First Test

Mon. Sept. 16

x 5 62 10 33 2

positions

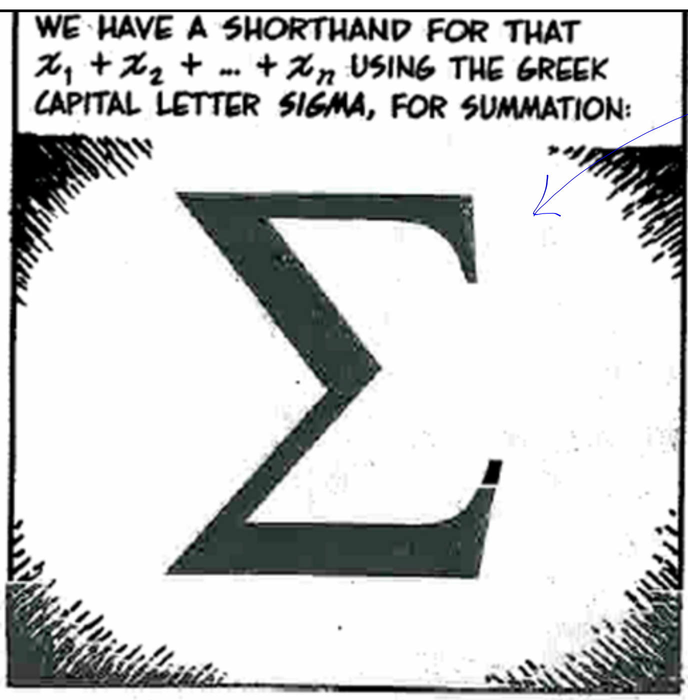
1 2 3 4 5 ... n

x 5 62 10 33 2 ... x_n

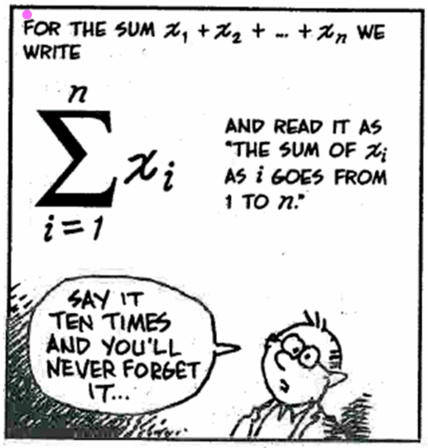
x_i

$x_2 = 62$ $x_5 = 2$

x_i



Means "Add Up"



5 62 10 33 2

$$\sum_{i=1}^{4} x_n$$

5 62 10 33 2 ... x

$$\sum_{i=1}^{n} x_i$$

Mean

$$\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{1}{n}\sum x^2$$

$$\frac{5x^2}{7} = \frac{1}{7}5x^2$$

Speaking of Formulas

The official Formula Sheet ← can be used on both parts of AP exam

→ Appendix F-1 ← has changed this summer

Aim

- Describe quantitative data.
- Calculate measures of center and variability.
- Explain how skewness affects those measures.

Measures of Center

Mean
Median

Measures of Variability

Range

Measures of Center

Mean
Median

Measures of Variability

Range
IQR
Variance
Standard Deviation

How many colleges are you applying to? 1.3 Day 1

How many different colleges is your group of 4 applying to? Find the total number of colleges for your whole group.

1. Record the data for the class here.

11 17

5

17

---

11 5 17 17

2. Calculate the **mean** and **median** for the set of data. Compare them.

$\bar{x} = \frac{11+5+17+17}{4} = 12.5$ colleges

5 11 | 17 17

med = 14 colleges

3. What is the **range** of the data?

$17-5 = 12$ colleges

single value

Finding Standard Deviation

4. Finding range is helpful but it does not tell us how spread out the data is between the minimum and maximum. How can we find the ***average distance of the values from the mean?***

a. Complete the table.

Value	Distance from mean	(Distance from mean)^2
5	$5-12.5=-7.5$	$(-7.5)^2 = 56.25$
11	$11-12.5=-1.5$	$(-1.5)^2 = 2.25$
17	$17-12.5=4.5$	$(4.5)^2 = 20.25$
17	$17-12.5=4.5$	$(4.5)^2 = 20.25$
	Total:	99
	Average (Distance from mean)^2:	$99/4 = 24.75$ colleges^2

b. The average you calculated is the average of the **squared distances** from the mean. How do we use this to find the **average distance from the mean**? Find it.

A $\cancel{\sqrt{\frac{99}{4}} = 4.97}$ colleges

B $\sqrt{\frac{99}{3}} = 5.74$ colleges

divide by n-1, not n

5. Go to stapplet.com. Enter the classroom data and find the summary statistics. Verify our work. How does it compare?

6. We forgot to add Mr Cedarlund. He applied to 20 colleges. Add his to the data set. Calculate the new mean, median and standard deviation using the applet. How does it compare to the original measures? Why do you think this is?

New mean $\bar{x} = 14$ colleges

median $= 17$ coll

Std. Dev $S = 6$ colleges

We'll formalize out to the left side as we go.

Let's go back
& formalize
a few things

Describing Quantitative Data with Numbers

Big Ideas:

Mean

$= \dfrac{\text{Sum of data}}{\text{\# of data}}$

Describing Quantitative Data with Numbers

Big Ideas:

Mean

$= \frac{\text{Sum of data}}{\text{\# of data}}$

Use with Symmetric Data

Describing Quantitative Data with Numbers

Big Ideas:

Mean

$= \frac{\text{Sum of data}}{\text{\# of data}}$

Use with Symmetric Data

Median

middle point of a distribution

Describing Quantitative Data with Numbers

Variability

Big Ideas:

Mean

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Describing Quantitative Data with Numbers

Variability

Big Ideas:

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Use with Symmetric Data

Median

middle point of a distribution

Range

IQR

Standard Deviation

Describing Quantitative Data with Numbers

Big Ideas:

Mean

$= \frac{\text{Sum of data}}{\text{\# of data}}$

Use with Symmetric Data

Median

middle point of a distribution

Variability

Range = max − min

IQR = Interquartile range

$Q_3 - Q_1$

Standard Deviation

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

4) Add all the squared deviations, divide by n – 1, and take the square root.

$$s_x = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \cdots + (x_n - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum (x_i - \bar{x})^2}{n-1}}$$

$$\frac{6x^2}{7}$$

$$\frac{1}{7} \cdot 6x^2$$

Measuring Variability: The Standard Deviation

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

The **standard deviation** measures the typical distance of the values in a distribution from the mean.

or

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

Describing Quantitative Data with Numbers

Big Ideas:

Mean

$\frac{\text{Sum of data}}{\text{\# of data}}$

Use with Symmetric Data

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middle point of a distribution

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Standard Deviation

$$S_x = \sqrt{\frac{\Sigma (x_i - \bar{x})^2}{n-1}}$$

The context typically varies by S_x from the mean of $\bar{x}$

Describing Quantitative Data with Numbers

Big Ideas:

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$\frac{\text{Sum of data}}{\text{\# of data}}$

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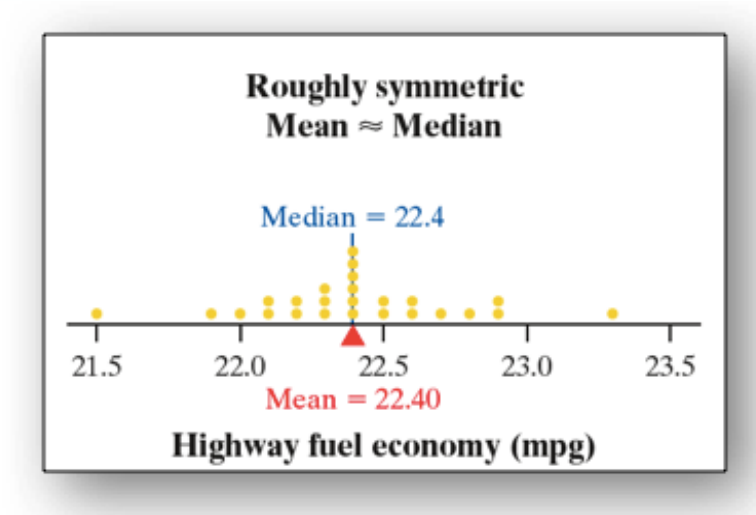
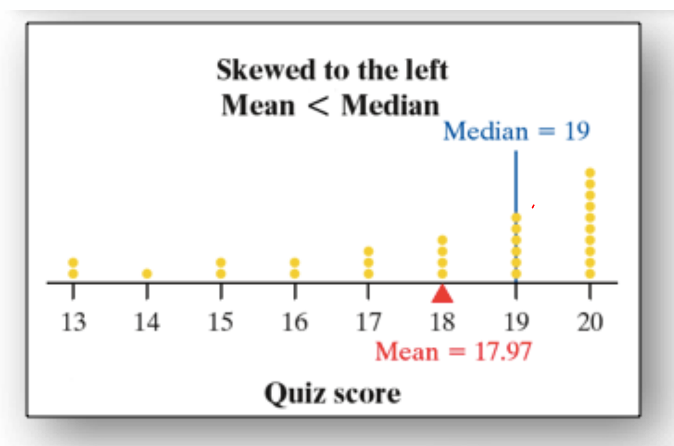
Mean and Std. Dev are greatly influenced by extremes. (non-resistant)

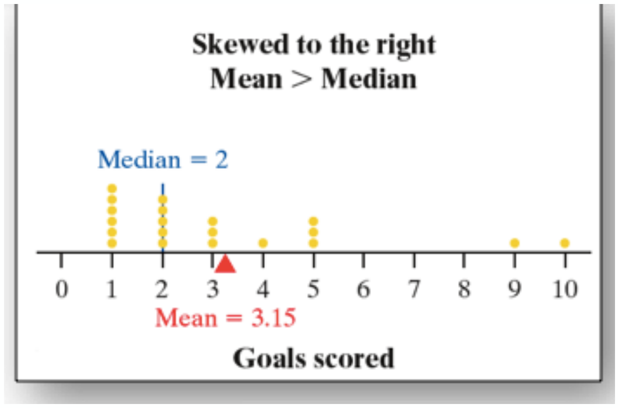
For skewed data, Use median.

For Symmetric data, Use mean/SD

Std. Dev


Roughly symmetric
Mean ≈ Median
Median = 22.4
21.5
22.0
22.5
23.0
23.5
Mean = 22.40
Highway fuel economy (mpg)


Skewed to the left
Mean < Median
Median = 19
13
14
15
16
17
18
19
20
Mean = 17.97
Quiz score



AP Exam Tip

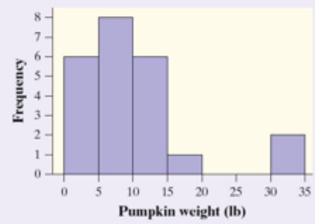
If students are asked to choose between the mean and median as a measure of center, be sure they justify their choice ***based on the shape of the distribution*** and **whether there are any possible outliers**

Check Your Understanding:

Some students purchased pumpkins for a carving contest. Before the contest began, they weighed the pumpkins. The weights in pounds are shown here, along with a histogram of the data.

1. Calculate the mean weight of the pumpkins. Use your graphing calculator and enter the values into list 1.

3.6	4.0	9.6	14.0	11.0	12.4	13.0	2.0	6.0	6.6	15.0	3.4
12.7	6.0	2.8	9.6	4.0	6.1	5.4	11.9	5.4	31.0	33.0	



2. Find the median weight of the pumpkins.

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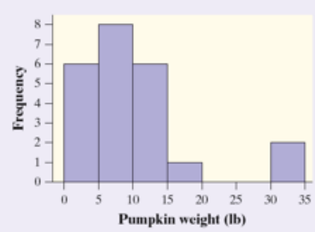
12.7	6.0	2.8	9.6	4.0	6.1	5.4	11.9	5.4	31.0	33.0	

$$\bar{X} = \frac{3.6 + 4.0 + \dots 33}{23}$$

$= 9.935$ pounds

9.94 lbs



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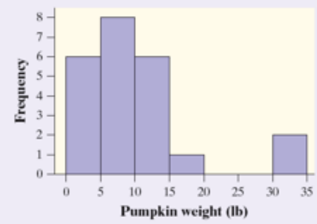

$$\bar{X} = \frac{3.6 + 4.0 + \cdots 33}{23}$$

$= 9.935$ pounds

9.94 context

2. Find the median weight of the pumpkins.

23 pieces of data

$\frac{23+1}{2} = 12$

So find the 12th weight

Check Your Understanding:

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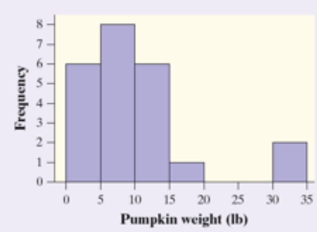

$$\bar{X} = \frac{3.6 + 4.0 + \cdots 33}{23}$$

$= 9.935$ pounds

context

2. Find the median weight of the pumpkins.

23 pieces of data

$\frac{23+1}{2} = 12$

So find the 12th weight $\approx$ 6.6 pounds

3. Would you use the mean or the median to summarize the typical weight of a pumpkin in this contest? Explain.

Median because there seems to be an outlier

4. **Calculate** and **interpret** the standard deviation (with your graphing calculator) of the weight of pumpkins.

The context typically varies by S_x from the mean of $\bar{x}$

3. Would you use the mean or the median to summarize the typical weight of a pumpkin in this contest? Explain.

I would use the median because the distribution is skewed right with possible outliers.

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I Would use the median because the distribution is skewed right. with possible outliers.

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$S_x = 8.01$ lbs

3. Would you use the mean or the median to summarize the typical weight of a pumpkin in this contest? Explain.

I Would use the median because the distribution is skewed right. with possible outliers.

4. **Calculate** and **interpret** the standard deviation (with your graphing calculator) of the weight of pumpkins.

$S_x = 8.01$ lbs

The weight typically varies by 8.01 lbs from the mean (9.9 lbs)

B.B.

The value before taking the square root is known as the....

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

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

$$s_x = \sqrt{\frac{18}{11-1}} = 1.34 \text{ close friends}$$

The value obtained before taking the square root in the standard deviation calculation is known as the **variance**.

$$s_x^2 = \frac{\sum (x_i - \bar{x})^2}{n-1} = \frac{18}{11-1}$$

= 1.80 *squared close friends*

IQR

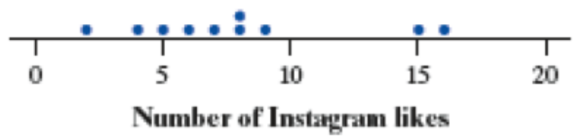
be sure to read the details on quartiles

pp. 63 to 65

Find the Interquartile Range

2 4 5 6 7

8 8 9 15 16



$\frac{21}{24}$

See your LCQ

$\frac{13}{15}$

but all LCQ's get scaled to 10.

A copy of the solutions will be given to each group.

Assignment

1.3....87, 89, 91, 95, 97, 101, 103, 105, 121

and study pp. 54-66