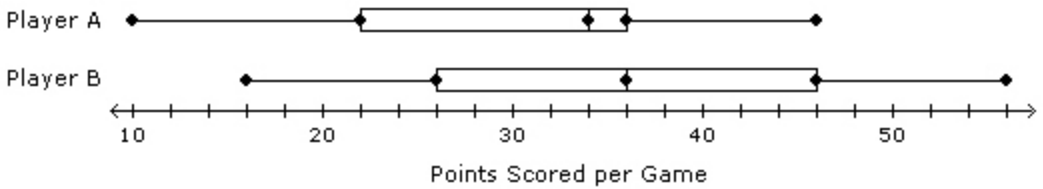
Warm UP

3. Compare the box-and-whisker plots below. Which player has the greater interquartile range?



A. They are the same.

B. Player B

C. Player A

Mean Absolute Deviation

Essential Question:

How do you use measures of central tendency and variation to describe data?

Standard:

MCC7.SP.4: Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.

Here are the scores of 20 students from 2 classes who took the same quiz.

Class 1	Class 2
100	100
100	90
100	90
100	85
90	80
60	75
60	70
60	70
50	60
50	50

- Find the mean of each class.
- Find the range of each class
- Based on the mean and range, do you think the classes performed at about the same level?

Here are the scores of 20 students from 2 classes who took the same quiz.

Class 1	Class 2
100	100
100	90
100	90
100	85
90	80
60	75
60	70
60	70
50	60
50	50

- Make a line plot for class 1 and class 2.
- Looking at the distribution of each line plot, do you agree with your previous answer of the classes performing on the same level?

Measures of Spread

Quantities that measure the degree of variation in data

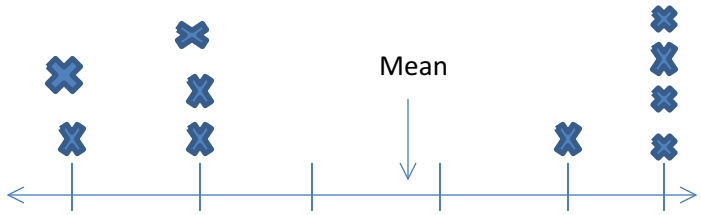
Even though their means and ranges are equal, the distributions of scores in Classes 1 and 2 are quite different.

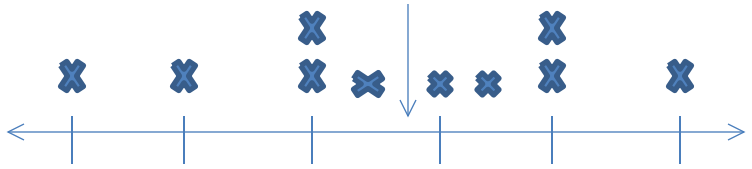
Most of the scores in Class 1 are either much higher or much lower than the mean.

In contrast, most of the scores in Class 2 are closer to the mean.

Range is a measure of spread which shows the difference of the highest and lowest values.

A measure of spread that shows the difference between these distributions is called the **mean absolute deviation, abbreviated m.a.d.**





Vocabulary

- **Deviation:** The distance that two points are separated from each other.

- **Deviation from the mean**: How far the data point is from the mean. To find this distance, subtract the two values (the data point and the mean).

- **Mean absolute deviation (MAD)**: the average distance of all the data points from their mean. **Mean Absolute Deviation**, is a better measure of dispersion than the standard deviation when there are outliers in the data

Mean Absolute Deviation

Formula:

$$\text{MAD} = \frac{\textit{difference of data and mean}}{\textit{number of data values}}$$

1. Find the **mean** of the data.
2. Subtract the mean from each value – the result is called the **deviation from the mean**.
3. Take the absolute value of each deviation from the mean.
4. Find the sum of the absolute values.
5. Divide the total by the number of items.

Example 1

Find the mean absolute deviation of the following test scores:

- 87, 94, 72, 65, 97, 77

87, 94, 72, 65, 97, 7

Step 1: Write the data in the first column of the table.

Column 1	Column 2	Column 3	Column 4
Data	Mean	Difference	Absolute Value
87			
94			
72			
65			
97			
7			
		Sum	
		Count	
		MAD	

87, 94, 72, 65, 97, 7

Step 2: Calculate the mean of the data and write that in each cell of column 2.

87
94
72
65
97
+ 7
422 ÷ 6 = 70.3

Column 1	Column 2	Column 3	Column 4
Data	Mean	Difference	Absolute Value
87	70.3		
94	70.3		
72	70.3		
65	70.3		
97	70.3		
7	70.3		
		Sum	
		Count	
		MAD	

87, 94, 72, 65, 97, 7

Step 3: Subtract column 1 from column 2 and write the difference in column 3.

	Column 1	Column 2	Column 3	Column 4
	Data	Mean	Difference	Absolute Value
70.3 – 87 = -16.7	87	70.3	-16.7	
70.3 – 94 = -23.7	94	70.3	-23.7	
70.3 – 72 = -1.7	72	70.3	-1.7	
70.3 – 65 = 5.3	65	70.3	5.3	
70.3 – 97 = -26.7	97	70.3	-26.7	
70.3 – 7 = 63.3	7	70.3	63.3	
			Sum	
			Count	
			MAD	

87, 94, 72, 65, 97, 7

Step 4: Rewrite all the numbers from column 3 as positive numbers in column 4.

Column 1	Column 2	Column 3	Column 4
Data	Mean	Difference	Absolute Value
87	70.3	-16.7	16.7
94	70.3	-23.7	23.7
72	70.3	-1.7	1.7
65	70.3	5.3	5.3
97	70.3	-26.7	26.7
7	70.3	63.3	63.3
		Sum	
		Count	
		MAD	

87, 94, 72, 65, 97, 7

Step 5: Calculate the mean of the data in column 4, and you're done! This is the MAD.

16.7
23.7
1.7
5.3
26.7
+ 63.3
137.4 ÷ 6 = 22.9

Column 1	Column 2	Column 3	Column 4
Data	Mean	Difference	Absolute Value
87	70.3	-16.7	16.7
94	70.3	-23.7	23.7
72	70.3	-1.7	1.7
65	70.3	5.3	5.3
97	70.3	-26.7	26.7
7	70.3	63.3	63.3
		Sum	137.4
		Count	6
		MAD	22.9

Example 2

Find the mean absolute deviation of the data. Round to the nearest hundredth, if necessary.

- 87, 75, 85, 77, 74, 82

Click here to
check your answer

87, 75, 85, 77, 74, 82

Solution:

Column 1	Column 2	Column 3	Column 4
Data	Mean	Difference	Absolute Value
87	80	-7	7
75	80	5	5
85	80	-5	5
77	80	3	3
74	80	6	6
82	80	-2	2
		Sum	28
		Count	6
		MAD	4.7