

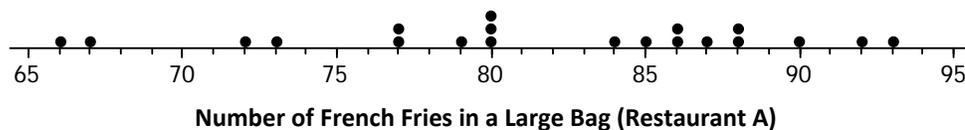
## Lesson 12: Describing the Center of a Distribution Using the Median

How do we summarize a data distribution? What provides us with a good description of the data? The following exercises help us to understand how a numerical summary answers these questions.

### Classwork

#### Example 1: The Median—A Typical Number

Suppose a chain restaurant (Restaurant A) advertises that a typical number of french fries in a large bag is 82. The graph shows the number of french fries in selected samples of large bags from Restaurant A.



#### Exercises 1–3

- You just bought a large bag of fries from the restaurant. Do you think you have 82 french fries? Why or why not?
- How many bags were in the sample?

3. Which of the following statements would seem to be true given the data? Explain your reasoning.
- Half of the bags had more than 82 fries in them.
  - Half of the bags had fewer than 82 fries in them.
  - More than half of the bags had more than 82 fries in them.
  - More than half of the bags had fewer than 82 fries in them.
  - If you got a random bag of fries, you could get as many as 93 fries.

### Example 2: The Median

Sometimes it is useful to know what point separates a data distribution into two equal parts, where one part represents the larger “half” of the data values and the other part represents the smaller “half” of the data values. This point is called the **median**. When the data are arranged in order from smallest to largest, the same number of values will be above the median as are below the median.

### Exercises 4–7

4. Suppose you were trying to convince your family that you needed a new pair of tennis shoes. After checking with your friends, you argued that half of them had more than four pairs of tennis shoes, and you only had two pairs. Give another example of when you might want to know that a data value is a half-way point? Explain your thinking.

5. Use the information from the dot plot in Example 1. The median number of fries was 82.
- What percent of the bags have more fries than the median? Less than the median?
  - Suppose the bag with 93 fries was miscounted and there were only 85 fries. Would the median change? Why or why not?
  - Suppose the bag with 93 fries really only had 80 fries. Would the median change? Why or why not?
6. The owner of the chain decided to check the number of french fries at another restaurant in the chain. Here is the data for Restaurant B: 82, 83, 83, 79, 85, 82, 78, 76, 76, 75, 78, 74, 70, 60, 82, 82, 83, 83, 83.
- How many bags of fries were counted?
  - Sallee claims the median is 75 as she sees that 75 is the middle number in the data set listed above. She thinks half of the bags had fewer than 75 fries. Do you think she would change her mind if the data were plotted in a dot plot? Why or why not?
  - Jake said the median was 83. What would you say to Jake?

- d. Betse argued that the median was halfway between 60 and 85 or 72.5. Do you think she is right? Why or why not?
- e. Chris thought the median was 82. Do you agree? Why or why not?
7. Calculate the mean and compare it to the median. What do you observe about the two values? If the mean and median are both measures of center, why do you think one of them is lower than the other?

### Exercises 8–10: Finding Medians from Frequency Tables

8. A third restaurant (Restaurant C) tallied a sample of bags of french fries and found the results below.

Number of fries	Frequency
75	
76	
77	
78	
79	
80	
81	
82	
83	
84	
85	
86	

- a. How many bags of fries did they count?
- b. What is the median number of fries for the sample of bags from this restaurant? Describe how you found your answer.
9. Robere decided to divide the data into four parts. He found the median of the whole set.
- a. List the 13 values of the bottom half. Find the median of these 13 values.
- b. List the 13 values of the top half. Find the median of these 13 values.
10. Which of the three restaurants seems most likely to really have 82 fries in a typical bag? Explain your thinking.

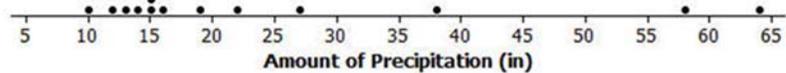
**Lesson Summary**

In this lesson, you learned about a summary measure for a set of data called the median. To find a median you first have to order the data. The **median** is the midpoint of a set of ordered data; it separates the data into two parts with the same number of values below as above that point. For an even number of data values, you find the average of the two middle numbers; for an odd number of data values, you use the middle value. It is important to note that the median might not be a data value and that the median has nothing to do with a measure of distance. Medians are sometimes called a measure of the center of a frequency distribution but do not have to be the middle of the spread or range (maximum-minimum) of the data.

**Problem Set**

- The amount of precipitation in the western states in the U.S. is given in the table as well as the graph.

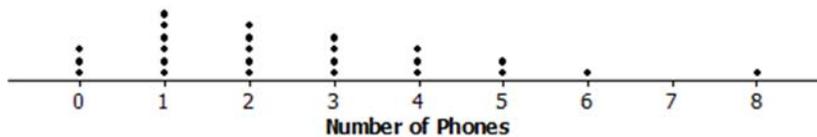
State	Amount of Precipitation (in.)
WA	38.4
OR	27.4
CA	22.2
MT	15.3
ID	18.9
WY	12.9
NV	9.5
UT	12.2
CO	15.9
AZ	13.6
NM	14.6
AK	58.3
HI	63.7



Data Source: <http://www.currentresults.com/Weather/US/average-annual-state-precipitation.php>

- How do the amounts vary across the states?
- Find the median. What does the median tell you about the amount of precipitation?
- Use the median and the range to describe the average monthly precipitation in western states in the U.S.
- Do you think the mean or median would be a better description of the typical amount of precipitation? Explain your thinking.

2. Identify the following as true or false. If a statement is false, give an example showing why.
- The median is always equal to one of the values in the data set.
  - The median is the midpoint between the smallest and largest values in the data set.
  - At most, half of the values in a data set have values less than the median.
  - In a data set with 25 different values, if you change the two smallest values of a data set to smaller values, the median will not be changed.
  - If you add 10 to every element of a data set, the median will not change.
3. Make up a data set such that the following is true:
- The set has 11 different values and the median is 5.
  - The set has 10 values and the median is 25.
  - The set has 7 values and the median is the same as the smallest value.
4. The dot plot shows the number of landline phones that a sample of people have in their homes.



- How many people were in the sample?
- Why do you think three people have no landline phones in their homes?
- Find the median number of phones for the people in the sample.
- Use the median and the range (maximum-minimum) to describe the distribution of the number of phones.

5. The salaries of the Los Angeles Lakers for the 2012–2013 basketball season are given below.

Player	Salary (\$)
Kobe Bryant	\$27,849,149
Dwight Howard	\$19,536,360
Pau Gasol	\$19,000,000
Steve Nash	\$8,700,000
Metta World Peace	\$7,258,960
Steve Blake	\$4,000,000
Jordan Hill	\$3,563,600
Chris Duhon	\$3,500,000
Jodie Meeks	\$1,500,000
Earl Clark	\$1,240,000
Devin Ebanks	\$1,054,389
Darius Morris	\$962,195
Antawn Jamison	\$854,389
Robert Sacre	\$473,604
Darius Johnson-Odom	\$203,371

Data Source: [www.basketball-reference.com/contracts/LAL.html](http://www.basketball-reference.com/contracts/LAL.html)

- Just looking at the data, what do you notice about the salaries?
  - Find the median salary, and explain what it tells you about the salaries.
  - Find the median of the lower half of the salaries and the median of the upper half of the salaries.
  - Find the width of each of the following intervals. What do you notice about the size of the interval widths, and what does that tell you about the salaries?
    - minimum salary to median of the lower half:
    - median of the lower half to the median of the whole set:
    - median of the whole set to the median of the upper half:
    - median of the upper half to the highest salary:
6. Use the salary table from above to answer the following.
- If you were to find the mean salary, how do you think it would compare to the median? Explain your reasoning.
  - Which measure do you think would give a better picture of a typical salary for the Lakers, the mean or the median? Explain your thinking.