Describing Data

Variations (Spread)

Name:

A company is shooting a commercial and asked two different modeling agencies to send them a group of 5 models with an average age 17.

The company "**Modeling Marvels Agency**" sent 5 models with the following ages: **16, 16, 15, 17, and 21.**

The company "**Acting Up Models Inc.**" sent 5 models with the following ages: **3, 5, 6, 31, and 40.**

1. Did each company correctly send a group of 5 models with an average age of 17?

MMA

$\text{MEAN}(\bar{x}) = \frac{16+16+15+17+21}{5} = \frac{85}{5} = 17$

AUM

$\text{MEAN}(\bar{x}) = \frac{(3+5+6+31+40)}{5} = \frac{85}{5} = 17$

2. What would you describe as being the most different between the two groups and how might you quantify this?

RANGE = HIGHEST DATA VALUE - LOWEST DATA VALUE

MMA (RANGE) = $\underset{\text{HIGH}}{21} - \underset{\text{LOW}}{15} = 6$

AUM (RANGE) = $\underset{\text{HIGH}}{40} - \underset{\text{LOW}}{3} = 37$

Two competing companies design similar android phones. A magazine is writing a review on the two companies and sampled 7 phones from each company to determine their battery life to the nearest hour while watching streaming videos:

Simsong's Universe 4 Android Phone Battery life sample: 3 hrs, 3 hrs, 4 hrs, 5 hrs, 6 hrs, 7 hrs, 7 hrs

Q1 MED Q3

Motovola's Void 5 Phone Battery life sample: 1hr , 1hr, 2hrs , 6hrs , 8hrs, 10hrs, 14hrs

Q1 MED Q3

3. What is the **mean** of each sample of phones?

$\text{UNIV}(\bar{x}) = \frac{3+3+4+5+6+7+7}{7} = \frac{35}{7} = 5\text{hr}$

$\text{VOID}(\bar{x}) = \frac{1+1+2+6+8+10+14}{7} = \frac{42}{7} = 6\text{ hrs}$

4. What is the **median** of each sample of phones?

UNIV (MEDIAN) = 5 hrs

VOID (MEDIAN) = 6 hrs

5. What is the **range** of each sample of phones?

UNIV (RANGE) = 7-3 = 4 hrs

VOID (RANGE) = 14-1 = 13 hrs

6. What is the **lower quartile (Q1)** of each sample of phones?

UNIV (Q_1) = 3 hrs

VOID (Q_1) = 1

7. What is the **upper quartile (Q3)** of each sample of phones?

UNIV (Q_3) = 7 hrs

VOID (Q_3) = 10

8. What is the **inner quartile range (IQR)** of each sample of phones?

UNIV (IQR) = $Q_3 - Q_1$ = 7-3 = 4 hrs.

VOID (IQR) = 10 - 1 = 9 hrs

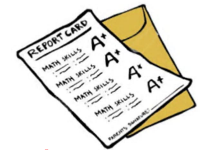
~~80~~, 81, 82, ~~90~~ | ~~90~~, 98, 99, ~~100~~ ~~89~~, 89, 90, ~~90~~ | ~~90~~, 90, 91, ~~91~~

MED Q1 MED 90.5

A math teacher must make a recommendation for a $2000 scholarship to a local chamber of commerce. The teacher has two students in mind **Alan** and **Brianna**. The teacher decides to let their grades be the determining factor.
Here are their test scores for the semester:

Alan: *90, 90, 80, 100, 99, 81, 98, 82* ***Brianna***: *90, 90, 91, 89, 91, 89, 90, 90*

~~80, 81, 82~~, 90, 90, ~~98, 99, 100~~ ~~89, 89, 90~~, 90, 90, ~~90, 91, 91~~



1. Which student has the higher arithmetic **mean**, (average $(\bar{X})$)?

ALAN $(\bar{x})$: $\frac{90+90+80+100+99+81+98+82}{8} = 90$ BRI $(\bar{x}) = \frac{90+90+91+89+91+89+90+90}{8} = 90$

2. Which student has the higher **median**?

ALAN (MED): $\frac{90+90}{2} = 90$ BRI (MED): $\frac{90+90}{2} = 90$

3. What might be the problem of using these measures of central tendency?

BOTH MEASURES OF CENTER ARE THE SAME FOR BOTH STUDENTS

4. What is **RANGE** of the data set?

ALAN (RANGE) = 100 - 80 = 20

BRI (RANGE) = 91 - 89 = 2

5. What is the **IQR** of each data set?

ALAN $(Q_1) = \frac{81+82}{2} = 81.5$ BRI $(Q_1) = \frac{89+90}{2} = 89.5$

ALAN $(Q_3) = \frac{98+99}{2} = 98.5$ BRI $(Q_3) = \frac{90+91}{2} = 90.5$

6. Consider using the measures of variability (or measures of spread) as a possible determining factor for the scholarship recipient.

ALAN (IQR) = 98.5 - 81.5 = 17 BRI (IQR) = 90.5 - 89.5 = 1

a. Find Mean Deviation b. Find Variance, σ^2. c. Find Standard Deviation.

$$\left(\frac{\sum_{i=1}^{n}|X_i-\bar{X}|}{n}\right) \qquad \left(\frac{\sum_{i=1}^{n}(X_i-\bar{X})^2}{n}\right) \qquad \left(\sqrt{\frac{\sum_{i=1}^{n}(X_i-\bar{X})^2}{n}}\right)$$

Alan's Data (X_i)	$X_i-\bar{X}$ DEVIATION	$\lvert X_i-\bar{X}\rvert$ |DEVIATION|	$(X_i-\bar{X})^2$ (DEVIATION)^2
90	-90 = 0	0	$0^2 = 0$
90	-90 = 0	0	$0^2 = 0$
80	-90 = -10	10	$(-10)^2 = 100$
100	-90 = 10	10	$(10)^2 = 100$
99	-90 = 9	9	$(9)^2 = 81$
81	-90 = -9	9	$(-9)^2 = 81$
98	-90 = 8	8	$(8)^2 = 64$
82	-90 = -8	8	$(-8)^2 = 64$
MEANS:	$\frac{0}{8} = 0$	$\frac{54}{8} = 6.75$	$\frac{490}{8} = 61.25$
	Should be Zero	*Mean Deviation*	*Variation*

$\sqrt{61.25} \approx 7.83$ *Standard Deviation*

Brianna's Data (X_i)	$X_i-\bar{X}$	$\lvert X_i-\bar{X}\rvert$	$(X_i-\bar{X})^2$
90	-90 = 0	0	$0^2 = 0$
90	-90 = 0	0	$0^2 = 0$
91	-90 = 1	1	$(1)^2 = 1$
89	-90 = -1	1	$(-1)^2 = 1$
91	-90 = 1	1	$(1)^2 = 1$
89	-90 = -1	1	$(-1)^2 = 1$
90	-90 = 0	0	$0^2 = 0$
90	-90 = 0	0	$0^2 = 0$
MEANS:	$\frac{0}{8} = 0$	$\frac{4}{8} = 0.5$	$\frac{4}{8} = 0.5$
	Should be Zero	*Mean Deviation*	*Variation*

$\sqrt{0.5} \approx 0.71$ *Standard Deviation*

7. What does the difference in the measures of variability (spread) suggest?

THE DATA SUGGESTS THAT BRIANNA IS MUCH MORE CONSISTENT BUT HAS NEVER SCORED ABOVE A 91.

8. Using your measures, explain which student you think the teacher should choose and why. BRIANNA

OR

Alan *Brianna*

9. Matching:

$4 = \frac{24}{6} = \frac{1+7+1+7+7+1}{6}$

__D__ Has a standard deviation of 0.

__B__ Has a standard deviation of 1.

__E__ Has a standard deviation of 2.

C, __A__ Has a standard deviation of 3.

$\sigma = 3$ A. 1, 7, 1, 7, 7,1

$\sigma = 1$ B. 1, 3, 1, 3, 1, 3

$\sigma = 3$ C. 4, –2, 8, 2, 4, 2

$\sigma = 0$ D. 1, 1, 1, 1, 1, 1

$\sigma = 2$ E. 5, 5, 5, 1, 1, 1

x	$\bar{x}$	DEV	DEV^2
1	4	-3	9
7	4	3	9
1	4	-3	9
7	4	3	9
7	4	3	9
1	4	-3	+ 9

$\frac{54}{6} = 9$

$\sqrt{9} = 3$

10. Can you make a data set of 6 elements that has a standard deviation of 4? RANGE = 8

IT SEEMS THAT THE STANDARD DEVIATION IS JUST HALF OF THE RANGE WHEN YOUR DATA POINTS ALTERNATE BACK AND FORTH BETWEEN 2 VALUES.

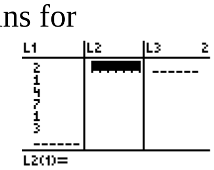
SO, WE CAN CREATE A DATASET LIKE THIS WITH A RANGE OF 8 → 0, 8, 0, 8, 0, 8

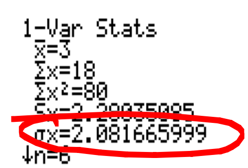
11. The table below shows the scores of the last 6 based ball games.

Winning Score	5	2	6	9	5	3
Losing Score	3	1	2	2	4	0
WINNING MARGIN:	2	1	4	7	1	3

The winning margin for each game is the difference between the winning score and the losing score. What is the standard deviation of the winning margins for these data?

$\sigma \approx 2.08$





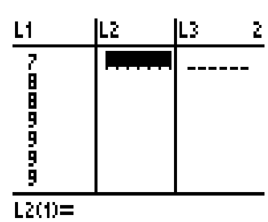
12. The following shows the shoes sizes of the students in a class

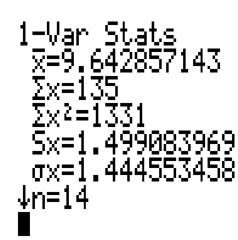
Shoe Size	7	8	9	10	11	12
Frequency	1	2	4	3	2	2

DATA SET: 7, 8, 8, 9, 9, 9, 9, 10, 10, 10, 11, 11, 12, 12

What is the standard deviation of this data set? $\sigma \approx 1.44$

What is the range of the data set? RANGE: $12 - 7 = 5$





13. Matching: Use the following dot plots to estimate which of each of the following distributions corresponds to which given standard deviation?

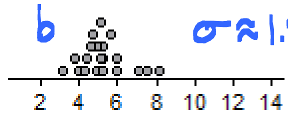
a. $\sigma \approx 0.43$ D

b. $\sigma \approx 1.22$ A

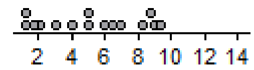
c. $\sigma \approx 2.91$ B

d. $\sigma \approx 4.08$ C

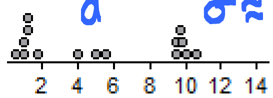
A. b $\sigma \approx 1.22$



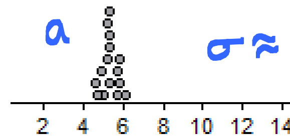
B. c $\sigma \approx 2.91$



C. d $\sigma \approx 4.08$



D. a $\sigma \approx 0.43$



14. The following represents the grades of each student on a test

31 79 97 70 70 79

~~31, 70~~, 70, 79, ~~79, 97~~

Find the MEAN: $\frac{426}{6} = 71$ Find the MEDIAN: $\frac{70+79}{2} = 74.5$ Find the MODE: 70 AND 79

Which the most appropriate central tendency to use to describe the data set? and Why?

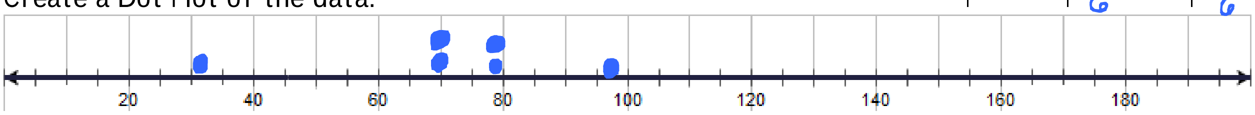
Find the RANGE: $97 - 31 = 66$

Find the ABS. MEAN DEV.: 14

Find the STANDARD DEV.: $\sqrt{401} \approx 20.02$

Data	Mean	Deviation	|Deviation|	Deviation²
31	71	-40	40	1600
79	71	8	8	64
97	71	26	26	676
70	71	-1	1	1
70	71	-1	1	1
79	71	8	8	64
		$\frac{0}{6} = 0$	$\frac{84}{6} = 14$	$\frac{2406}{6} = 401$

Create a Dot Plot of the data:



The teacher thought the class average was too low and decided to curve the tests 5 points. Add 5 points to everyone's grade and re-valuate the following:

MEAN: 76 MEDIAN: 79.5 MODE: 75 AND 84

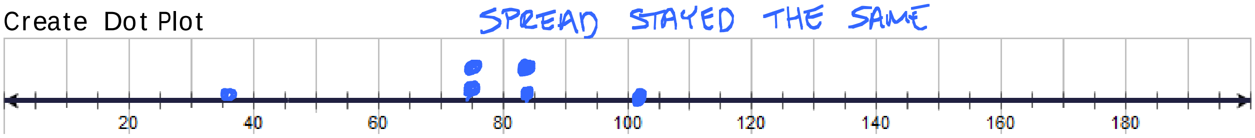
RANGE: 66 ABS. MEAN DEV.: 14 STANDARD DEV.: ≈ 20.02

$102 - 36 = 66$ $\sqrt{401}$

Data	Mean	Deviation	|Deviation|	Deviation²
36	76	-40	40	1600
84	76	8	8	64
102	76	26	26	676
75	76	-1	1	1
75	76	-1	1	1
84	76	8	8	64
		$\frac{0}{6} = 0$	$\frac{84}{6} = 14$	$\frac{2406}{6} = 401$

Describe how each statistic changed. CENTERS WENT UP BY 5

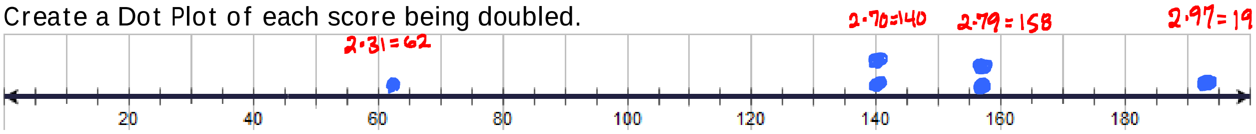
Create Dot Plot SPREAD STAYED THE SAME



What do you think would happen to each of the statistics if the teacher decided to double each student's score?

Create a Dot Plot of each score being doubled.

$2 \cdot 31 = 62$ $2 \cdot 70 = 140$ $2 \cdot 79 = 158$ $2 \cdot 97 = 194$



MEASURES OF CENTER ALL DOUBLED (MEAN, MEDIAN, MODE).

MEASURES OF SPREAD ALSO ALL DOUBLED (RANGE, IQR, ABS. MEAN DEV., STD DEV)