

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Welcome to A.P. Statistics!

Requirements for the course:

Graphing Calculator (*TI-84 or TI-84 Plus versions*) **You will be using this calculator almost everyday.*

Notebook *dedicated to the course*

Summer Work Assignments include:

A Reading Section - *this is intended to review things you have learned in previous math classes and teach you the new statistical concepts*

Note Taking Instructions - *this section gives you the terms and ideas you need to define in your notebook. These concepts will be used throughout our class.*

Problem Set - *you are expected to complete each problem set on a separate piece of paper to be turned in.*

The work is due on the **first day of class**. Do not wait until the last minute to complete this packet. Pace yourself throughout the summer and complete this over an extended period of time. This summer work will be worth a quiz grade (based on the accuracy of your responses and completion). All work should be shown in a neat and orderly fashion on separate pieces of paper. Notes and definitions should be written in your notebook. You will need to bring your work packet and statistics notebook to class on the first day. We will be highlighting key concepts covered in the packet in class during the first two weeks of school.

Have a restful, safe, and enjoyable summer! You may reach me at my email (ddarabus@sscps.org) with any questions.

I look forward to a great year.

Donika

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Part I – Math Skills Review

1. Solve each equation/inequality on a separate sheet of paper:

a. $2\sqrt{x} + 9 = 21$

b. $\sqrt{2x+10} = x+1$

c. $2|x-1| = 14$

d. $4(x-2) = 3^2 - x$

e. $\frac{1}{3}n + 3 - n - 2$

f. $9(2p+1) - 3p > 4p - 6$

g. $\frac{2}{3}y = \frac{8}{13}$

h. $x^2 - 8x + 7 = 0$

i. $\frac{m}{12} + \frac{5}{6} = \frac{5}{24}$

j. $\frac{1}{2}x^2 - 8 = 0$

k. $-3x^2 + 343 = 0$

l. $3(q - 12) \leq 5q + 2$

m. $y = 8^{\frac{2}{3}}$

n. $9^x = 81$

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

2. Write equations of the horizontal and vertical lines that pass through the point $(-3, 4)$.

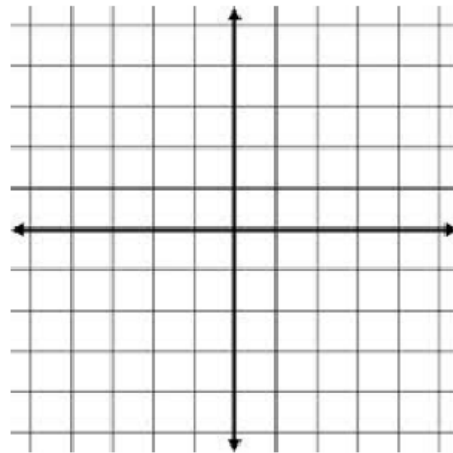
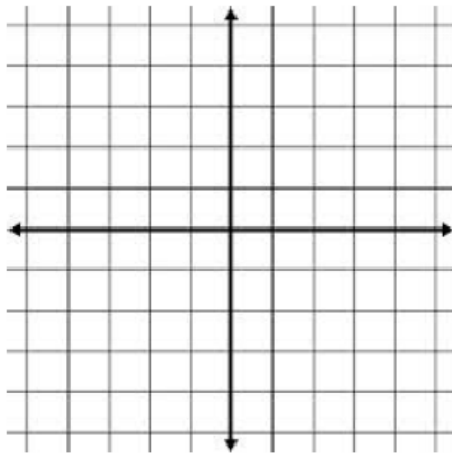
Horizontal: _____

Vertical: _____

3. Find the slope and y-intercept of the line. Sketch the line.

a. $y = \frac{2}{3}(2x - 4)$

b. $\frac{1}{3}y - 6x = 4$



4. Find the slope and write the equation of the line containing the points $(6, -2)$ and $(0, 5)$.

5. What is the slope of the line that is parallel to $2x + 3y = 9$?

A.P. Statistics Summer Work

South Shore Charter Public School

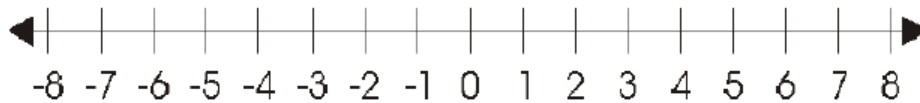
Teacher: Donika Darabus (ddarabus@sscps.org)

6. What is the slope of the line that is perpendicular to the line $y = \frac{5}{2}x + 2$?

7. A line has the equation $y = 2x - 3$. Does the point $(4,3)$ lie on this line? Justify.

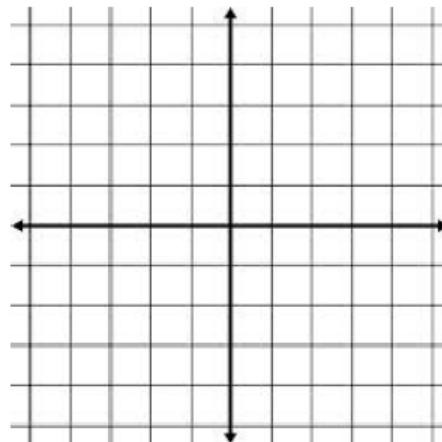
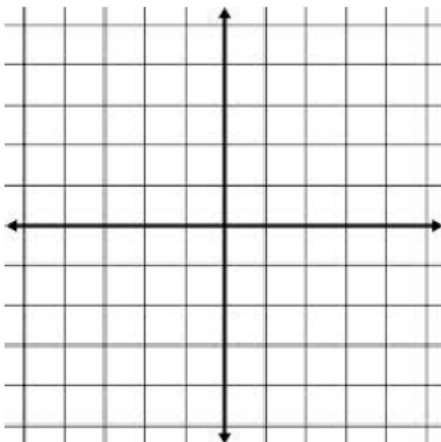
8. Solve and graph each inequality.

a. $|x - 2| < 4$



b. $-2x + 3y > x + 9$

c. $-y > 3x - 1$



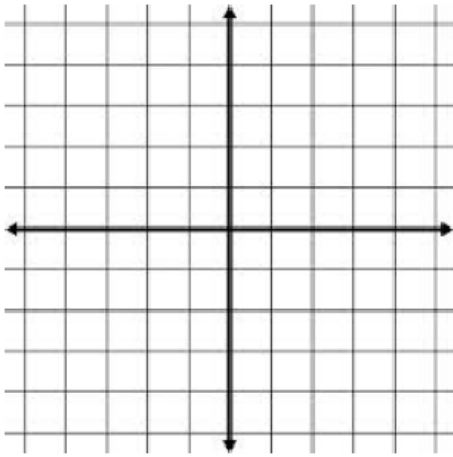
A.P. Statistics Summer Work

South Shore Charter Public School

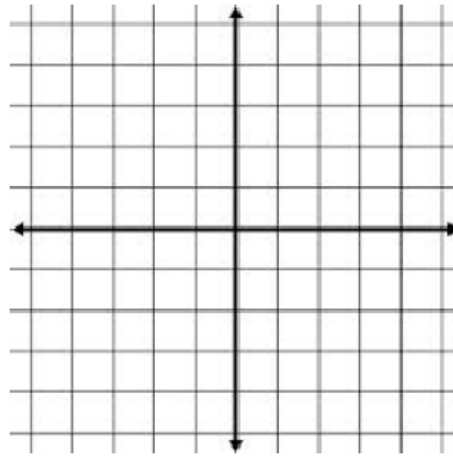
Teacher: Donika Darabus (ddarabus@sscps.org)

9. Plot the data using a scatter plot then decide if the data is linear, exponential, quadratic, or absolute value. Label each scatterplot.

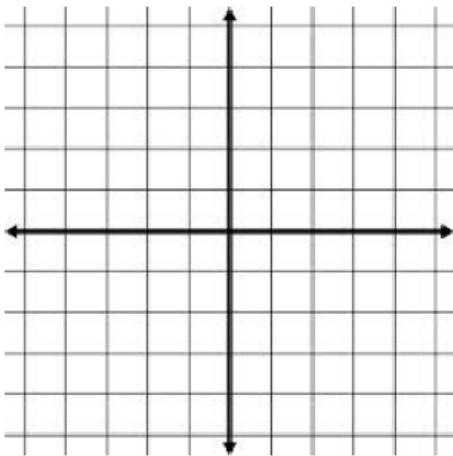
- a. $(-3, 4)$ $(-2, 3.5)$ $(-1, 3)$ $(0, 2.5)$ $(1, 2)$ $(2, 1.5)$ $(3, 1)$
- b. $(-3, 4)$ $(-2, 3)$ $(-1, 2)$ $(0, 1)$ $(1, 2)$ $(2, 3)$ $(3, 4)$
- c. $(-3, 4)$ $(-2, 2)$ $(-1, 1)$ $(0, \frac{1}{2})$ $(1, \frac{1}{4})$ $(2, \frac{1}{8})$ $(3, \frac{1}{16})$
- d. $(-3, 4)$ $(-2, \frac{7}{3})$ $(-1, \frac{4}{3})$ $(0, 1)$ $(1, \frac{4}{3})$ $(2, \frac{7}{3})$ $(3, 4)$



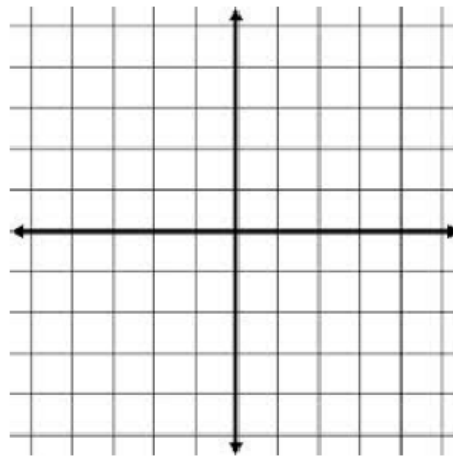
a. _____



b. _____



c. _____



d. _____

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

10. For each function, find $f(x)$ for $x = -3, 0,$ and 2 .

a. $f(x) = 4x - 2$

b. $f(x) = (x - 3)^2 + 1$

$f(-3) =$ _____

$f(-3) =$ _____

$f(0) =$ _____

$f(0) =$ _____

$f(2) =$ _____

$f(2) =$ _____

11. Evaluate $g(f(-2))$ and $f(g(3))$ for each of the following functions.

a. $f(x) = 3x; g(x) = 2x + 3$

$g(f(-2)) =$ _____

$f(g(3)) =$ _____

b. $f(x) = -x; g(x) = x^2 + 5$

$g(f(-2)) =$ _____

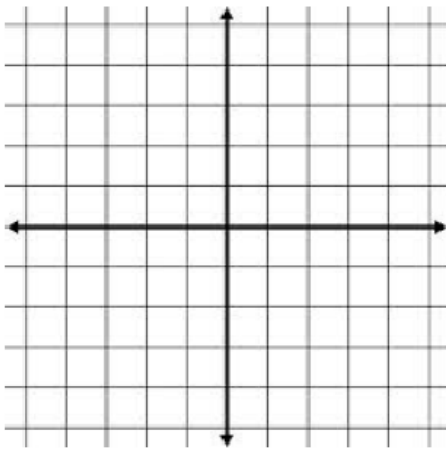
$f(g(3)) =$ _____

A.P. Statistics Summer Work

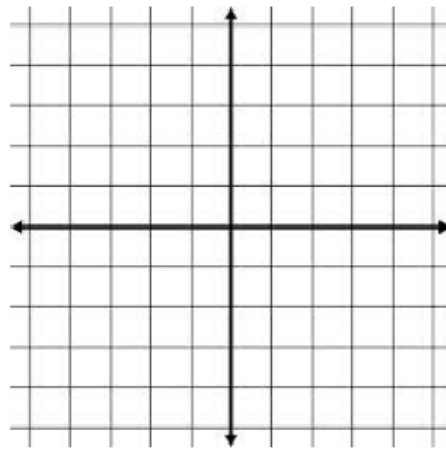
South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

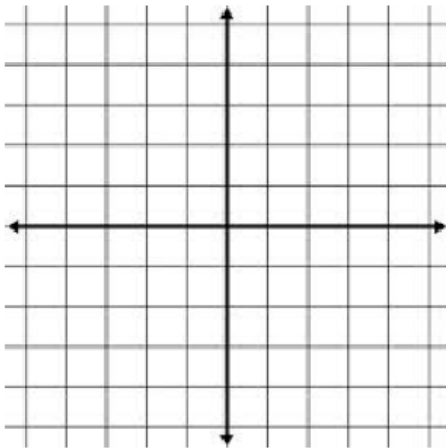
12. Sketch each of the following on the grids provided. You may use your calculator to help you, but you should label important features such as x/y intercepts, max/mins, etc. Be sure to include a scale on your graphs.



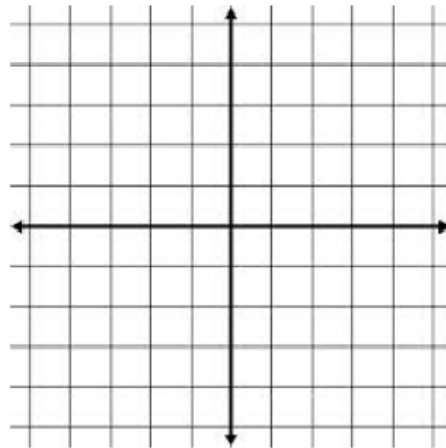
a. $y = -x^2 + 2$



b. $y = 3|x - 2| + 1$



c. $y = \sqrt{x - 9}$



d. $y = 4^x - 2$

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

13. Each of the members of a recent high school graduating class was asked to name his/her favorite among these subjects: English, foreign language, history, mathematics, science. The results are shown in the table. Construct a bar graph that shows these results. Label your axes.

| | |
|------------------|----|
| English | 62 |
| Foreign Language | 40 |
| History | 40 |
| Mathematics | 18 |
| Science | 33 |

14. Find a set of numbers that will satisfy the following conditions:
- The median of a set of 20 numbers is 24.
 - The range is 42.
 - To the nearest whole number the mean is 24.
 - No more than three numbers are the same.
 - Show your strategy!

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Part II – Basic Probability Review

15. A special lottery is to be held to select the student who will live in the only deluxe room in a dormitory. There are 100 seniors, 150 juniors, and 200 sophomores who applied. Each senior's name is placed in the lottery 3 times; each junior's name, 2 times; and each sophomore's name, 1 time. What is the probability that a senior's name will be chosen?
- A. $1/8$ B. $2/9$ C. $2/7$ D. $3/8$ E. $1/2$
16. Which of the following has a probability closest to 0.5?
- A. The sun will rise tomorrow.
B. It will rain tomorrow.
C. You will see a dog with only three legs when you leave the room.
D. A fair die will come up with a score of 6 four times in a row.
E. There will be a plane crash somewhere in the world within the next five minutes.
17. A famous advertisement reads "4 out of 5 dentists surveyed recommend Brand X Sugarless gum for their patients who chew gum." What is the best interpretation of this claim?
- A. That 80% of dentists recommend that their patients chew gum.
B. That of the 5 dentists surveyed, 4 of them recommend Brand X gum.
C. That while dentists don't generally recommend that their patients chew gum, for those that insist on doing so, 80% of them recommend Brand X.
D. 80% of all dentist patients chew gum.
18. The probability of flipping a coin and getting heads is 0.5. What does this mean?
- A. Every time you flip a coin, you'll get exactly 0.5 heads.
B. Over time, you can expect 50% of all coin tosses to be heads.
C. For every two coins you toss, you'll get one head.
D. You have to toss a coin more than 10 times to see these results, but once you do, you'll get an equal number of heads and tails.
19. Which of the following is NOT a plausible probability?
- A. 0
B. 0.0001
C. 0.50
D. 0.998
E. 1.01

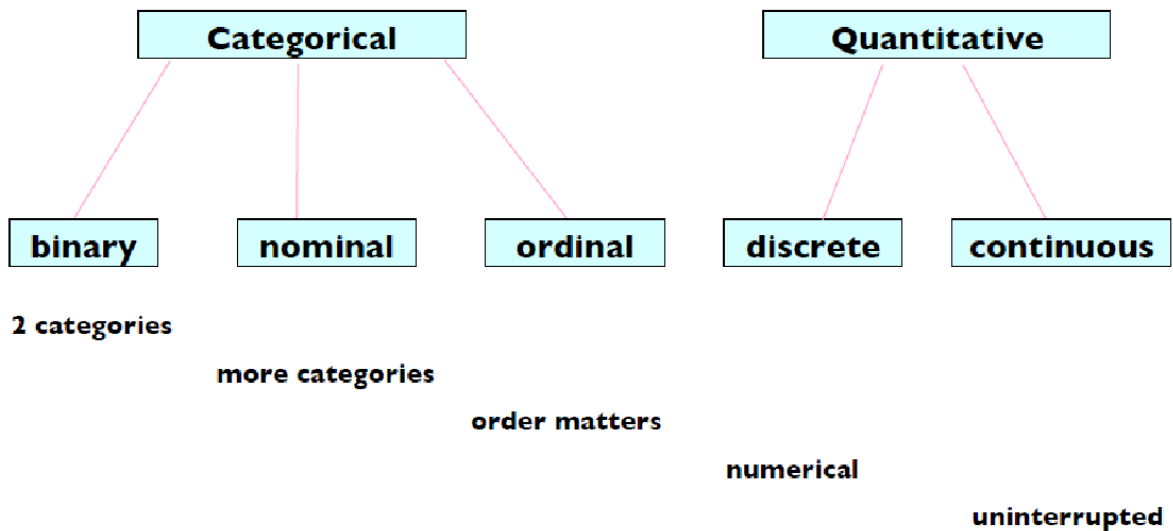
A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Part III – Exploratory Data Introduction

Types of Data



A categorical/qualitative variable places an individual into one of several groups or categories

- examples: Gender, Race, Job Type, Geographic location...
- These are *nominal*

A quantitative variable takes numerical values for which arithmetic operations such as adding and averaging make sense

- examples: Height, Age, Salary, Price, Cost...
- Can be further divided to ordinal and continuous

Both types require their own summaries (graphically and numerically) and analysis.

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Histograms

- The purpose of a graph is to help us understand the data
- We will describe the features of the distribution that the histogram is displaying with three characteristics

1. Shape

- Symmetric, skewed right, skewed left, uni-modal, multi-modal, bell shaped

2. Center

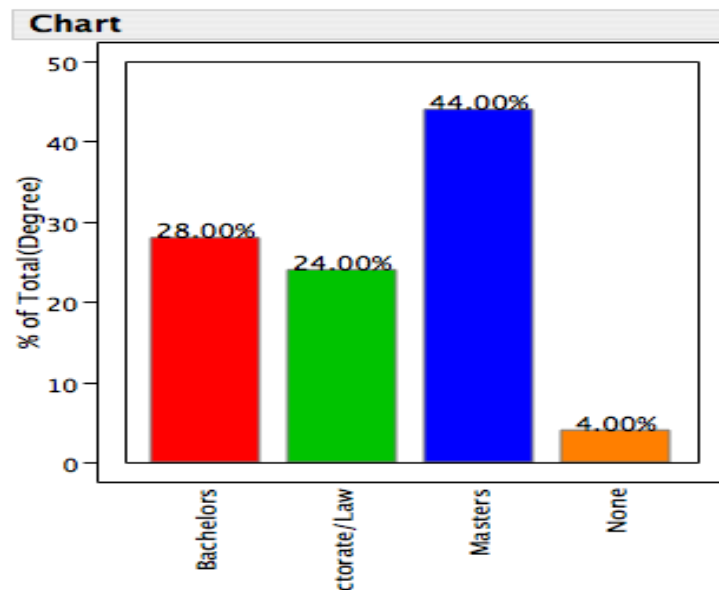
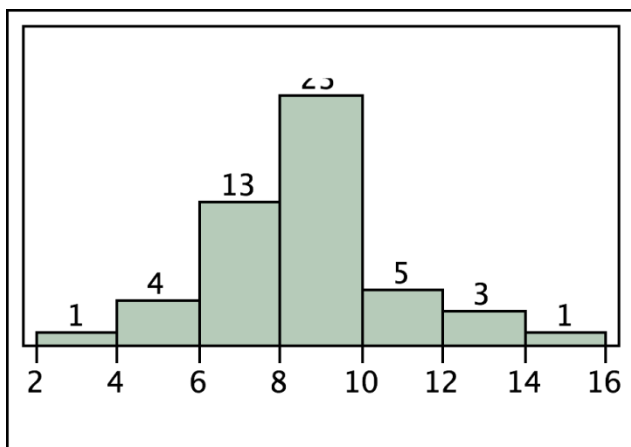
- Mean, median

3. Spread (outliers or not)

- Standard deviation, Inter-quartile range

Histograms vs. Bar Graphs

- Spaces mean something in histograms but not in bar graphs
- Shape means nothing with bar graphs
- The biggest difference is that they are displaying fundamentally different types of variables

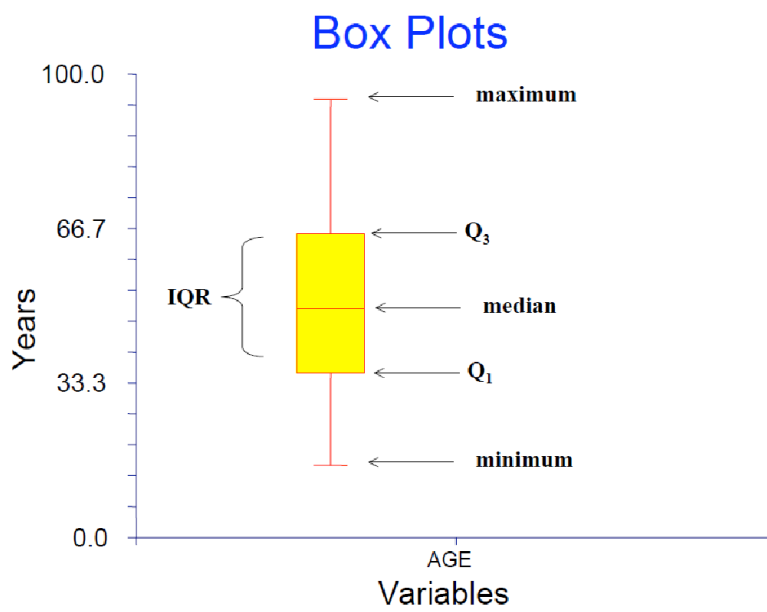


A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Box Plots

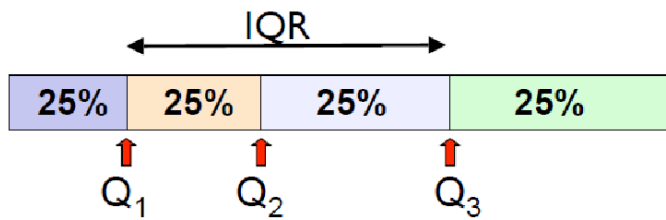


A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Scale: Quartiles and IQR



- The first quartile, Q_1 , is the value for which 25% of the observations are smaller and 75% are larger
- Q_2 is the same as the median (50% are smaller, 50% are larger)
- Only 25% of the observations are greater than the third quartile

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Stemplots

A stemplot is used to display quantitative data, generally from small data sets (50 or fewer observations). The stemplot below shows IQ scores for 30 sixth graders.

| Stems | Leaves |
|--------------|---------------------|
| 15 | 1 |
| 14 | |
| 13 | |
| 12 | 2 6 |
| 11 | 4 5 7 9 |
| 10 | 1 2 2 2 5 7 9 9 |
| 9 | 0 2 3 4 4 5 7 8 9 9 |
| 8 | 1 1 4 7 8 |

Key: 11 | 7 represents an IQ score of 117

- In a stemplot, the entries on the left are called stems; and the entries on the right are called leaves. In the example above, the stems are tens (8 represents 80, 9 represents 90, 10 represents 100, and so on); and the leaves are ones. However, the stems and leaves could be other units - millions, thousands, ones, tenths, etc.
- Some stemplots include a key to help the user interpret the display correctly. The key in the stemplot above indicates that a stem of 11 with a leaf of 7 represents an IQ score of 117.
- Looking at the example above, you should be able to quickly describe the distribution of IQ scores. Most of the scores are clustered between 90 and 109, with the center falling in the neighborhood of 100. The scores range from a low of 81 (two students have an IQ of 81) to a high of 151. The high score of 151 might be classified as an **outlier**.
 - An extreme value is considered to be an **outlier** if it is at least 1.5 interquartile ranges below the first quartile (Q1), or at least 1.5 interquartile ranges above the third quartile (Q3).

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Numerical summaries of quantitative variables

- Want a numerical summary for center and spread
 - Center: Mean, Median
 - Spread: Range, Inter-quartile range, Standard deviation
 - 5 number summary is a popular collection of the following: minimum, 1st quartile (Q1), median, 3rd quartile(Q3), maximum

Mean

To find the *mean* of a set of observations, add their values and divide by the number of observations

Example: The average age of 20 people in a room is 25. A 28 year old leaves while a 30 year old enters the room.

- Does the average age change?
- If so, what is the new average age?

Median

The *median* is the midpoint of a distribution

- The number such that half the observations are smaller and the other half are larger
- Also called the 50th percentile or 2nd quartile

To compute a median:

- Order observations
- If number of observations is odd the median is the center observation
- If number of observations is even the median is the average of the two center observations

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Example: The median age of 21 people in a room is 25. A 28 year old leaves while a 30 year old enters the room.

- Does the median age change?
- If so, what is the new median age?

Mean vs Median

- When histogram is symmetric mean and median are similar
- Mean and median are different when histogram is skewed
 - Skewed to the right mean is larger than median
 - Skewed to the left mean is smaller than median

Example: The business magazine Forbes estimates that the “average” household wealth of its readers is either about \$800,000 or about \$2.2 million, depending on which “average” it reports. Which of these numbers is the mean wealth and which is the median wealth? Why?

Measures of spread

- Range: subtract the largest value from the smallest
- Interquartile range:
 - subtract the 3rd quartile from the 1st quartile
 - Standard Deviation (SD): “average” distance from the mean

Standard Deviation

- The standard deviation looks at how far observations are from their mean
- It is the square root of the average squared deviations from the mean
- Compute distance of each value from mean
- Square each of these distances
- Take the average of these squares and square root

A.P. Statistics Summer Work

South Shore Charter Public School

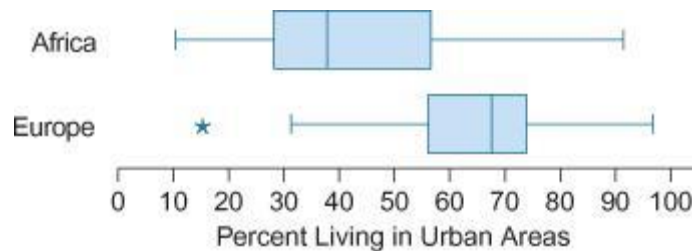
Teacher: Donika Darabus (ddarabus@sscps.org)

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

-
- Often we will use SD or S to denote standard deviation

Part IV - Problem Set

1. Display 2.61 shows parallel boxplots of the percentages of people living in urban areas for countries of Europe and countries of Africa. Describe the data distributions as well as the key differences in shape, center, and spread between the two continents. The outlier is Liechtenstein.



Display 2.61

Percentage of residents living in urban areas.[Source: Population Reference Bureau, *World Population Data Sheet*, 2008.]

2. Verify that the sum of the deviations from the mean is 0 for the numbers 1, 2, 4, 6, and 9.

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

Find the standard deviation.

3. Without computing, match each list of numbers in the top column with its standard deviation in the bottom column. Check any answers you aren't sure of by computing.

a. 1 1 1 1

b. 1 2 2

c. 1 2 3 4 5

d. 10 20 20

e. 0.1 0.2 0.2

f. 0 2 4 6 8

g. 0 0 0 0 5 6 6 8 8

i. 0

ii. 0.058

iii. 0.577

iv. 1.581

v. 3.162

vi. 3.606

vii. 5.774

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

4. How did family sizes change over the years from 1967 to 2007? Display 2.64 shows the data on family size for two representative sets of 100 families each, one from 1967 and one from 2007. (The U. S. Census Bureau defines a family as two or more people related by birth, marriage, or adoption living together.)

| Family Size | 1967 | 2007 |
|-------------|------|------|
| 2 | 33 | 45 |
| 3 | 21 | 22 |
| 4 | 19 | 20 |
| 5 | 13 | 8 |
| 6 | 7 | 3 |
| 7 | 5 | 1 |
| 8 | 2 | 1 |

**Display
2.64**

Family sizes for representative samples of 100 families in two different years.

[Source: U.S. Census Bureau.]

- Sketch a histogram of family size for each year and comment on how the distribution changed from 1967 to 2007.
- Use the formulas for the mean and standard deviation of values in a frequency table to compute the mean and standard deviation of the family sizes for each year. Compare.

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

5. The stemplot of average mammal longevities is shown in Display 2.63



**Display
2.63**

Average longevity (in years) of 38 mammals.

- Use the stemplot to find the five-number summary.
- Find the *IQR*.
- Compute $Q_1 - 1.5 \cdot IQR$. Identify any outliers (give the animal name and longevity) at

A.P. Statistics Summer Work

South Shore Charter Public School

Teacher: Donika Darabus (ddarabus@sscps.org)

the low end.

d. Identify any outlier at the high end and the largest nonoutlier.

e. Draw a boxplot.