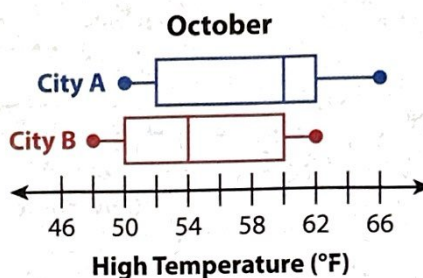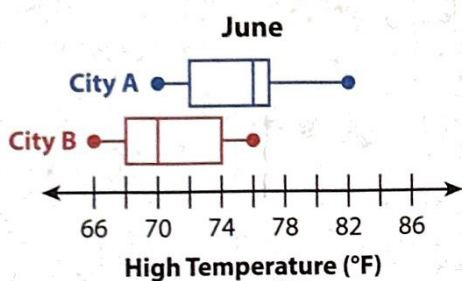# Develop Comparing Centers of Data Relative to Variability

▶ **Read and try to solve the problem below.**

The box plots below compare the high temperatures in two cities in June and in October. Are the high temperatures in the two cities more similar in June or in October? Show how you know.

June

City A

City B

66   70   74   78   82   86
High Temperature (°F)

October

City A

City B

46   50   54   58   62   66
High Temperature (°F)

TRY IT   **Math Toolkit** grid paper, number lines

	June	October
Median difference	$76 - 70 = 6$	$60 - 54 = 6$
Lower quartile difference	$72 - 68 = 4$	$52 - 50 = 2$
Upper quartile difference	$77 - 72 = 5$	$62 - 60 = 2$

When comparing the different parts of the box plots it shows that the high temperatures in October have less variability, making them more similar. Also there is more overlap in the box plots in October

DISCUSS IT

**Ask:** What are some ways to compare two data sets besides comparing their medians?

Share: I can see from the box plots that . . .

DISCUSS IT   *continued*

➤ **Explore different ways to compare the centers of two data sets relative to their variabilities.**

The box plots below compare the high temperatures in two cities in June and in October. Are the high temperatures in the two cities more similar in June or in October? Show how you know.
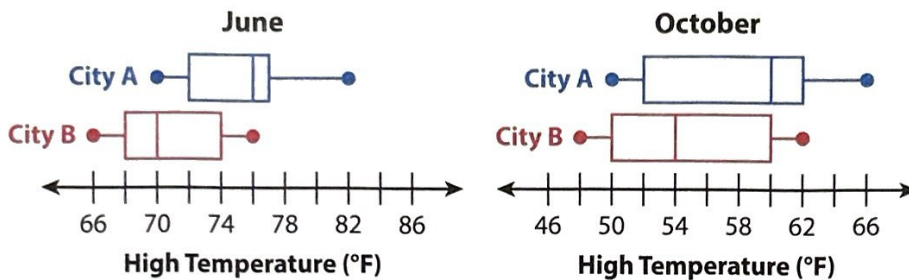
Picture It

You can look at and compare the overlap in the boxes for each month.
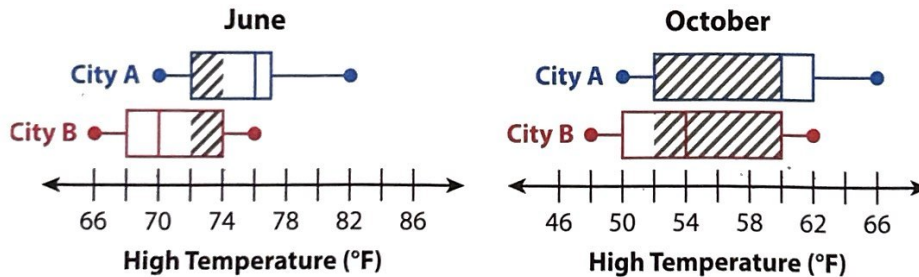
Analyze It

You can show how similar two data sets are by expressing the <u>difference in the medians as a multiple of each IQR.</u>

Difference in the medians for June: $76 - 70 = 6$

IQR for City A in June: $77 - 72 = 5$ IQR for City B in June: $74 - 68 = 6$

The difference in the medians, 6, divided by the IQR for City A, 5, is 1.2. So, the difference in the medians is **1.2 times the IQR for City A.**

The difference in the medians is **1 times the IQR for City B.**

Difference in the medians for October: $60 - 54 = 6$

The difference in the medians is **0.6 times the IQR for both cities.**

$$\frac{\text{median difference}}{\text{IQR}}$$

June   October

$A \quad \dfrac{6}{5} = 1.2 \qquad \dfrac{6}{10} = 0.6$

$B \quad \dfrac{6}{6} = 1 \qquad \dfrac{6}{10} = 0.6$

➤ Use this page to deepen your understanding of comparing the centers of two data sets relative to their variabilities.

1 Talk About It

a. Look at **Picture It**. How does the overlap of the boxes show how similar the data sets are?

More overlap means the temperatures are more similar

b. Look at **Analyze It**. Both June and October have the same difference in the medians for the two cities. However, the multiple of the IQRs is less in October. Why does it make sense that the multiple is less in October?

when the difference is the same but the IQR is greater it makes sense the multiple would be smaller

c. The lesser the multiple of the IQR, the more the boxes in the plots overlap. Why?

① could mean the difference between the medians low, so the data sets are similar

② the IQR could be great so the data is more spread out and there is more overlap

2 Show What You Know

a. Mean is another measure of center and MAD is another measure of variability. You can express the difference in the means as a multiple of the MADs. The lesser the multiple of the MAD, the more overlap there will be. Explain why.

b. How does expressing the difference in centers of two data sets as a multiple of their variabilities indicate how similar or different the data sets are?

The lesser the multiple, the more the data overlaps

3 Reflect
Think about all the models and strategies you have discussed today. Describe how one of them helped you understand how to express the difference in centers of data sets relative to their variability.

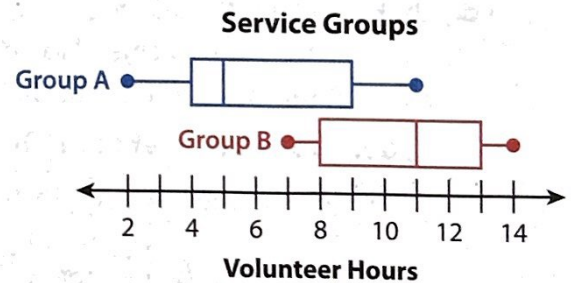## Apply It

➤ **Use what you learned to solve these problems.**

4　The students in a science class take a quiz before they start a new unit. The mean score is 3 and the MAD is 1.8. After the unit, the students take the quiz again. The mean score is 7.5 and the MAD is 1.5. Suppose you plotted the scores for both quizzes. Would you expect to see a lot of overlap? Explain.

$$\frac{\text{difference mean}}{\text{MAD}}$$

Before　　　After

$$\frac{4.5}{1.8} = 2.5 \qquad \frac{4.5}{1.5} = 3$$

The centers are far apart relative to the variabilities, so there should not be much overlap.

5　The box plots show the number of hours members of two different service groups volunteered last month. Express the difference in the medians as a multiple of the IQR for each group. Show your work.

$$\frac{\text{difference median}}{\text{IQR}}$$

A
$$\frac{6}{5} = 1.2$$

B
$$\frac{6}{5} = 1.2$$

Service Groups

Group A ●

Group B ●

2　4　6　8　10　12　14

Volunteer Hours

SOLUTION _The difference in the medians is 1.2 times the IQR for both groups_

6　At a dog show, the mean weight of the Norfolk Terriers is 11.5 pounds with a MAD of 2. The mean weight of the Cairn Terriers is 13 pounds with a MAD of 1.8. Express the difference in mean weights as a multiple of the MAD for both dog breeds. Show your work.

$$\frac{\text{difference mean}}{\text{MAD}}$$

N.T.
$$\frac{1.5}{2} = 0.75$$

C.T
$$\frac{1.5}{1.8} = 0.8\overline{3} = \frac{5}{6}$$

Mean Weights

Norfolk Terriers　Cairn Terriers

11.5 pounds　　**13** pounds

SOLUTION _The difference between the mean is 0.75 times the MAD for the Norfolk Terrier and $\frac{5}{6}$ times the MAD for the Cairn Terrier_