87, 84, 66, 72, 91, 89, 85, 77, 84, 86, 88, 89, 84, 76, and 78.

What were the mean, median, and mode for these test scores?

1. To find the mean:

So the mean or average test score of this fourth period class is _____.

2. Find the median:

So the median of this fourth period class is _____.

3. Find the mode:

So the mode of this fourth period class is _____.

4. Find the Range:

So the range of this first period class is _____.

Now let's compare the information we found:

	Mean	Median	Mode	Range
1 st period				
4 th period				

Do you see anything interesting? Write a sentence about what you notice.

HOMEWORK Stat 1

Solve each problem, making sure to label your answers and round to the nearest tenth and showing your work.

1. Find the mean, median, mode, and range of each of the following sets.

a) ~~61, 75, 75, 63, 67, 72, 66, 81, 79, 62~~

61, 62, 63, 64, 67, 72, 75, 75, 79, 81

mean: 70.1
median: 69.5
Mode: 75
Range: 20

b) ~~28, 12, 21, 19, 20, 18, 24, 28, 30, 25~~

12, 18, 19, 20, 21, 24, 25, 28, 28, 30

Mean: 22.5
Median: 22.5
Mode: 28
Range: 18

c) ~~190, 182, 198, 187, 195, 181, 199, 192, 184, 148, 188, 197~~

148, 181, 182, 184, 187, 188, 190, 192, 195, 197, 198, 199.

186.75 mean: ~~177.5~~ mode: No mode
median: 189 Range: 51

2. Create a set of data that would have the following:

a) A mean of 18

15, 26, 12, 18, ~~18~~, 18, 22, 26, 13, 19 = 180/10 = 18

b) A median of 50

25, 32, 50, 65, 98

c) A Mean of 25 and a Mode of 15

15, 15, 15, ~~15~~, 28, 30, 32, 38, 29, 22, 26

d) A range of 48 and a median of 27

15, 19, 24, 27, 29, 30, 33

3. Several seaside hotels were rated between "no stars" and "Five Stars" by the tourist board. The table below shows how many hotels got each number of stars.

Find the mean number of stars earned.

Stars	Frequency
0	2
1	6
2	8
3	3
4	0
5	1

0
6
16
9
0
5

1.8 stars

4. Professor Baker and Doctor Cooper keep a record of their golf scores, as shown in the table below. Find the mean, median, mode and range of the Professors and Doctors golf scores. Make a comparison about what the Measures of Central Tendency tells us about the two sets of data.

Professor Baker	
Score	Frequency
70	3
71	4
72	4
73	4
74	3
75	2

210
~~18284~~
 288
 292
 222
 50
~~1235~~
 1446

5 Range
 72.73.77 mode
 72 median
~~67.5~~ mean 72.3

Doctor Cooper	
Score	Frequency
68	3
70	4
72	3
74	5
77	3
79	2

204
 280
 216
 370
 231
 68
 23 1459

median: 74
 mean: 63.43
 mode: 75
 Range: 11

5. A storeowner kept a tally of the sizes of suits purchased in her store. Which measure of central tendency should the storeowner use to describe the average size of suits sold? *mean*
6. A tally was made of the number of times each color of crayon was used by a kindergarten class. Which measure of central tendency should the teacher use to determine which color is the favorite color of her class? *mode*
7. The science test grades are posted. The class did very well. All students taking the test scored over 75. Unfortunately, 4 students were absent for the test and the computer listed their scores are 0 until the test is taken. Assuming that no score repeated more times than the 0's, what measure of central tendency would most likely give the best representation of this data.

median

Name: _____

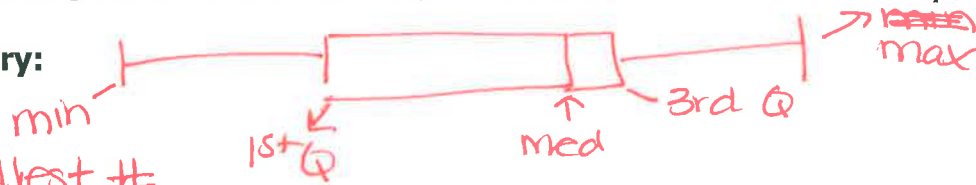
Date: _____

Stat 2: Box Plots and the 5-Number Summary

In Class Notes and Practice

In the last section we practiced finding the mean, median, mode, and range of a set of numbers. Another way to display information like a set of numbers is a box plot. You may have seen one of these before as well, but finding the 5-number summary can be tricky.

5-number summary:



minimum: smallest #

first quartile: Median between min and Median (not including median)

median: Middle # (Average if needed)

third quartile: Median between Med and max (not including median)

maximum: Largest #.

Outlier: Extreme #'s that lie outside the expected range
Find by determining IQR $3rd\ Q - 1st\ Q = _ \cdot 1.5 = IQR$

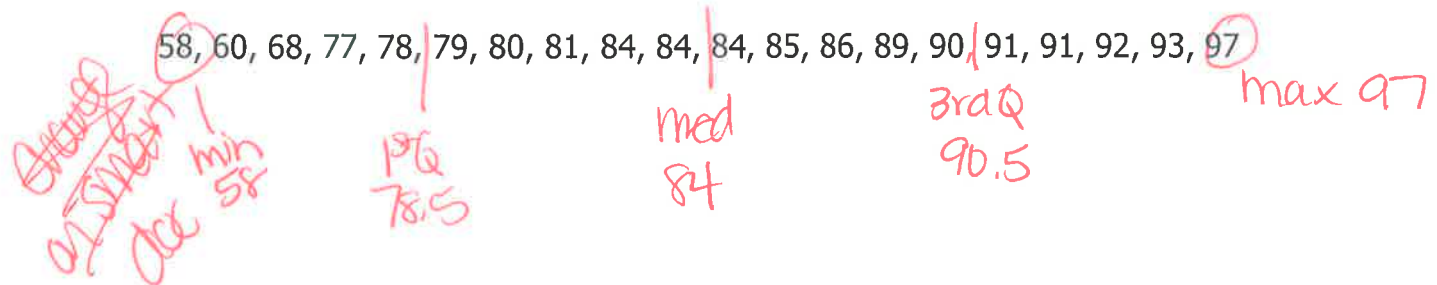
Let's look at the same example we looked at last class.

Example: Ms. Lingle's first period class took a test and had the following scores:

81, 97, 92, 58, 77, 89, 84, 60, 68, 93, 91, 85, 79, 84, 86, 90, 91, 84, 78, and 80.

What is the 5-number summary?

To find the 5-number summary, we need to start by putting the numbers in order from smallest to largest.



Find the Inter Quartile Range.

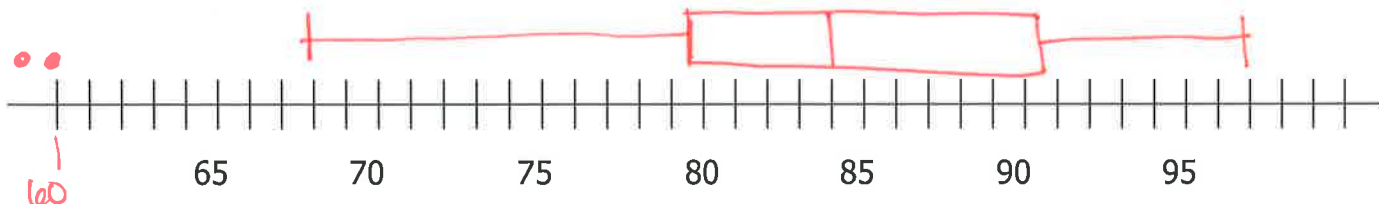
$$3^{\text{rd}} Q - 1^{\text{st}} Q = 90.5 - 78.5 = 12 \cdot 1.5 = 18$$

$$1^{\text{st}} Q - \text{IQR} = 78.5 - 18 = 60.5$$

$$3^{\text{rd}} Q + \text{IQR} = 90.5 + 18 = 108.5$$

58 & 60 are outliers

Now that we have our five number summary, we can create a box plot.



Now let's try to create our own on the second example.

Example: Ms. Lingle's ^{fourth} first period class took a test and had the following scores: 79, 95, 90, 63, 75, 87, 84, 66, 72, 91, 89, 85, 77, 84, 86, 88, 89, 84, 76, and 78.

What is the 5-number summary?

Med: 84

1Q: 76.5

med: 84

3Q: 88.5 max 95

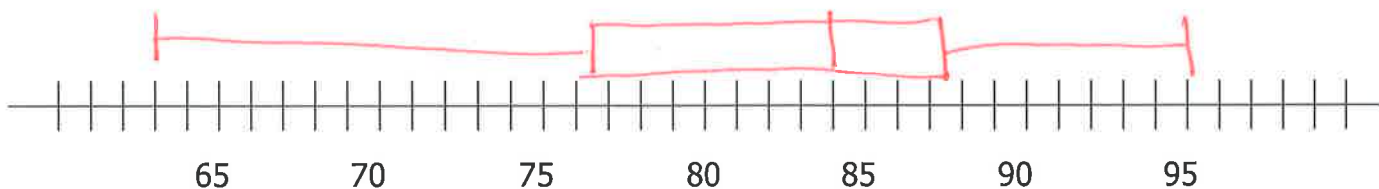
$$88.5 - 76.5 = 12 \cdot 1.5 = 18$$

$$88.5 + 18 = 106.5$$

$$76.5 - 18 = 58.5$$

NO Outliers.

Now that we have our five number summary, we can create a box plot.



Now let's compare the information we found:

	Minimum	1 st Quartile	Median	3 rd Quartile	Maximum
1 st period	58	78.5	84	90.5	97
4 th period	63	76.5	84	88.5	95

Do you see anything interesting? Have a quick conversation with a partner and write down your observations. Remember to use complete sentences!

Homework

1. Below are the prices of snowboards at two competing snowboard stores:

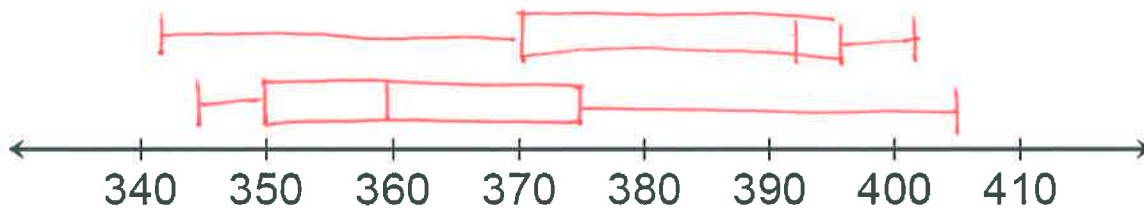
Middletown Snowboards
345, 350, 356, 360, 375, 405

Snowboard Central
343, 370, 386, 392, 395, 402

a. Identify the 5# Summary of each set of data.

<u>Middletown Snowboards</u>		<u>Snowboard Central</u>	
min: 345	$375 - 350 = 25 \cdot 1.5 = 37.5$	min: 343	$395 - 370 = 25 \cdot 1.5 = 37.5$
1Q: 350		1Q: 370	
Med: 360	$350 - 37.5 = 312.5$	med: 392	$370 - 37.5 = 332.5$
3Q: 375	$375 + 37.5 = 412.5$	3Q: 395	$395 + 37.5 = 432.5$
max: 405		max: 402	

b. Draw a double box-and-whisker plot of the above data on the scale below:



c. What is the median price for a snowboard at Middletown Snowboards?

\$360

d. What is the lowest price you could pay for a snowboard at Snowboard Central?

\$343

e. What is the most expensive board at Middletown Snowboards?

\$405

f. What is the range of prices for snowboards at Snowboard Central?

\$59

g. Which price represents the 3rd Quartile for Middletown Snowboards?

\$375

h. Which store would you rather buy a snowboard from? Why?

Middletown Snowboards. 75% of their boards are below \$375

snowboard central 75% are above \$370!

2. The accompanying box-and-whisker plot represents the cost, in dollars, of twelve CD's.

a. Which cost is the 3rd quartile?

\$26

b. What is the range of the costs the CD's?

29-7 = \$22

c. What is the median?

\$20.50

d. Which cost represents the maximum price?

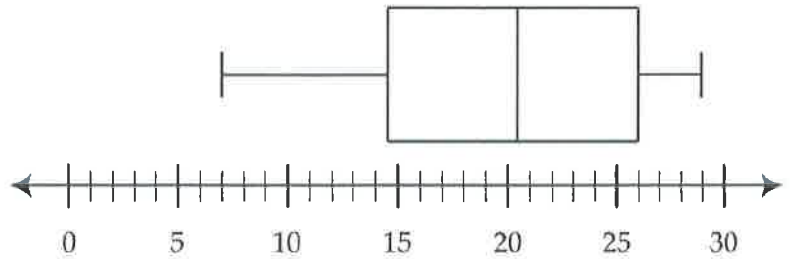
\$29

e. How many CD's cost between \$14.50 and \$26.00?

6cd's

f. How many CD's cost less than \$14.50?

3cd's



of

3. The accompanying box-and-whisker plot represents the scores earned on a math test. *20*

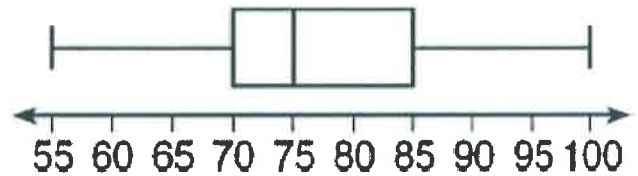
a. What is the median score? *75*

b. What score represents the first quartile? *70*

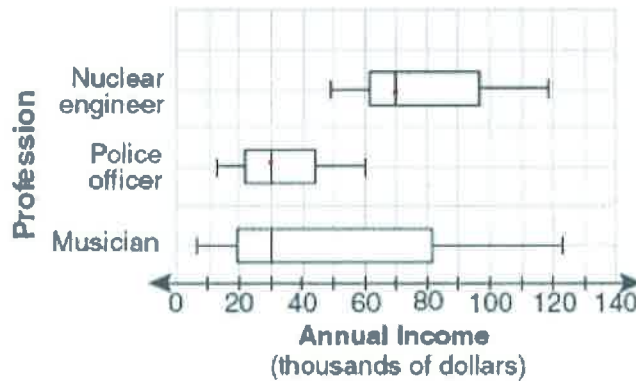
c. How many scores represent 50% of the scores? *10*

10K

d. A score of an 85 on the box-and-whisker plot shown refers to what? *3Q 75% are below*



4. The accompanying box-and-whisker plots can be used to compare the annual incomes of three professions.



Based on the box-and-whisker plots determine whether each statement is true or false.

a. The median income for nuclear engineers is greater than the income of all musicians. *false*

b. The median income for police officers and musicians is the same. *TRUE*

c. All nuclear engineers earn more than all police officers. *False*

d. A musician will eventually earn more than a police officer. *TRUE*

Stat 3: Standard Deviation

The standard deviation is used to tell how far on average any data point is from the mean. The smaller the standard deviation, the closer the scores are on average to the mean. When the standard deviation is large, the scores are more widely spread on average from the mean.

The **standard deviation** is calculated as the **average distance from the mean**.

Follow the steps below to calculate the standard deviation **by hand**.

Step 1: List the scores in the first column *Scores*, in the table below.

Step 2: Find the mean of the *Scores*.

Step 3: Subtract each of the scores from the mean. Record the difference in the *Difference From The Mean* column in the table below. Be sure to record whether the answer is positive or negative. (i.e.: $4-5=-1$, $7-5=2$)

Step 4: Find the square of each number in the *Difference From The Mean* column and record the result in the *Square of the Difference* column (i.e.: $(-1)^2 = 1$)

Step 5: Find the sum of the numbers in the *Square of the Difference* and record your answer in the table.

Step 6: Take the Sum of the $(\text{Difference from the Mean})^2$ and divide it by n , one less than the amount of scores you have in your data set. Record your answer.

Step 7: The square root of step 7 is the standard deviation. Record your answer below:

Example:

The junior high basketball team played ten games. Find the standard deviation for the number of baskets scored by the team for the ten games:

8, 4, 6, 6, 7, 9, 4, 8, 5

$\bar{x} = 6.8$

~~27.96~~ $5x$

Score	Difference from the mean	(Difference from the mean) ²
8	$8 - 6.8 = 1.2$	1.44
4	$4 - 6.8 = -2.8$	7.84
6	$6 - 6.8 = -.8$.64
6	$6 - 6.8 = -.8$.64
7	$7 - 6.8 = .2$.04
9	$9 - 6.8 = 2.2$	4.84
4	$4 - 6.8 = -2.8$	7.84
8	$8 - 6.8 = 1.2$	1.44
5	$5 - 6.8 = -1.8$	3.24
	Sum of (Diff.from the mean)²	27.96
	Divide Sum by 1 less than the number of data values	$27.96 / 8 = 3.50$
	Square Root your number to get your standard deviation	$\sqrt{3.50} = 1.87 \text{ pts.}$

Standard deviation $\left(\sqrt{\frac{\text{diff. from Mean}^2}{n}}\right)$ is 2 pts.

Means?

Calculator Steps:

Step 1: Press 2nd and List (Stat button)

Step 2: Over Arrow to get to MATH

Step 3: Select 7:stdDev(

Step 4: Enter data with in brackets and separate with commas. (To get bracket press 2nd and parenthesis.)

i.e. stdDev({8, 4, 6, 6, 7, 9, 4, 8, 5})

Practice Problem

Find the standard deviation for the following test scores. Use the chart below to record the steps.

85, 100, 92, 96, 87, 94

$$\bar{x} = 92.33$$

Score	Difference from the mean	(Difference from the mean) ²
85	$85 - 92.33 = -7.33$	53.73
100	$100 - 92.33 = 7.67$	58.83
92	$92 - 92.33 = -.33$.11
96	$96 - 92.33 = 3.67$	13.47
87	$87 - 92.33 = -5.33$	28.41
94	$94 - 92.33 = 1.67$	2.79
	Sum of (Diff.from the mean) ²	157.34
	Divide Sum by 1 less than the number of data values	$\div 5 = 31.47$
	Square Root your number to get your standard deviation	$\sqrt{31.47} = 5.61$

Standard deviation $\left(\sqrt{\frac{\text{diff. from Mean}^2}{n}}\right)$ is 5.61

Explain what this means:

Homework Stat 3

Find the standard deviation for each problem below on the calculator. Round your answers to the nearest hundredth.

1. Josh wanted to test his vertical jump. Each day he jumped and recorded his height.

22, 18, 19, 25, 27, 21, 24 = 3.25

What does the standard deviation mean?

Each height is on average 3.25 in away from the average height. Meaning he's not changing very dramatically.

2. Sam was playing flappy bird. These are her scores from her 8 attempts to beat her highest score.

38, 46, 37, 42, 39, 40, 48, 42 = 3.85 \approx 4pts.

What does the standard deviation mean?

Sam is consistent!

Find the standard deviation for each problem below by hand. Show all work for credit!! Round your answers to the nearest hundredth. Explain what the standard deviation means.

3. The data represents the amount of time (minutes) that someone waited from their lunch at taco bell.

8.4, 7.7, 8.6, 7.5, 8.9, 7.8, 8.6, 9.1, 8.0 = .56

Taco bell is very consistent with wait time each time is about .56 mins away from the mean.

4. The data represents the weight of Jackson's lunch for a week.

1.25, 3.69, 5.67, 4.89, 0.12, 4.35, 2.78 = 1.97

each weight is about 1.92 oz from the mean. consistently close in weight.

5. Represents the amount of calories James burnt during each workout.

515, 720, 635, 895, 585, 690, 770, 840 = 254.64 calories.

Big variance from the mean. Each workout is about 254.64 calories away from the average calories burnt.

6. The data represents the cost of an iPod at different electronic stores.

116, 105, 117, 124, 107, 112, 117, 125, 110, 113 = 6.59

each store is around \$6.59 from the average meaning I'm not terribly concerned where I buy my iPod!