# Stem-and-Leaf Plots

CK12 Editor

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CONCEPT 1

# Stem-and-Leaf Plots

## Introduction

***The Check points***

During the third day of class on the Iditarod, the students began to examine the routes on the map. The race begins in Anchorage, Alaska and travels 1150 miles of rough terrain to the city of Nome, Alaska where it finishes.

While racing, the teams face all kinds of wild weather. There can be blizzards, ice and unbelievable winds not to mention that the surrounding terrain can be woods or frozen tundra.

"Wow, can you imagine being out there and not seeing anyone?" Sam said to his friend Juan.

"I think they do see people at the checkpoints, isn't that right Mr. Hawkins?" Juan asked as Mr. Hawkins walked around the room.

"Yes Juan. The mushers all have to check in at the checkpoints. It helps the race officials to keep track of everyone as well as check on the dogs, refuel, and take any other safety precautions."

"How many are there?"

"Well, there are 24, and you can figure out the distances and organize them in a data display. That is the next task that you are all going to work on," Mr. Hawkins said, taking out a giant ruler. "Then I want you to figure out the median distance of the checkpoints."

Juan took out a piece of paper and wrote down the distance between each check point. Here are his notes.

20, 29, 52, 34, 45, 30, 48, 75, 54, 18, 25, 59, 112, 52, 52, 42, 90, 42, 48, 48, 28, 18, 55, 22

Juan wanted to create a stem-and-leaf plot to show the data. He knew that once he arranged the data in a stem-and-leaf plot, it could help him to find the median distance between two checkpoints.

**Do you have an idea how Juan can do this? Have you ever created a stem-and-leaf plot? Take the time to learn about them during this lesson. At the end of the lesson, you will see how Juan created his data display.**

***What You Will Learn***

By the end of this lesson, you will be able to demonstrate the following skills.

- Make a stem-and-leaf plot to represent given data.
- Use a stem-and-leaf plot to find the mean, median, mode and range of a set of data.

- Compare and interpret multiple stem-and-leaf plots of real-world data.

***Teaching Time***

I. **Make a Stem-and-Leaf Plot to Represent Given Data**

In this lesson, you will learn another way to display data. This way of organizing and displaying data helps us to see values according to their size, so we can order them accordingly. Think about the base ten number system of 10,100,1000 etc. We can organize numbers by ones, tens, hundreds and thousands. In fact, you think about numbers in this way when working with decimals. Now we are going to look at the stem of a number so that we can organize it as part of a visual display of data.

**A *stem-and-leaf plot* organizes data in order. In a stem-and-leaf plot each data value is split into a stem and a leaf.**

**The leaf is the last digit to the right. The stem is the remaining digits to the left. For the number 243, the stem is 24 and the leaf is 3.**


Yes it does. Identifying the leaf will help you to know what the stem is and this will assist you in creating an accurate stem-and-leaf plot.

Example

Construct a stem-and-leaf plot for the data below.

Science test scores for third period (out of 100%):

97, 92, 77, 82, 96, 75, 68, 80, 79, 96

***Step 1:*** Arrange the data in order from least to greatest.

68, 75, 77, 79, 80, 82, 85, 92, 96, 96

***Step 2:*** Separate each number into a stem and a leaf.

TABLE 1.1:

| Stem | Leaf |
|---|---|
| 6 | 8 |
| 7 | 5 7 9 |
| 8 | 0 2 |
| 9 | 2 6 6 7 |

***Step 3:*** Create a key and give the stem-and-leaf plot a title.

**Answer**

**Science Test Scores:** $3^{rd}$ **Period**

**TABLE 1.2:**

| Stem | Leaf |
|---|---|
| **6** | **8** |
| **7** | **5 7 9** |
| **8** | **0 2** |
| **9** | **2 6 6 7** |

**Key:** $6|8 = 68$

**If we were to analyze this data, you could see that most of the values cluster around the stem of 9. There are more numbers in this category.**

Example

Three friends began a babysitting service over the summer. The amount of money they made for each appointment is listed on the data table below. Use the information on the data table to create a stem-and-leaf plot.

**TABLE 1.3:**

| Date: | Amount Made: |
|---|---|
| June 26, 2006 | $17.00 |
| June 27, 2006 | $12.00 |
| July 5, 2005 | $22.00 |
| July 9, 2005 | $23.00 |
| July 15, 2006 | $18.00 |
| July 22, 2006 | $31.00 |
| August 1, 2006 | $40.00 |
| August 5, 2006 | $35.00 |
| August 13, 2006 | $19.00 |
| August 20, 2006 | $8.00 |

***Step 1:*** Arrange the data values in order from least to greatest.

Since the data values are to the nearest whole number, arrange the data without the decimal points.

8, 12, 17, 18, 19, 22, 23, 31, 35, 40

***Step 2:*** Separate each value into a stem and a leaf.

**TABLE 1.4:**

| Stem | Leaf |
|---|---|
| 0 | 8 |
| 1 | 2 7 8 9 |
| 2 | 2 3 |
| 3 | 1 5 |
| 4 | 0 |

***Step 3:*** Create a key and give the stem-and-leaf plot a title.

**Answer**

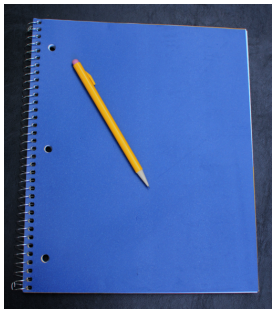
**TABLE 1.5: Babysitting Fund**

| Stem | Leaf |
|---|---|
| **0** | **8** |
| **1** | **2 7 8 9** |
| **2** | **2 3** |
| **3** | **1 5** |
| **4** | **0** |
| **Key:** $0\|8 = 8$ | |

## 11E. Lesson Exercises

a. **What is the stem of the number 256?**
b. **What is the leaf of the number 256?**
c. **What is the stem of the number 1,289?**
d. **What is the leaf of the number 1,289?**


***Take a few minutes and check your work with a friend.***



***Write the steps to creating a stem-and-leaf plot down in your notebook. Then move on to the next section.***

## II. Use a Stem-and-Leaf Plot to Find the Mean, Median, Mode and Range of a Set of Data

Now that you know how to create a stem-and-leaf plot, let's look at how we can use it to analyze data and draw conclusions. First, let's review some of the vocabulary words that we used in the first lesson of this chapter.

The ***mean*** is sometimes also called the average of a set of data. To find the mean, add the data values and then divide the sum by the number of data values.

The ***median*** is the data value in the middle when the data is ordered from least to greatest. Since the data is ordered from least to greatest on a stem-and-leaf plot, find the data value in the middle of the stem-and-leaf plot.

The ***mode*** is the data value that occurs most often. On a stem-and-leaf plot, the mode is the most repeated leaf.

The ***range*** is the difference between the highest and the lowest data value.

**Data from a stem-and-leaf plot can be used to determine the mean, median, mode, and range for a set of data. Let's look at how we can do this.**

Example

The stem-and-leaf plot below depicts the weight (in pounds) of the ten trout caught in a fishing competition. Determine the mean, median, mode, and range of the data on the stem-and-leaf plot.

**TABLE 1.6: Weight of Trout Caught**

| Stem | Leaf |
|---|---|
| 2 | 9 |
| 3 | 1 |
| 4 | 0 5 |
| 5 | 2 |
| 6 | 2 |
| 7 | 6 |
| 8 | 3 |
| 9 | 2 2 |

**Key:** $2|9 = 2.9$

***Step 1:*** Using the key, combine the stem with each of its leaves. The values are in order from least to greatest on the stem-and-leaf plot. Therefore, keep them in order as you list the data values.

2.9, 3.1, 4.0, 4.5, 5.2, 6.2, 7.6, 8.3, 9.2, 9.2

***Step 2:*** Recall that to determine the mean you add the data values and then divide the sum by the number of data values.

$$2.9+3.1+4.0+4.5+5.2+6.2+7.6+8.3+9.2+9.2=60.2$$
$$60.2\div 10=6.2$$
$$\text{Mean}=6.2\ \textit{pounds}$$

***Step 3:*** The data is already arranged in order from least to greatest. Therefore, to determine the median, identify the number in the middle of the data set. In this case, two data values share the middle position. To find the median, find the mean of these two data values.

$$2.9,\ 3.1,\ 4.0,\ 4.5,\ 5.2,\ 6.2,\ 7.6,\ 8.3,\ 9.2,\ 9.2$$
$$5.2+6.2=11.4$$
$$11.4\div 2=5.7$$
$$\text{Median}=5.7\ \textit{pounds}$$

***Step 4:*** Recall that the mode is the data value that occurs most. Looking at the stem-and-leaf plot, you can see that the data value 9.2 appears twice. Therefore, the mode is 9.2.

Mode = 9.2 pounds

***Step 5:*** Recall that the range is the difference of the greatest and least values. On the stem-and-leaf plot, the greatest value is the last value; the smallest value is the first value.

$$9.2-2.9=6.3$$
$$\text{Range}=6.3$$

**Answer**

**Mean = 6.2 pounds**

**Median = 5.7 pounds**

**Mode = 9.2 pounds**

**Range = 6.3 pounds**

**Try this out on your own. Here is a set of data to use.**

**11F. Lesson Exercises**

**Determine the mean, median, mode, and range for the data on the stem-and-leaf plot.**

**TABLE 1.7: Annual DVD Sales (in millions)**

| **Stem** | **Leaf** |
|---|---|
| **1** | **4 6 7 8 8** |
| **2** | **0 2 4 9** |
| **3** | **1 3** |

**Key:** $2|0=20$


***Take a few minutes to check your work with a partner. Are your answers accurate? Correct any errors and then continue with the lesson.***

III. **Compare and Interpret Multiple Stem-and-Leaf Plots of Real-World Data**

**Multiple stem-and-leaf plots are used to compare two sets of data. Multiple stem-and-leaf plots are displayed back to back to make comparisons easier.**

**Let's look at how this applies with an example.**

Example

The multiple stem-and-leaf plot below depicts the amount of time (in minutes) it took for students in two classes to complete a math exam of twenty-five questions. Use the information on the stem-and-leaf plot to answer the questions below.

**TABLE 1.8: Math Exam**

| **Class Period 1** | | **Class Period 2** |
|---|---|---|
| Leaf | Stem | Leaf |
| 8 5 5 4 | 2 | 3 7 8 9 |
| 9 7 4 1 | 3 | 0 2 3 6 8 |
| 5 0 | 4 | 3 4 9 |
| 2 1 1 | 5 | 4 7 |
| 2 1 | 6 | 0 |
| Key: $1\|6 = 61$ | | Key: $6\|0 = 60$ |

**How many students took the test in each class?**

Because there are fifteen data values for Class Period 1 and Class Period 2, it can be inferred that there are fifteen students in each class.

**How many stems are on this stem-and-leaf plot?**

On this stem-and-leaf plot, there are five stems.

**Determine the median for each class period.**

Looking at the data for Class Period 1, you can see that the median is 39. The median or data value in the middle of the set of data for Class Period 2 is 36.

**Identify the modes for each class period.**

Two modes occur in Class Period 1. The data values that appear most often are 25 and 51. There is no mode in Class Period 2.

**What is the range in data for each class period?**

The largest data value in Class Period 1 is 62 minutes. The smallest data value in Class Period 1 is 24 minutes. The difference between the two (or the "range") is 38. The largest data value in Class Period 2 is 60 minutes. The smallest data value in Class Period 2 is 23 minutes. Therefore, the range for Class Period 2 is 37 minutes.

**Compare the mean for Class Period 1 with Class Period 2.**

Recall that to determine the mean, first rewrite the data using the key from the stem-and-leaf plot. Add the data values and then divide the sum by the number of data values.

Class Period 1:

$$24+25+25+28+31+34+37+39+40+45+51+51+52+61+62=605$$
$$605\div 15=40.3$$
$$\text{Mean}=40.3$$

Class Period 2:

$$23+27+28+29+30+32+33+36+38+43+44+49+54+57+60=583$$
$$583\div 15=38.86$$
$$\text{Mean}=38.86$$

**Using a stem-and-leaf plot shows us what the data looks like. We could have analyzed the data in the same way if it had been written out, but looking at the data organized in a visual way can help us to keep track of the information and make conclusions based on the values presented.**

## Real Life Example Completed

***The Check points***

**Here is the original problem once again. Reread it and then create your own stem-and-leaf plot. Compare your work with Juan's.**

During the third day of class on the Iditarod, the students began to examine the routes on the map. The race begins in Anchorage, Alaska and travels 1150 miles of rough terrain to the city of Nome, Alaska where it finishes.

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"Yes Juan. The mushers all have to check in at the checkpoints. It helps the race officials to keep track of everyone as well as check on the dogs, refuel, and take any other safety precautions."

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Juan took out a piece of paper and wrote down the distance between each check point. Here are his notes.

20, 29, 52, 34, 45, 30, 48, 75, 54, 18, 25, 59, 112, 52, 52, 42, 90, 42, 48, 48, 28, 18, 55, 22

Juan wanted to create a stem-and-leaf plot to show the data. He knew that once he arranged the data in a stem-and-leaf plot, it could help him to find the median distance between two checkpoints.

**Now Juan is ready to create his stem-and-leaf plot. He begins by organizing his data in order from least to greatest.**

**18, 18, 20, 22, 25, 28, 29, 30, 34, 42, 42, 45, 48, 48, 48, 52, 52, 52, 54, 55, 59, 75, 90, 112**

**Next, he can organize the data in stems and leaves.**

TABLE 1.9:

| Stem | Leaves |
|---|---|
| 1 | 8 8 |
| 2 | 0 2 5 8 9 |
| 3 | 0 4 |
| 4 | 2 2 5 8 8 8 |
| 5 | 2 2 2 4 5 9 |
| 6 | |
| 7 | 5 |
| 8 | |
| 9 | 5 |
| 10 | |
| 11 | 2 |

**Juan can see that the median distance centers in the 40 – 50's mile zone. He makes these notes.**

**42, 42, 45, 48, 48, 48, 52, 52, 52, 54, 55, 59**

**The median distance is between 48 and 52 miles. Since there isn't a check point with a distance of 50 miles, it is accurate to say that the median is both 48 and 52 miles.**

## Vocabulary

Here are the vocabulary words that are found in this lesson.

**Stem-and-Leaf Plot** a visual way to organize data which divides numbers up into their stems and their leaves. You are able to easily count the number of values in each grouping.

**Leaf** the last digit to the right in the number

**Stem** the rest of the digits to the left of the leaf

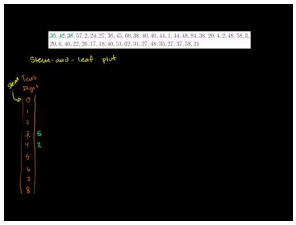
**Mean** the average of a set of numbers

**Median** the middle value in a set of numbers

**Mode** the value that occurs the most times in a set of numbers

**Range** the difference between the highest value in a set of numbers and the lowest value in a set of numbers.

## Technology Integration



MEDIA

Click image to the left for more content.

KhanAcademy, Stem and Leaf Plots

Other Videos:

a. http://www.mathplayground.com/howto_stemleaf.html – This is a great video on how to read stem-and-leaf plots.

## Time to Practice

Directions: Create stem-and-leaf plots and answer the questions on each.

1. Make a stem-and-leaf plot to display the data: 22, 25, 27, 29, 31, 34, 34, 39, 40, and 44.

2. Make a stem-and-leaf plot to display the data: 88, 96, 72, 65, 89, 91, 90, 100, 101, and 86.

The data table below depicts the number of miles ten students commute to school each day.

8 7 11 6 9 15 6 20 12 4

3. Create a stem-and-leaf plot to display the data.

4. Use the stem-and-leaf plot to determine the mean.

5. Use the stem-and-leaf plot to determine the median.

6. Use the stem-and-leaf plot to determine the mode.

7. Use the stem-and-leaf plot to determine the range of the data.

The data table below depicts the final score each basketball game for an entire season.

27 36 31 29 25 39 21 26 34 40 38 29

8. Use the data to create a stem-and-leaf plot.

9. Use the data to determine the mean.

10. Use the data to determine the median.

11. Use the data to determine the mode.

12. Use the data to determine the range.

The stem-and-leaf plot depicts the class sizes for two grade levels at Huntington Middle School. Use the information on the stem-and-leaf plot to answer the questions below.

$7^{th}$ and $8^{th}$ Grade Class Size

**TABLE 1.10:**

| $7^{th}$**Grade:** | | $8^{th}$**Grade:** |
|---|---|---|
| Leaf | Stem | Leaf |
| 9 8 | 1 | 6 7 7 |
| 1 2 4 | 2 | 3 4 |
| 0 | 3 | 2 |
| Key: $4\|2 = 24$ | | Key: $1\|6 = 16$ |

13. Identify the stems for this set of data.

14. Which grade level has a greater mean class size?

15. Determine the range in class size for $7^{th}$ grade and $8^{th}$ grade.

16. Which grade level has a smaller median class size?

The data on the stem-and-leaf plots below compare the average daily temperature in Austin, Texas and Seattle, Washington for ten days in January.

**TABLE 1.11: Temperature in Two Cities (in Fahrenheit)**

| **Temperature in Austin, Texas** | | **Temperature in Seattle, Washington** |
|---|---|---|
| Leaf | Stem | Leaf |
| 9 | 4 | 0 0 2 4 5 7 |
| 9 6 6 3 1 | 5 | 1 2 4 6 |
| 7 4 2 1 | 6 | |
| Key: $1\|5 = 51$ | | Key: $4\|0 = 40$ |

17. What are the stems for the data?

18. What is the coolest temperature in Austin Texas?

19. What is the coolest temperature in Seattle Washington?

20. Which city has the lowest mean temperature?

21. What is the range of the temperatures in Austin?

22. What is the range of the temperatures in Seattle?

23. What are the modes in both cities?