Shape of Data Distributions

PARASAILING The line plot shows the costs in dollars for parasailing for different companies on a certain beach.

1. Find the measures of central tendency. Round to the nearest tenth if necessary.
2. Draw a vertical line through the middle of the data. What do you notice?

The distribution of a set of data shows the arrangement of data values. It can be described by its center, spread (variation), and overall shape. If the left side of a distribution looks like the right side, then the distribution is symmetric. The distribution below has a cluster of several data values within the interval 10–12. The gaps 9 and 13 have no data values. The value 10 is a peak because it is the most frequently occurring value.

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REAL-WORLD EXAMPLE

Describe the Shape of a Distribution

PARASAILING Refer to the line plot “Parasailing Costs” above. Use clusters, gaps, peaks, outliers, and symmetry to describe the shape of the distribution.

The left side of the data looks like the right side, so the shape of the distribution is symmetric. There is a cluster from $31–$39. The distribution has a peak in the center at $35. There are no gaps or outliers.

CHECK Your Progress

a. SOLAR ECLIPSES Use clusters, gaps, peaks, outliers, and symmetry to describe the shape of the distribution at the right.
While you cannot identify gaps, peaks, and clusters in a box-and-whisker plot, you can still identify symmetry and outliers, as well as describe the shape of a data distribution.

**REAL-WORLD EXAMPLE**

**PARKS** The box-and-whisker plot shows the number of visitors to a state park. Describe the shape of the distribution using symmetry and outliers.

Each box and whisker has the same length. So, the data is evenly distributed. The distribution is symmetric since the left side of the data looks like the right side. There are no outliers.

**CHECK Your Progress**

b. **FLIGHTS** The box-and-whisker plot shows the distance of several airplane flights in feet. Describe the shape of the distribution using symmetry and outliers.

You can also describe the center and spread of a data distribution. The shape of the distribution tells you which measures are most appropriate. The mean and mean absolute deviation are affected by outliers, while the median and interquartile range are resistant to outliers. If there is an outlier, the distribution is not symmetric.

**Key Concept** **Measures of Center and Spread**

Use the following flow chart to decide which measures of center and spread are most appropriate to describe a data distribution.

- Is the data distribution symmetric?
  - Yes
    - Use the **mean** to describe the center. Use the **mean absolute deviation** to describe the spread.
  - No
    - Use the **median** to describe the center. Use the **interquartile range** to describe the spread.
TRAVEL  The line plot shows the number of states students in Elisa’s social studies class have visited.

a. Choose the appropriate measures to describe the center and spread of the distribution. Justify your response based on the shape of the distribution.

The distribution is not symmetric and there is an outlier, 19. The median and interquartile range are appropriate measures to use.

b. Write a few sentences describing the center and spread of the distribution using the appropriate measures.

The median is 12 states. The lower quartile is 11. The upper quartile is 13. The interquartile range is 13 – 11, or 2 states.

The data are centered around 12 states. The spread of the data around the center is about 2 states.

Real-World Link
In a recent year, California was the state most visited by U.S. travelers. The top three states visited were California, Florida, and Texas.

CHECK Your Progress

3. TENNIS  Choose the appropriate measures to describe the center and spread of the distribution. Justify your response based on the shape of the distribution. Then describe the center and spread. Round to the nearest tenth if necessary.

Example 1  1. CONCERTS  The histogram shows the wait times in minutes for entering a concert. Use clusters, gaps, peaks, outliers, and symmetry to describe the shape of the distribution.

Example 2  2. DOGS  The line plot shows the weights in pounds of several dogs. Describe the shape of the distribution using symmetry and outliers.
Example 3  

3. **INTERNET**  The line plot shows the number of hours several students spent on the Internet during the week.

   a. Choose the appropriate measures to describe the center and spread of the distribution. Justify your response based on the shape of the distribution.

   b. Write a few sentences describing the center and spread of the distribution using the appropriate measures. Round to the nearest tenth if necessary.

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**Practice and Problem Solving**

Example 1  

4. **ANIMALS**  The histogram shows the average animal speeds in miles per hour of several animals. Use clusters, gaps, peaks, outliers, and symmetry to describe the shape of the distribution.

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Example 2  

6. **SCHOOL**  The box-and-whisker plot shows the science test scores for Mrs. Everly’s students. Describe the shape of the distribution using symmetry and outliers.

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7. **DONATIONS**  The box-and-whisker plot shows the donations in dollars to charity by several people. Describe the shape of the distribution using symmetry and outliers.
Example 3

8. TEXT MESSAGING The line plot shows the number of text messages sent by different students in one day.

a. Choose the appropriate measures to describe the center and spread of the distribution. Justify your response based on the shape of the distribution.

b. Write a few sentences describing the center and spread of the distribution using the appropriate measures.

9. RUNNING The line plot shows the number of miles Elisa ran each week.

a. Choose the appropriate measures to describe the center and spread of the distribution. Justify your response based on the shape of the distribution.

b. Write a few sentences describing the center and spread of the distribution using the appropriate measures. Round to the nearest tenth if necessary.

For Exercises 10 and 11, refer to the following information.

A distribution that is not symmetric is called skewed. A distribution that is skewed left has fewer data values on the left side than the right side. A distribution that is skewed right has fewer data values on the right side than the left side.

10. TREES The box-and-whisker plot shows the heights in feet of several trees.

a. Explain how you know the distribution is not symmetric.

b. Is the distribution skewed left or skewed right? Explain.

c. Use appropriate measures to describe the center and spread of the distribution. Justify your choice of measure based on the shape of the distribution.

11. FAMILY The line plot shows the number of siblings for 18 students in Jeremiah’s homeroom.

a. Explain how you know the distribution is not symmetric.

b. Is the distribution skewed left or skewed right? Explain.

c. Use appropriate measures to describe the center and spread of the distribution. Justify your choice of measure based on the shape of the distribution.
12. **OPEN ENDED** Draw a line plot for which the median is the most appropriate measure to describe the center of the distribution.

13. **CHALLENGE** Explain why you cannot describe the specific location of the center and spread of the box-and-whisker plot shown using the most appropriate measures.

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  Calories in Servings of Fruits
```

14. **REASONING** The table gives the average lengths in millimeters of several insects. Without creating a graphical display, describe what the shape of the distribution would look like. Justify your response.

<table>
<thead>
<tr>
<th>Length of Insects (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 30 35 28 15 90 27</td>
</tr>
<tr>
<td>32 55 36 24 60 20 30</td>
</tr>
</tbody>
</table>

15. **WRITE MATH** Explain how the shape of a data distribution tells you which measures are most appropriate to describe the center and spread of the distribution.

16. Refer to the box-and-whisker plot below.

```
Roller Coaster Speeds (mph)
```

Which of the following statements is false?

A. The distribution is symmetric.
B. The distribution is not symmetric.
C. The distribution has an outlier.
D. The distribution has a gap of data.

17. Refer to the line plot below.

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Gas Mileage (miles per gallon)
```

Which measure is the most appropriate to describe the variation (spread) of the distribution?

F. interquartile range
G. mean
H. mean absolute deviation
I. median