

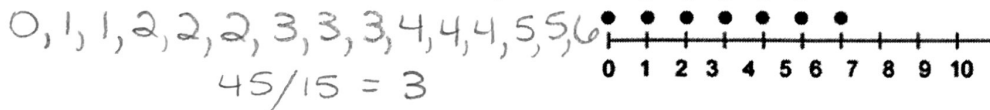
Measures of Center

1) Mean (Average):

To find the mean: Add up the numbers, divide by how many numbers there are
 Examples:

1. Find the mean of Justine's test scores: 94, 85, 71, 75, 81, 88 $82.\bar{3}$
 $494/6$

2. Find the mean of the data from the dot plot



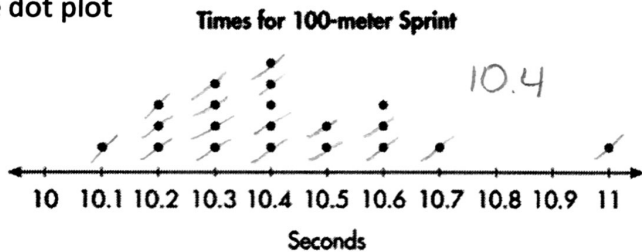
2) Median "Middle"

To find the median: – put the numbers in order, find the middle (When there's two numbers, average them)

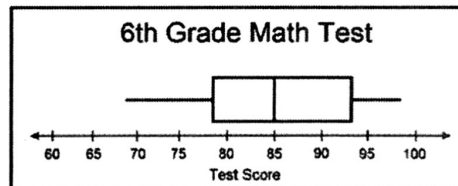
Examples:

1. Find the median of Justine's test scores: 94, 85, 71, 75, 81, 88 Median = 83
 $71, 75, 81, 85, 88, 94$ $106/2$

2. Find the median time for the 100-meter sprint from the dot plot



3. What is the median of the box and whisker plot below?

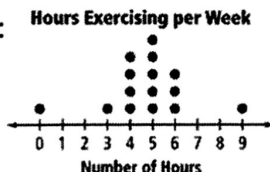


85

3) Mode

To find the mode: identify the number used most

1. Find the mode of the following data: 23, 24, 23, 19, 10, 23, 24, 33 23
 2. Find the mode from the dot plot:



Measure of Spread and Variation

Measure of Variation: shows how values are varied within a data set.

Range - To find the range: Maximum - Minimum

Example: -3, 2, 1, 14, -10, 4 $14 - (-10)$

Highest: 14 Lowest: -10 The range is 24

Quartiles: separate data into 4 sections

Lower quartile (Q1) – the median of the lower half of the data set

Second quartile (Q2) – the median of the whole data set

Upper quartile (Q3) – the median of the upper half of the data set

*the median is NOT included when calculating Q1 & Q3, unless there are two numbers, in which case you split them

Interquartile Range:

Subtract Quartile 3 - Quartile 1 = IQR

Example 1:

5, 17, 33, 52, 23, 29, 30

5, 17, 23, 29, 30, 33, 52
x / x / x / x / x / x / x /

Lower Quartile (Q1) 17

Range 47

Second Quartile (Q2) 29

Interquartile Range 16

Upper Quartile (Q3) 33

Example 2:

The following list shows the scores of the first 9 games for a high school basketball team. 67, 59, 62, 64, 71, 71, 52, 53, 61

52, 53, 59, 61, 62, 64, 67, 71, 71
x / x / x / x / x / x / x / x /

Lower Quartile (Q1) 56

Range 19

Second Quartile (Q2) 62

Interquartile Range 13

Upper Quartile (Q3) 69

Example 3:

The following list shows the scores that Deanna received on the last eight computer games she played.

53, 59, 34, 48, 63, 55, 63, 50

34, 48, 50, 53, 55, 59, 63, 63
x / x / x / x / x / x / x /

Lower Quartile (Q1) 49

Range 29

Second Quartile (Q2) 54

Interquartile Range 12

Upper Quartile (Q3) 61

Guided Notes - Box and Whisker Plots

Date _____

Name _____

Students trying out for the basketball team were asked their heights. The coach is looking to see if a student's height has any effect on his or her ability to shoot the ball. The height of 17 students are shown below.

Heights of Basketball Team (in inches)

55, 56, 59, 47, 60, 60, 72, 59, 63, 64, 58, 59, 65, 72, 73, 68, 63

Step 1

Arrange your data in order from least to greatest and record in the space below.

47, 55, 56, 58, 59, 59, 59, 60, 60, 63, 63, 64, 65, 68, 72, 72, 73

Step 2

Find the median of your data and mark it with a dot on the number line below.

Step 3

Find the median of the lower half of the data (this is the lower quartile). Circle this value.

Find the median of the upper half of the data (this is the upper quartile). Circle this value.

Q1 58.5 Q3 66.5

Step 4

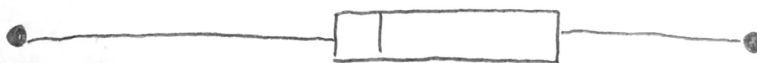
Find the values that you circled in the data on the number line below. Place a dot above the number line at each of these points.

Step 5

Draw a box above the number line that goes from the lower quartile to the upper quartile. This box represents the interquartile range.

Step 6

Draw a line from the left side of the box to the point above the number line where the smallest number in the data is located. Draw a second line from the right side of the box to the point above the number line where the largest number in the data is located. These lines are the "whiskers" for your box-and-whisker plot.



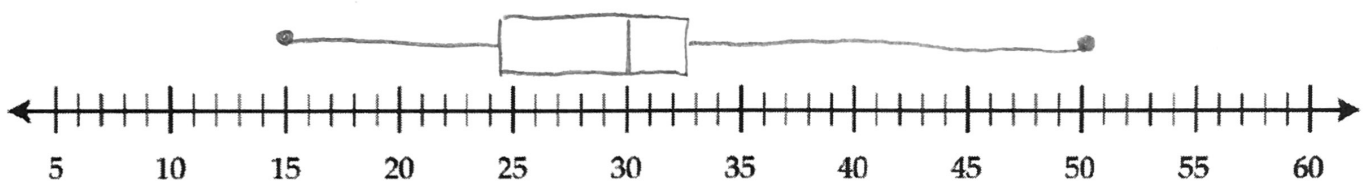
Box and Whisker Plots Homework

Date _____

Create a Box-and-Whisker plot for the following set of data.

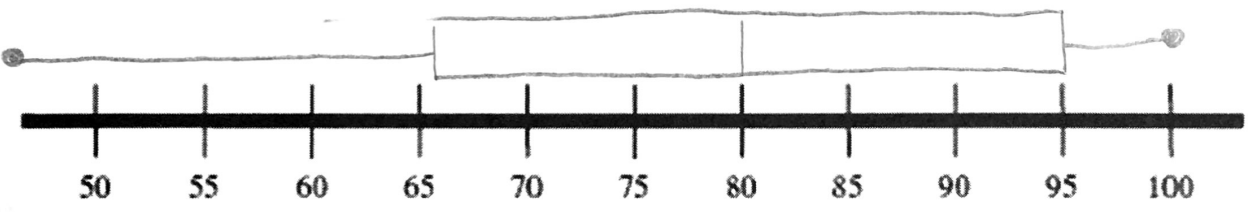
15, 19, 20, 22, 27, 29, 30, 30, 30, 31, 31, 32, 33, 34, 45, 50
 20, 15, 45, 33, 19, 30, 31, 32, 31, 30, 27, 34, 50, 22, 29, 30

Q1 = 24.5 Q2 = 30 Q3 = 32.5
 Minimum = 15 Maximum = 50 Range = 35 IQR = 8

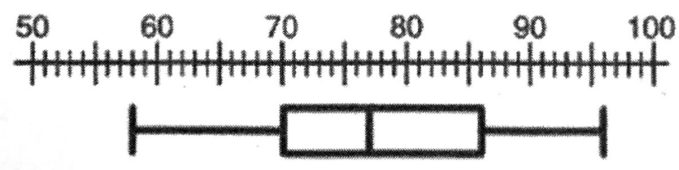


1. These are the averages of 7 students in Mrs. Johnson's math class:
45, 55, 66, 66, 70, 80, 88, 90, 95, 98, 100.

Q1 = 66 Q2 = 80 Q3 = 95
 Minimum = 45 Maximum = 100



2. Mr. Andrews made a box-and-whisker graph of the quiz grades in his chemistry class.



What is the median of the quiz scores? 77
 What was the lowest quiz score? 58 The highest? 96
 What is the range of the quiz scores? 38
 Jack earned a 70 on the quiz. What percentage of the students in his class did worse than him? 25% What percentage did better? 75%

Guided Notes - Outlier

Data that is much higher or lower from the rest of the data

Mr. Hale's Test Scores: 95, 90, 85, 10, 91, 81, 79, 85

What is the outlier? 10

What does the outlier affect? mean and range

1. The school librarian tracked how many books were checked out each day during a one-week period.

| Day of the Week | Number of Books |
|-----------------|-----------------|
| Monday | 265 |
| Tuesday | 234 |
| Wednesday | 28 |
| Thursday | 210 |
| Friday | 265 |

Which of these measures is most affected by the number of books that were checked out on Wednesday?

- A. the mean
- B. the mode
- C. the median
- D. the maximum

2. Consider the following scores:

12, 56, 62, 66, 74, 83, 88, 90, 93, 96

If the outlier, 12, is removed from the set above, what is the approximate increase in the mean of the remaining scores?

With 12 Mean: 72

W/o 12 Mean: $78.\bar{6}$

Difference: $6.\bar{6}$

3. Below are the total points scored by two players for six games.

| | Game 1 | Game 2 | Game 3 | Game 4 | Game 5 | Game 6 |
|----------|--------|--------|--------|--------|--------|--------|
| Player A | 45 | 88 | 90 | 86 | 92 | 98 |
| Player B | 50 | 78 | 65 | 62 | 74 | 72 |

The players are each allowed to drop their lowest score before their averages are calculated.

In your **Answer Document**, explain which player would benefit the most by dropping their lowest score.

A w/ 45 $83.1\bar{6}$ > dif: 7.63

A w/out 45 90.8

B w/ 50 $66.8\bar{3}$ > dif. 3.37

B w/out 50 70.2

Player A
benefits most.

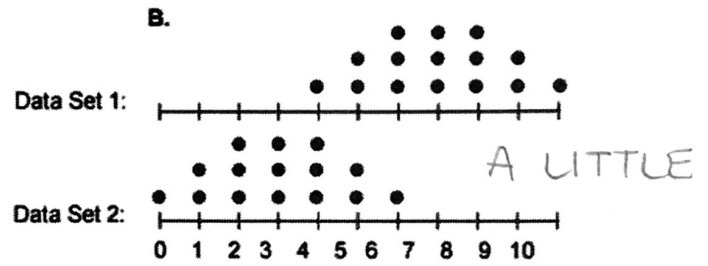
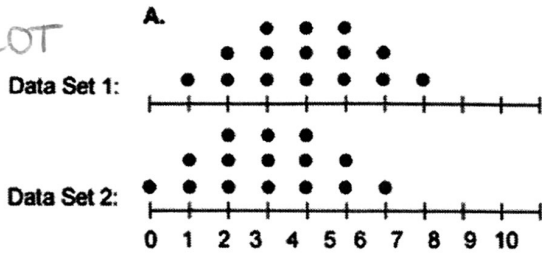
45 is farther from other data than Player B's lowest.

Guided Notes – Visual Overlap

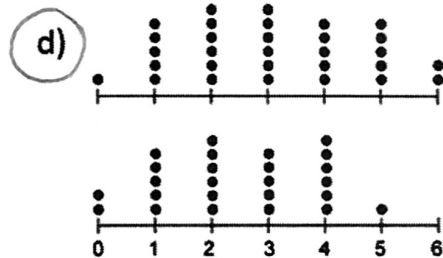
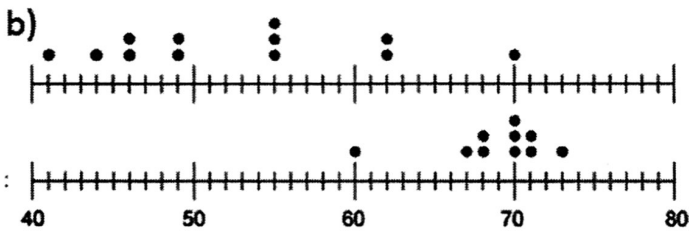
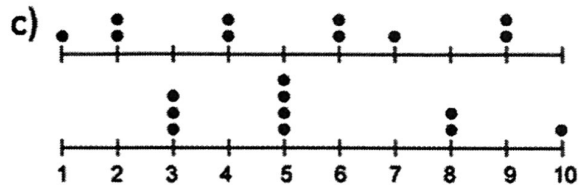
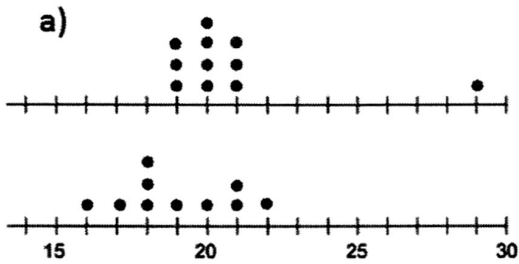
Date _____

Determine the degree of visual overlap for each set of dot plots (a lot, a little or no overlap)

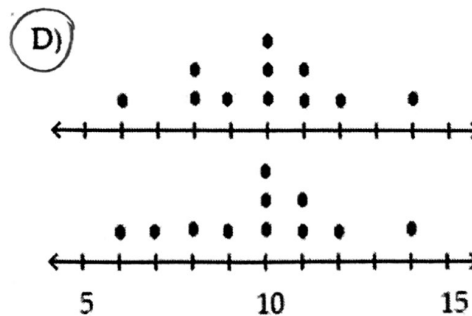
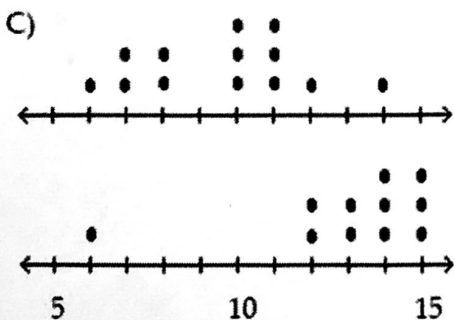
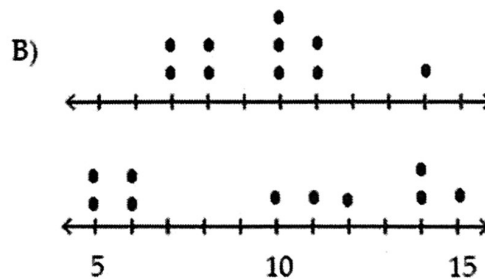
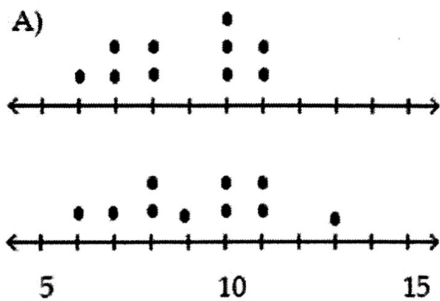
A LOT



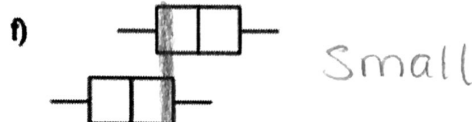
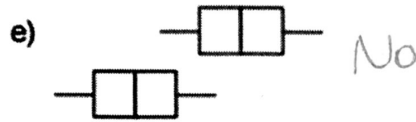
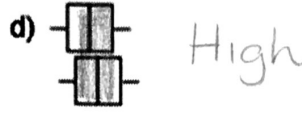
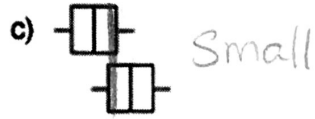
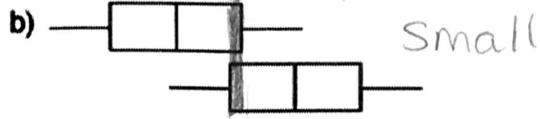
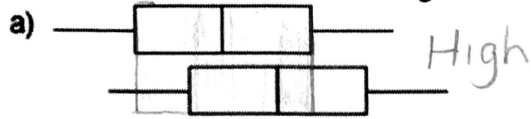
1) Which set of dot plots has the most visual overlap?



2) Which set of dot plots has the most visual overlap?

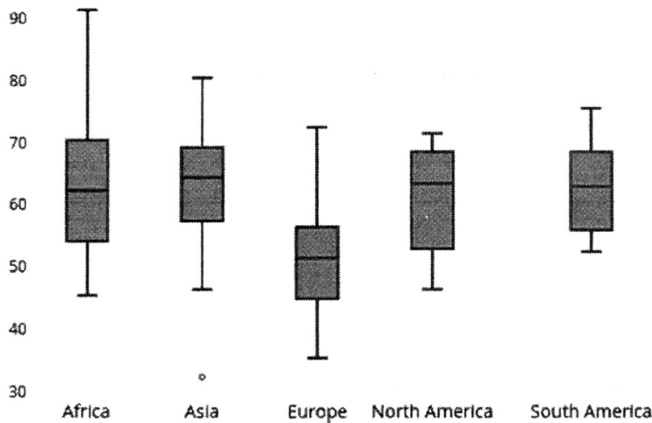


Exercises: Copy the box plots and color the part that overlaps. Describe the degree of overlap between the two data sets as high overlap, small overlap, or no overlap.



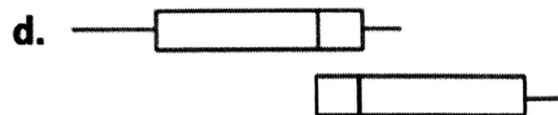
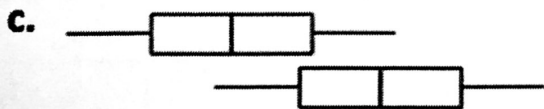
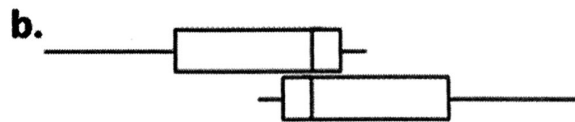
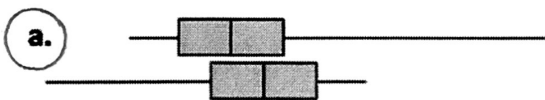
- 2) Which two seem to have the most visual overlap? Africa & NA
 Which have the least visual overlap? Asia & Europe

Ages of Heads of Governments Around the World



Source: Wikipedia

- 3) Which choice shows two box and whisker plots with the most visual overlap?



Guided Notes – Comparing Data

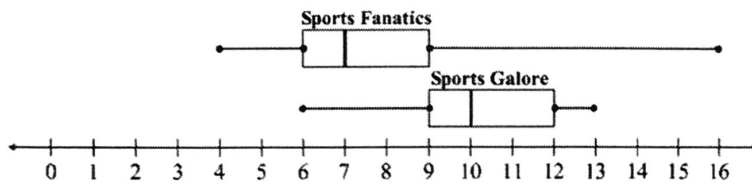
Date _____

Data can be compared through measures of center and measures of spread/variation.

Box and whisker plots, stem and leaf, and dot plots diagrams help us compare data.

1) Box and Whisker

The box-and-whisker plots below picture the wages of part-time employees at two local sports stores. Find the range, median, lower quartile, upper quartile, and interquartile range for both stores. If you wanted to get a summer job and make as much money as possible, at which store would you want to work? Explain your reasoning.



| | Sports Fanatics | Sports Galore |
|---------------------|-----------------|---------------|
| Range | 12 | 7 |
| Median | 7 | 10 |
| Lower Quartile | 6 | 9 |
| Upper Quartile | 9 | 12 |
| Interquartile Range | 3 | 3 |

As a brand new employee, which store would you want to work and why?

Sports Galore - Lower salaries are higher

2) Stem and Leaf

To make a stem and leaf plot:

Step 1: Put the data in order from least to greatest

Step 2: Find the Stems - tens place

Step 3: Find the Leaves - ones place

Step 4: Include a key

Step 5: Make a title

| | | | | |
|---------------|---------------|---------------|---------------|---------------|
| 1 | 76 | 15 | 21 | 25 |
| 35 | 24 | 27 | 35 | 9 |
| 12 | 10 | 40 | 56 | 59 |

| Stem | Leaf |
|------|------------|
| 0 | 1, 9 |
| 1 | 0, 2, 5 |
| 2 | 1, 4, 5, 7 |
| 3 | 5, 5 |
| 4 | 0 |
| 5 | 0, 9 |
| 6 | 4, 9 |
| 7 | 6 |

Comparing Data using stem and leaf

Ages of People in Two Exercise Classes

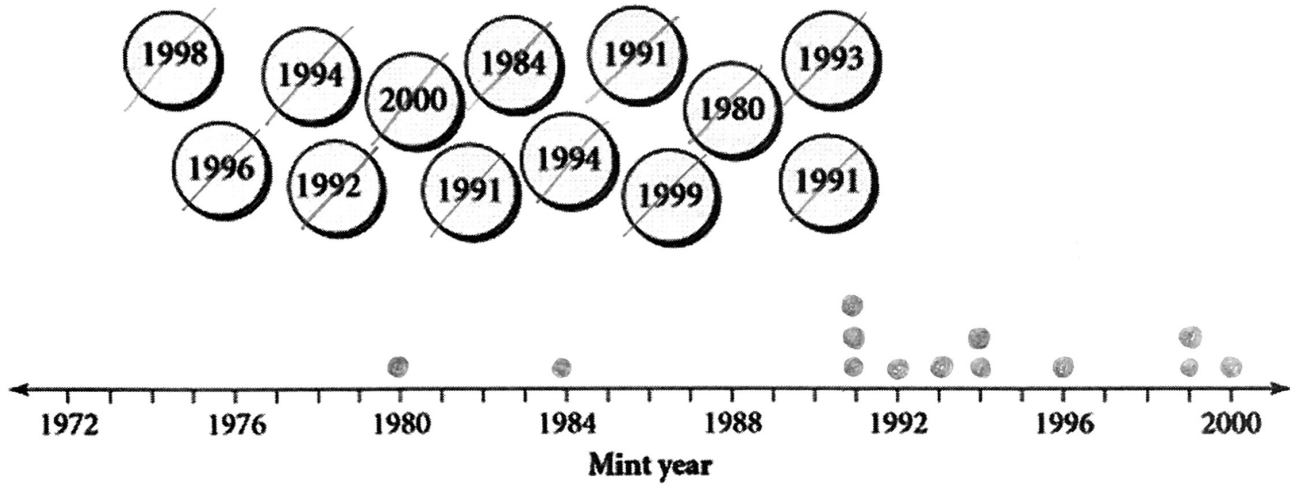
| 10:00 A.M. Class | 8:00 P.M. Class |
|-------------------------|------------------|
| 9 | 1 8 9 |
| 7 | 2 1 2 2 7 9 9 |
| 3 | 3 0 3 4 5 7 |
| 2 | 4 0 |
| 2 | 5 40 - 18 = 22 |
| 7 | 6 |
| 5 | 7 |
| 4 | |
| 3 | |
| 1 | |
| 70 - 42 = 28 | |
| 0 | |
| 0 | |

Key: 1 | 8 = 18

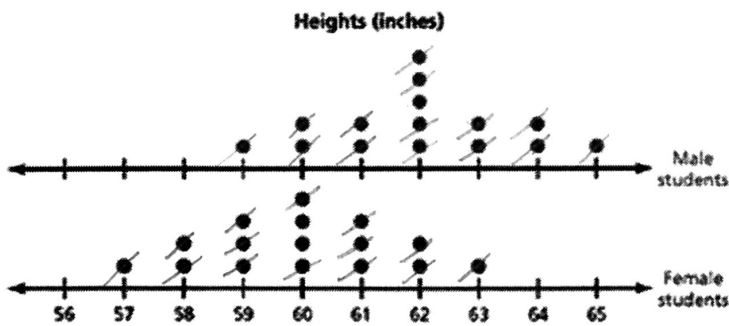
| | 10:00AM Class | 8:00PM Class |
|----------------------|---------------|--------------|
| Range | 28 | 22 |
| Mean | 52.8 | 28.3 |
| Median | 55 | 29 |
| Mode | 42 | 22, 29 |
| # of people in class | 15 | 14 |

Guided Notes – Comparing Data Continued

- 3) **Dot Plots** When going through her piggy bank, Lexy found the 13 pennies below. Make a dot plot of this data.



Comparing Dot Plots



| | Male Students | Female Students |
|----------------------|---------------|-----------------|
| Range | 6 | 6 |
| Mean | 62 | 60 |
| Median | 62 | 60 |
| Mode | 62 | 60 |
| # of people in class | 15 | 16 |

Guided Notes – Mean Absolute Variation

Date _____

Mean Absolute Deviation:

The average distance between each data value and the mean.

- 1) Find the mean.
- 2) Find the distance or difference between each data value and the mean.
(Absolute value)
- 3) Find the average/mean of those differences.

Example 1:

Mean 17.5

MAD 17.875

| Known Moons of Planets | | | |
|------------------------|----|----|----|
| 0 | 0 | 1 | 2 |
| 63 | 34 | 27 | 13 |

| | | | | | | | | |
|-------------------|------|------|------|------|-----|-----|------|------|
| Data | 0 | 0 | 1 | 2 | 13 | 27 | 34 | 63 |
| How far from mean | 17.5 | 17.5 | 16.5 | 15.5 | 4.5 | 9.5 | 16.5 | 45.5 |

Example 2:

Mean 8.75

MAD 0.50

| Zoo Admission Prices (\$) | | |
|---------------------------|------|------|
| 9.50 | 9.00 | 8.25 |
| 9.25 | 8.00 | 8.50 |

| | | | | | | |
|-------------------|------|------|------|------|------|------|
| Data | 8 | 8.25 | 8.5 | 9 | 9.25 | 9.5 |
| How far from mean | 0.75 | 0.5 | 0.25 | 0.25 | 0.5 | 0.75 |

Example 3:

Mean 129.4

MAD 18.48

| Number of Daily Visitors to a Web Site | | | | |
|--|-----|-----|-----|-----|
| 112 | 145 | 108 | 160 | 122 |

| | | | | | |
|-------------------|------|------|-----|------|------|
| Data | 108 | 112 | 122 | 145 | 160 |
| How far from mean | 21.4 | 17.4 | 7.4 | 15.6 | 30.6 |

Comparing Two Sets of Data

Example 1:

| Running Time for Movies (min) | | | | | | | | | |
|-------------------------------|----|----|-----|----|-------|-----|-----|-----|-----|
| Comedy | | | | | Drama | | | | |
| 90 | 95 | 88 | 100 | 98 | 115 | 120 | 150 | 135 | 144 |

4.2 0.8 6.2 5.8 3.8 17.8 12.8 17.2 2.2 11.2

Comedy

Mean 94.2

Mean Absolute Deviation 4.16

Drama

Mean 132.8

Mean Absolute Deviation 12.24

Mean Absolute Deviation Homework

Name _____

Directions: Find the mean and mean absolute deviation of the data set.

1) The data set below gives the prices (in dollars) of cordless phones at an electronics store:

35, 50, 60, 60, 75, 65, 80 Mean \$60.71 Mean Absolute Deviation \$10.82

Does the value of mean absolute deviation indicate that the data were spread out or close together?
Explain your answer.

Spread out - Phones cost \$35-80 each

2) The data set below gives the numbers of home runs for the 10 batters who hit the most home runs during the 2005 Major League Baseball regular season.

51, 48, 47, 46, 45, 43, 41, 40, 40, 39 Mean 44 Mean Absolute Deviation 3.4

Does the value of mean absolute deviation indicate that the data were spread out or close together?
Explain your answer.

Close together

3) The data set below gives the waiting times (in minutes) of several people at a department of motor vehicles service center.

11, 7, 14, 2, 8, 13, 3, 6, 10, 3, 8, 4, 8, 4, 7 Mean 7.2 Mean Absolute Deviation 2.88

Does the value of mean absolute deviation indicate that the data were spread out or close together?
Explain your answer.

Close together

4) The data set below gives the calories in a 1-ounce serving of several breakfast cereals.

135, 115, 120, 110, 110, 100, 105, 110, 125 Mean 114.4 Mean Absolute Deviation 8.26

Does the value of mean absolute deviation indicate that the data were spread out or close together?
Explain your answer.

Spread out

5) The data set below gives the GPAs for eight students:

1.25, 3.69, 5.67, 4.89, 0.12, 4.35, 2.78, 4.0

Mean 3.34375 Mean Absolute Deviation 1.4703125

Does the value of mean absolute deviation indicate that the data were spread out or close together?
Explain your answer.

Close together

Guided Notes – Population Samples

Date _____

Sample:

A part of the population use to draw conclusions or generalizations about that population

The bigger your sample, the more accurate your results.

*The Best (Most Accurate Sample):

Random Sample

Sampling where each member of the population has an equal chance of being included in the sample

Example: Survey every 5th person to walk in school

*Inaccuracies May Occur Due to:

Convenience Samples

Sampling where the researcher uses whatever individuals are available rather than selecting from the entire population

Example: Ask people at your lunch table

A good sample is _____ and _____ of the population

Examples:

1) A restaurant manager is planning a survey to determine which three desserts are most preferred by his customers.

Which sample would best represent the customers at the restaurant?

- A. Survey all children who enter the restaurant.
- B. Survey all customers over 50 years old for one week.
- C. Survey all of the men that come into the restaurant for one week.
- D. Survey every fifth customer that enters the restaurant for one week.

3) Jeffrey wants to determine the favorite professional sport of the students in his high school.

Which sample should Jeffrey use?

- A. a random sample of the students in the chess club
- B. a random sample of the students on the football team
- C. a random sample of the students on the official school roster
- D. a random sample of the students in the library during fifth period

2) George wants to conduct a survey to determine the types of music that the students want at a school dance.

Which sample population should George survey to represent the entire student body?

- A. survey the teachers
- B. survey the captain from each sports team
- C. randomly survey two people from each homeroom class
- D. randomly survey 50 people from the freshman class

4) There are 1000 students in grades 6, 7 and 8 at the Oak Lake Middle School. To determine which after-school activities are preferred by the students at the school, the student council decided to survey 20 eighth graders in a first period French class.

In your **Answer Document**, explain whether or not this is an appropriate sampling technique.

Not appropriate -
Only 8th graders asked

If a sample is random and representative, we can make predictions about a population

Step 1: Find the probability Step 2: Multiply by population

Example 1:

Kwame found that 20 of the 50 students he surveyed in the lunch line liked enchiladas the best.

A What is the probability that any student will like enchiladas the best?

$$\frac{20}{50}$$

B There are 520 students at Kwame's middle school. Predict how many like enchiladas the best.

$$\frac{20}{50} \cdot 520 = 208 \text{ students}$$

Example 2:

Kwame found that 10 out of the 50 students liked hamburgers the best.

1. What is the probability that any student will like hamburgers the best?

$$\frac{10}{50}$$

2. Predict how many of the 520 students will like hamburgers the best.

$$\frac{10}{50} \cdot 520 = 104 \text{ students}$$

Example 3:

A pizza shop wants to determine how often it delivers to three different areas of a city. The table shows the areas from a random sample of 80 deliveries.

| Area of City | Number of Deliveries |
|--------------|----------------------|
| Northern | 14 |
| Central | 44 |
| Southern | 22 |

$$\frac{22}{80} = \frac{11}{40}$$

Based on these data, if the driver makes 200 deliveries, how many deliveries will be to the southern area of the city?

$$\frac{11}{40} \cdot 200 = 55 \text{ deliveries to southern area}$$

Example 4:

Carmelina conducted a survey to find out if students preferred in-line skating or skateboarding. 64 out of 80 students preferred in-line skating. There are 200 students at her school. Predict how many of them prefer in-line skating.

$$\frac{64}{80} = \frac{4}{5} \cdot 200 = 160 \text{ students}$$

Using a Chart or Graph:

1) Cafeteria workers at the Wentworth School surveyed 100 students to find out which lunch items they liked best. The results are shown in the table.

| Lunch | Number of Students |
|----------------|--------------------|
| Pizza | 34 |
| Mac and Cheese | 30 |
| Hamburgers | 20 |
| Other | 16 |

Using the sample above, make predictions about the following items:

If the school has 500 students, predict the number of students that will prefer:

Pizza 170 = $\frac{34}{100} \cdot 500$

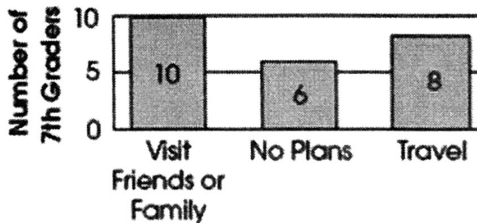
Mac and Cheese 150 = $\frac{30}{100} \cdot 500$

Hamburgers 100 = $\frac{20}{100} \cdot 500$

Other 80 = $\frac{16}{100} \cdot 500$

2) Manny surveyed 24 of his classmates about their vacation plans. The bar graph shows the results.

Plans for Winter Vacation



Manny's class is representative of the entire school. What is a reasonable estimate for how many of the 360 students in the school plan to do the following:

Visit friends or family 150 = $\frac{10}{24} \cdot 360$

No plans 90 = $\frac{6}{24} \cdot 360$

Travel 120 = $\frac{8}{24} \cdot 360$

Predictions From Samples Homework:

- 1) Cafeteria workers at the Wentworth School surveyed 100 students to find out which lunch items they liked best. The results are shown in the table.

| Lunch | Number of Students |
|----------------|--------------------|
| Pizza | 34 |
| Mac and Cheese | 30 |
| Hamburgers | 20 |
| Other | 16 |

Using the sample above, make predictions about the following items:

If the school has 250 students, predict the number of students that will prefer:

Pizza _____

Mac and Cheese _____

Hamburgers _____

Other _____

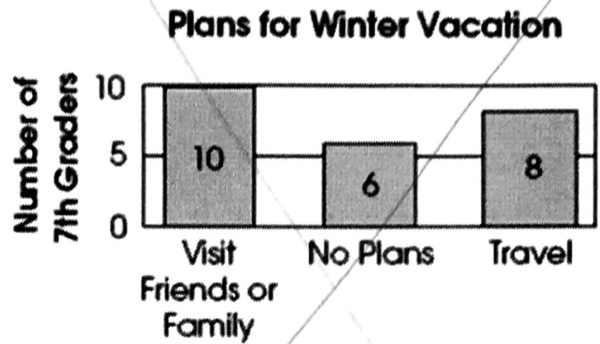
- 3) A pizza shop wants to determine how often it delivers to three different areas of a city. The table shows the areas from a random sample of 80 deliveries.

| Area of City | Number of Deliveries |
|--------------|----------------------|
| Northern | 14 |
| Central | 44 |
| Southern | 22 |

Based on these data, if the driver makes 200 deliveries, how many deliveries will be to the southern area of the city?

Name _____

- 2) Manny surveyed 24 of his classmates about their vacation plans. The bar graph shows the results.



Manny's class is representative of the entire school. What is a reasonable estimate for how many of the 300 students in the school plan to do the following:

Visit friends or family _____

No plans _____

Travel _____

- 4) The transportation department has selected three possible routes for a new section of highway and wants to know which route landowners and residents of the affected areas prefer. The transportation department plans to survey the public by posting the three possible routes on the department's Web site with a request that all visitors to the Web site vote for their preferred route. Does this survey provide a valid representative sample of the landowners and residents of the affected area? **Explain.**

No, unless prompted to visit the website, a large amount of the population would likely not be surveyed.