

Frequency and Histograms

Objectives

Create stem-and-leaf plots.

Create frequency tables and histograms.

Vocabulary

stem-and-leaf plot

frequency

frequency table

histogram

cumulative frequency

A stem-and-leaf plot arranges data by dividing each data value into two parts. This allows you to see each data value.

The digits other than the last digit of each value are called a stem.

The last digit of a value is called a leaf.



2 | 3

Key: 2 | 3 means 23

The key tells you how to read each value.

Example 1A: Making a Stem-and-Leaf Plot

The numbers of defective widgets in batches of 1000 are given below. Use the data to make a stem-and-leaf plot.

14, 12, 8, 9, 13, 20, 15, 9, 21, 8, 13, 19

Number of Defective
Widgets per Batch

| Stem | Leaves |
|------|-------------|
| 0 | 8 8 9 9 |
| 1 | 2 3 3 4 5 9 |
| 2 | 0 1 |

Key: 1|9 means 19

The tens digits are the stems.

The ones digits are the leaves. List the leaves from least to greatest within each row.

Title the graph and add a key.

Example 1B: Making a Stem-and-Leaf Plot

The season's scores for the football teams going to the state championship are given below. Use the data to make a back-to-back stem-and-leaf plot.

Team A: 65, 42, 56, 49, 58, 42, 61, 55, 45, 72

Team B: 57, 60, 48, 49, 52, 61, 58, 37, 63, 48

Example 1B Continued

Team A: 65, 42, 56, 49, 58, 42, 61, 55, 45, 72

Team B: 57, 60, 48, 49, 52, 61, 58, 37, 63, 48

Football State Championship Scores

| Team A | | Team B |
|---------|---|--------|
| | 3 | 7 |
| 9 5 2 2 | 4 | 8 8 9 |
| 8 6 5 | 5 | 2 7 8 |
| 5 1 | 6 | 0 1 3 |
| 2 | 7 | |

Key: $|4|8$ means 48
 $2|4|$ means 42

*The tens digits are the stems.
The ones digits are the leaves.*

Put Team A's scores on the left side and Team B's scores on the right.

Title the graph and add a key.

Try 1

The temperature in degrees Celsius for two weeks are given below. Use the data to make a stem-and-leaf plot.

7, 32, 34, 31, 26, 27, 23, 19, 22, 29, 30, 36, 35, 31

Temperature in
Degrees Celsius

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

Key: 1 | 9 means 19

The tens digits are the stems.

The ones digits are the leaves. List the leaves from least to greatest within each row.

Title the graph and add a key.

The **frequency** of a data value is the number of times it occurs. A **frequency table** shows the frequency of each data value. If the data is divided into intervals, the table shows the frequency of each interval.

16 - 20

21 - 25

26 - 30

31 - 35

Example 2: Making a Frequency Table

The numbers of students enrolled in Western Civilization classes at a university are given below. Use the data to make a frequency table with intervals.

12, 22, 18, 9, 25, 31, 28, 19, 22, 27, 32, 14

Step 1 Identify the least and greatest values.

The least value is 9. The greatest value is 32



Example 2 Continued

Step 2 Divide the data into equal intervals.

For this data set, use an interval of 10.

Step 3 List the intervals in the first column of the table. Count the number of data values in each interval and list the count in the last column. Give the table a title.

| Enrollment in Western Civilization Classes | |
|--|-----------|
| Number Enrolled | Frequency |
| 1 – 10 | 1 |
| 11 – 20 | 4 |
| 21 – 30 | 5 |
| 31 – 40 | 2 |

Try 2

The number of days of Maria's last 15 vacations are listed below. Use the data to make a frequency table with intervals.

4, 8, 6, 7, 5, 4, 10, 6, 7, 14, 12, 8, 10, 15, 12

Step 1 Identify the least and greatest values.

The least value is 4. The greatest value is 15.

Step 2 Divide the data into equal intervals.

For this data set use an interval of 3.

Try 2 Continued

Step 3 List the intervals in the first column of the table. Count the number of data values in each interval and list the count in the last column. Give the table a title.

| Number of Vacation Days | |
|-------------------------|-----------|
| Interval | Frequency |
| 4 – 6 | 5 |
| 7 – 9 | 4 |
| 10 – 12 | 4 |
| 13 – 15 | 2 |

Make a stem-and-leaf plot
for the data at the right.

22, 34, 11, 55, 13, 22,
30, 21, 39, 48, 38, 46

A **histogram** is a bar graph used to display the frequency of data divided into equal intervals. The bars must be of equal width and should touch, but not overlap.

Example 3: Making a Histogram

Use the frequency table in Example 2 to make a histogram.

Step 1 Use the scale and interval from the frequency table.

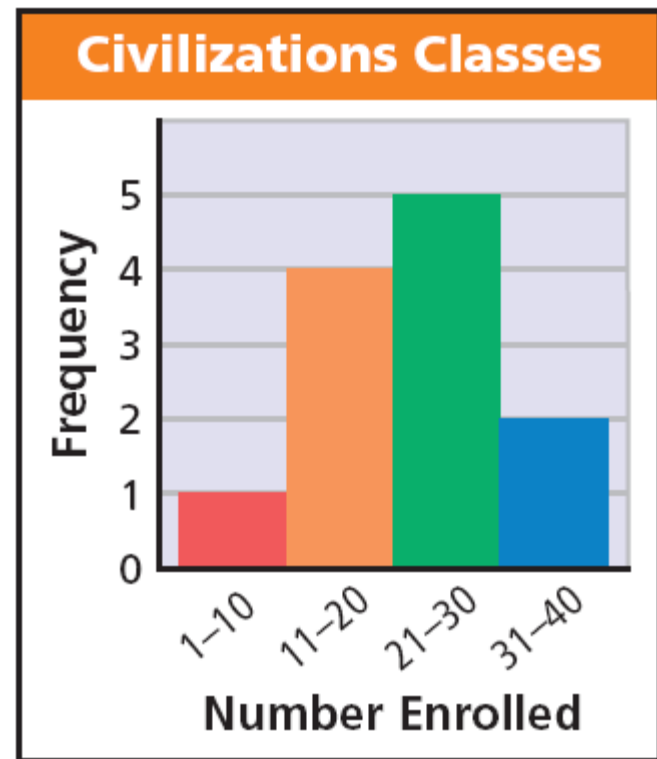
Step 2 Draw a bar for the number of classes in each interval.

All bars should be the same width. The bars should touch, but not overlap.

| Enrollment in Western Civilization Classes | |
|--|-----------|
| Number Enrolled | Frequency |
| 1 – 10 | 1 |
| 11 – 20 | 4 |
| 21 – 30 | 5 |
| 31 – 40 | 2 |

Example 3 Continued

Step 3 Title the graph and label the horizontal and vertical scales.



Try 3

Make a histogram for the number of days of Maria's last 15 vacations.

4, 8, 6, 7, 5, 4, 10, 6, 7, 14, 12, 8, 10, 15, 12

Step 1 Use the scale and interval from the frequency table.

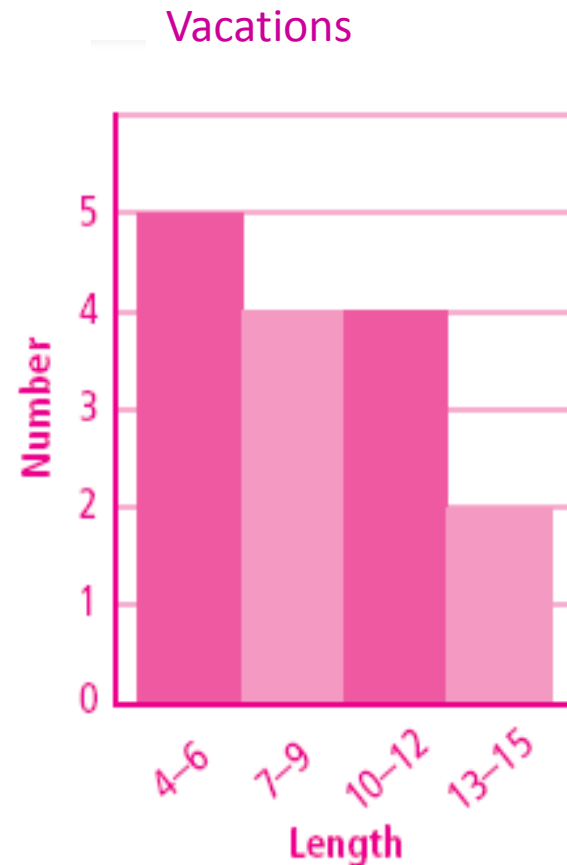
| Number of Vacation Days | |
|-------------------------|-----------|
| Interval | Frequency |
| 4 – 6 | 5 |
| 7 – 9 | 4 |
| 10 – 12 | 4 |
| 13 – 15 | 2 |

Try 3 Continued

Step 2 Draw a bar for the number of scores in each interval.

All bars should be the same width. The bars should touch, but not overlap.

Step 3 Title the graph and label the horizontal and vertical scales.



Cumulative frequency shows the frequency of all data values less than or equal to a given value. You could just count the number of values, but if the data set has many values, you might lose track. Recording the data in a cumulative frequency table can help you keep track of the data values as you count.

Example 4: Making a Cumulative Frequency Table

The weights (in ounces) of packages of pork chops are given below.

19, 20, 26, 18, 25, 29, 18, 18, 22, 24, 27, 26, 24, 21, 29, 19

a. Use the data to make a cumulative frequency table.

Step 1 Choose intervals for the first column of the table.

Step 2 Record the frequency values in each interval for the second column.

Example 4 Continued

Step 3 Add the frequency of each interval to the frequencies of all the intervals before it. Put that number in the third column of the table.

Step 4 Title the table.

| Pork Chops | | |
|-------------|-----------|----------------------|
| Weight (oz) | Frequency | Cumulative Frequency |
| 18-20 | 6 | 6 |
| 21-23 | 2 | 8 |
| 24-26 | 5 | 13 |
| 27-29 | 3 | 16 |

Example 4 Continued

b. How many packages weigh less than 24 ounces?

All packages less than 24 oz are displayed in the first two rows of the table, so look at the cumulative frequency shown in the second row.

There are 8 packages with weights under 24 oz.

| Pork Chops | | |
|-------------|-----------|----------------------|
| Weight (oz) | Frequency | Cumulative Frequency |
| 18-20 | 6 | 6 |
| 21-23 | 2 | 8 |
| 24-26 | 5 | 13 |
| 27-29 | 3 | 16 |

Try 4

The number of vowels in each sentence of a short essay are listed below.

33, 36, 39, 37, 34, 35, 43, 35, 28, 32, 36, 35, 29,
40, 33, 41, 37

a. Use the data to make a cumulative frequency table.

Step 1 Choose intervals for the first column of the table.

Step 2 Record the frequency values in each interval for the second column.

Try 4 Continued

Step 3 Add the frequency of each interval to the frequencies of all the intervals before it. Put that number in the third column of the table.

Step 4 Title the table.

| Vowels in Sentences | | |
|---------------------|-----------|----------------------|
| Number | Frequency | Cumulative Frequency |
| 28-31 | 2 | 2 |
| 32-35 | 7 | 9 |
| 36-39 | 5 | 14 |
| 40-43 | 3 | 17 |

Try 4 Continued

b. How many sentences contain 35 vowels or fewer?

All sentences with less than 35 vowels. are displayed in the first two rows of the table, so look at the cumulative frequency shown in the second row.

There are 9 sentences with fewer than 35 vowels.

| Vowels in Sentences | | |
|---------------------|-----------|----------------------|
| Number | Frequency | Cumulative Frequency |
| 28-31 | 2 | 2 |
| 32-35 | 7 | 9 |
| 36-39 | 5 | 14 |
| 40-43 | 3 | 17 |