**Section 2.3 Additional Displays of Quantitative Data**

***Objective 1: Draw Stem-and-Leaf Plots***

Objective 1, Page 1

In a stem-and-leaf plot, how are the stem and leaf identified?

In a stem-and-leaf plot (or *stem plot*), use the digits to the left of the rightmost digit to form the **stem**. Each rightmost digit forms a **leaf**.

For example, a data value of 147 would have 14 as the stem and 7 as the leaf.

STATCRUNCH

**Drawing Stem-and-Leaf Plots**

1. If necessary, enter the raw data into the spreadsheet. Name the column variable.
2. Select **Graph** and highlight **Stem and Leaf.**
3. **Select column data**
4. **Outlier data none**
5. Click on the variable you want to summarize. Select None for outlier trimming. You also have the option of selecting the leaf unit from the drop-down menu. Click Compute!.

**ANSWER** **BELOW**   
Bizarre

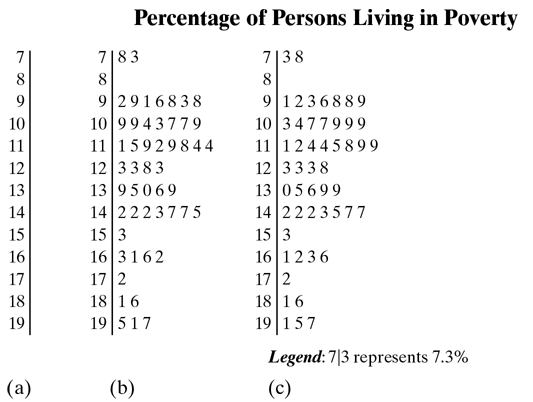
Decimal point is 1 digit(s) to the right of the colon.  
Leaf unit = 1

0 : 78999

1 : 00000011111111122222223344444444

1 : 555566677899

2 : 00

Page 2

Page 3

**Step 1.**Treat the integer portion of the number as the stem and the decimal portion as the leaf. For example, the stem of Alabama will be 16 and the leaf will be 3. The stem of 16 will include all data from 16.0 to 16.9.

2. Write the stems vertically in ascending order and then draw a vertical line to the right of the stems.

3. Write the leaves corresponding to the stem.

4. Within each stem, rearrange the leaves in ascending order. Title the plot and include a legend to indicate what the values represent.

Page 4

1. List an advantage that a stem-and-leaf plot has over frequency distributions and histograms. One advantage of the stem-and-leaf plot over frequency distributions and histograms is that the raw data can be retrieved from the stem-and-leaf plot. So, from a stem-and-leaf plot we can determine the maximum observation. We cannot learn this information immediately from a histogram. Refer to Figure 12, which shows a histogram of the poverty data drawn in StatCrunch. We can see that the largest observation is between 19 and 19.9, but we don't know that the largest value is 19.7
2. Under what conditions do stem-and-leaf plots lose their usefulness? On the other hand, stem-and-leaf plots lose their usefulness when data sets are large or consist of a large range of values.
3. when constructing a stem-and-leaf plot, under what conditions is it advisable to use split stems? Answer: **When The data appear rather bunched**

***Objective 2: Construct Frequency Polygons***

Objective 2, Page 1

1. Explain how to construct a frequency polygon. A **frequency polygon** is a graph that uses points, connected by line segments, to represent the frequencies for the classes. It is constructed by plotting a point above each **class midpoint** (the sum of consecutive lower class limits divided by 2) on a horizontal axis at a height equal to the frequency of the class.

**Construct Frequency and Relative Frequency Polygons**

1. Enter class midpoints in var1 and frequency or relative frequency in var2. Title the columns. Be sure to enter a class midpoint one class below the first class midpoint with a frequency or relative frequency of 0. Also, enter a class midpoint one class above last class midpoint with a frequency or relative frequency of 0.
2. Select **Graph** and highlight **Scatter Plot**.
3. The class midpoints are the X column. The frequency or relative frequency is the Y column. Highlight “Points and Lines” in the Display window. Label the axes and title the graph. Click Compute!.
4. Problem
5. Draw a frequency polygon of the five-year rate of return data summarized in [Table 16](https://xlitemprod.pearsoncmg.com/assignment/containerassignmentplayer.aspx#xln-lb-lnk_obj2_2_d2f5d9fd-1c26-eb86-9e16-355ecdcec804).
6. **Video Solution**

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1. **Technology Step-By-Step**
2. [](https://xlitemprod.pearsoncmg.com/assignment/containerassignmentplayer.aspx#xln-lb-lnk_obj2_2_790fc62a-e355-d60f-e892-1f03561a2d05)
3. Approach
4. Begin by calculating the class midpoints of each class. The class midpoint is found by adding consecutive lower class limits and dividing the result by 2. Plot points above each class midpoint at a height equal to the frequency of the class. Next, draw line segments connecting the points. Draw two additional line segments connecting each end of the graph with the horizontal axis. Remember to label your axes and title your graph.
5. Solution
6. The class midpoints of each class are shown in Table 16. Now plot points with the class midpoints as the x-coordinates and the frequencies as the y-coordinates. Connect these points with line segments. Then determine the midpoint of the class preceding the first class (7.5) and the midpoint of the class after the last class (20.5). Finally, connect each end of the graph with the horizontal axis at (7.5,0) and (20.5,0), respectively, to create Figure 14

***Objective 3: Create Cumulative Frequency and Relative Frequency Distributions***

Objective 3, Page 1

1. What does a cumulative frequency distribution display? A **cumulative frequency** distribution displays the aggregate frequency of the category. In other words, it displays the total number of observations less than or equal to the upper class limit of the class.
2. What does a cumulative relative frequency distribution display? A **cumulative relative frequency** distribution displays the proportion (or percentage) of observations less than or equal to the upper class limit of the class.

Explain how to find the cumulative frequency for the fifth class in a cumulative frequency distri Approach

For the cumulative frequency distribution, determine the total number of observations less than or equal to each class. For the cumulative relative frequency distribution, determine the proportion of observations less than or equal to each class.

Solution

Table 17 displays the cumulative frequency and cumulative relative frequency of the data summarized from Table 13. Table 17 shows that 38 of the 40 mutual funds had five-year rates of return of 15.99% or less. The cumulative relative frequency distribution is shown in the fifth column. We see that 95% of the mutual funds had a five-year rate of return of 15.99% or less. Also, a mutual fund with a five-year rate of return of 16% or higher outperformed 95% of its peers. Notice that the last class 19–19.99% has a cumulative relative frequency of 1—this will always be the case.

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| **TABLE 17** | | | | |
| **Class (Five-year rate of return)** | **Frequency** | **Relative Frequency** | **Cumulative Frequency** | **Cumulative Relative Frequency** |
| 8–8.99 | 2 | 0.05 | 2 | 0.05 |
| 9–9.99 | 2 | 0.05 | 4 | 0.1 |
| 10–10.99 | 4 | 0.1 | 8 | 0.2 |
| 11–11.99 | 1 | 0.025 | 9 | 0.225 |
| 12–12.99 | 6 | 0.15 | 15 | 0.375 |
| 13–13.99 | 13 | 0.325 | 28 | 0.7 |
| 14–14.99 | 7 | 0.175 | 35 | 0.875 |
| 15–15.99 | 3 | 0.075 | 38 | 0.95 |
| 16–16.99 | 1 | 0.025 | 39 | 0.975 |
| 17–17.99 | 0 | 0 | 39 | 0.975 |
| 18–18.99 | 0 | 0 | 39 | 0.975 |
| 19–19.99 | 1 | 0.025 | 40 | 1 |

2.3 Additional Displays of Quantitative Data

**DEFINITION**

An **ogive** (read as “oh jive”) is a graph that represents the cumulative frequency or cumulative relative frequency for the class. It is constructed by plotting points whose x-coordinates are the upper class limits and whose y-coordinates are the cumulative frequencies or cumulative relative frequencies of the class. Then line segments are drawn connecting consecutive points. An additional line segment is drawn connecting the first point to the horizontal axis at a location representing the upper limit of the class that would precede the first class (if it existed).

Approach

A relative frequency ogive is drawn by plotting points whose x-coordinates are the upper class limit of each class and whose y-coordinates are the cumulative relative frequencies of each class. Then connect the points with line segments. Also, an additional line segment is drawn connecting the first point to the horizontal axis at a location representing the upper limit of the class that would precede the first class (if it existed).

Solution

See Figure 15. Notice how 20% of the mutual funds had a five-year rate of return less than or equal to 10.99%. Ogives do not have a line segment drawn from the last point to the horizontal axis because ogives represent the number or proportion of observations less than or equal to the x-coordinate of the point. Note the height of the last point in a relative frequency ogive is always 1.

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| A line graph shows five-year rate of return. Vertical axis represents cumulative relative frequency and ranges from 0 to 1, with increment of 0.2. Horizontal axis represents five-year rate of return (percent) and ranges from 7.99 to 19.99, with increment of 1. |  |
| Figure 15 | |

2.3 Additional Displays of Quantitative Data

***Objective 5: Draw Time-Series Graphs***

Objective 5, Page 1

1. Define time-series data. If the value of a variable is measured at different points in time, then the data are referred to as **time-series data**. The closing price of Cisco Systems stock at the end of each year for the past 12 years is an example of time-series data.

Objective 5, Page 1 (continued)

Explain how to create a time-series plot. If the value of a variable is measured at different points in time, then the data are referred to as **time-series data**. The closing price of Cisco Systems stock at the end of each year for the past 12 years is an example of time-series data.

**DEFINITION**

A **time-series plot** is obtained by plotting the time in which a variable is measured on the horizontal axis and the corresponding value of the variable on the vertical axis. Line segments are then drawn connecting the points.

If the value of a variable is measured at different points in time, then the data are referred to as **time-series data**. The closing price of Cisco Systems stock at the end of each year for the past 12 years is an example of time-series data.

Problem

The Partisan Conflict Index (PCI) tracks the degrees of political disagreement among U.S. politicians in the federal government. It is found by measuring the frequency of newspaper articles reporting disagreement in a given month. Higher values of the index suggest greater conflict among political parties, Congress, and the President. The data in Table 18 represent the PCI in March from 1999 to 2017. Construct a time-series plot of the data. In what year was the index highest? In what year was the index lowest?

**Video Solution**

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**Technology Step-By-Step**

[](https://xlitemprod.pearsoncmg.com/assignment/containerassignmentplayer.aspx#xln-lb-lnk_obj5_2_fbb1f99b-6c09-93ea-90e8-b709c9d4a987)

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| |  |  | | --- | --- | | **TABLE 18** | | | **Year** | **Partisan Conflict Index (PCI)** | | 1999 | 85.87 | | 2000 | 94.67 | | 2001 | 78.23 | | 2002 | 86.67 | | 2003 | 88.49 | | 2004 | 98.55 | | 2005 | 100.07 | | 2006 | 91.49 | | 2007 | 85.44 | | 2008 | 90.87 | | 2009 | 88.04 | | 2010 | 142.42 | | 2011 | 155.83 | | 2012 | 154.18 | | 2013 | 180.56 | | 2014 | 131.4 | | 2015 | 163.54 | | 2016 | 173.88 | | 2017 | 270.72 | | *Source* : Federal Reserve Bank of Philadelphia | | |  |

Approach

**Step 1.** Plot points for each year, with the date on the horizontal axis and the Partisan Conflict Index on the vertical axis.

SHOW STEP 2

2.3 Additional Displays of Quantitative Data

2.3 Additional Displays of Quantitative Data

This concludes the Interactive Reading Assignment for Section 2.3. Click A button reads “Save Assignment.” to save your and me back to the navigation page.