Descriptive Statistics: Stem and Leaf Graphs (Stemplots), Line Graphs and Bar Graphs*

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Abstract

This module introduces the use of stem-and-leaf graphs (stemplots), line graphs and bar graphs for describing a set of data visually.

One simple graph, the **stem-and-leaf graph** or **stemplot**, comes from the field of exploratory data analysis.It is a good choice when the data sets are small. To create the plot, divide each observation of data into a stem and a leaf. The leaf consists of a **final significant digit**. For example, 23 has stem 2 and leaf 3. Four hundred thirty-two (432) has stem 43 and leaf 2. Five thousand four hundred thirty-two (5,432) has stem 543 and leaf 2. The decimal 9.3 has stem 9 and leaf 3. Write the stems in a vertical line from smallest the largest. Draw a vertical line to the right of the stems. Then write the leaves in increasing order next to their corresponding stem.

Example 1

For Susan Dean's spring pre-calculus class, scores for the first exam were as follows (smallest to largest):

33; 42; 49; 49; 53; 55; 55; 61; 63; 67; 68; 68; 69; 69; 72; 73; 74; 78; 80; 83; 88; 88; 88; 90; 92; 94; 94; 94; 94; 96; 100

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Stem-and-Leaf Diagram

Stem	Leaf
3	3
4	299
5	355
6	1378899
7	2348
8	03888
9	0244446
10	0

Table 1

The stemplot shows that most scores fell in the 60s, 70s, 80s, and 90s. Eight out of the 31 scores or approximately 26% of the scores were in the 90's or 100, a fairly high number of As.

The stemplot is a quick way to graph and gives an exact picture of the data. You want to look for an overall pattern and any outliers. An **outlier** is an observation of data that does not fit the rest of the data. It is sometimes called an **extreme value.** When you graph an outlier, it will appear not to fit the pattern of the graph. Some outliers are due to mistakes (for example, writing down 50 instead of 500) while others may indicate that something unusual is happening. It takes some background information to explain outliers. In the example above, there were no outliers.

Example 2

Create a stem plot using the data:

1.1; 1.5; 2.3; 2.5; 2.7; 3.2; 3.3; 3.3; 3.5; 3.8; 4.0; 4.2; 4.5; 4.5; 4.7; 4.8; 5.5; 5.6; 6.5; 6.7; 12.3

The data are the distance (in kilometers) from a home to the nearest supermarket.

Problem ***(Solution on p. 6.)***

1. Are there any outliers?
2. Do the data seem to have any concentration of values?

HINT: The leaves are to the right of the decimal.

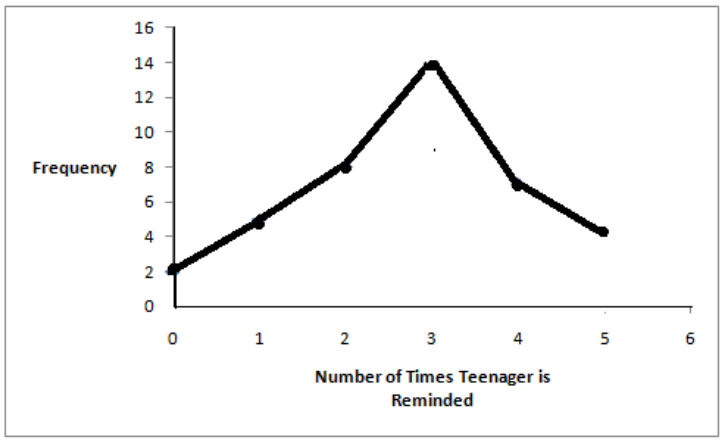
Another type of graph that is useful for specific data values is a **line graph**. In the particular line graph shown in the example, the **x-axis** consists of **data values** and the **y-axis** consists of **frequency points**. The frequency points are connected.

Example 3

In a survey, 40 mothers were asked how many times per week a teenager must be reminded to do his/her chores. The results are shown in the table and the line graph.

Number of times teenager is reminded	Frequency
0	2
1	5
2	8
3	14
4	7
5	4

Table 2



Bar graphs consist of bars that are separated from each other. The bars can be rectangles or they can be rectangular boxes and they can be vertical or horizontal.

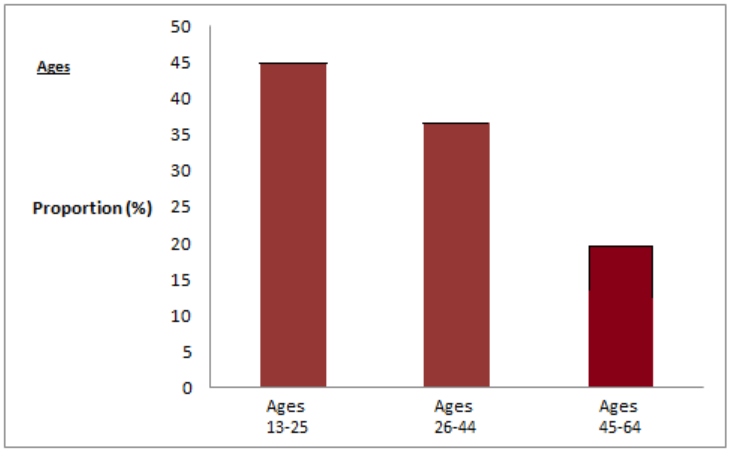
The **bar graph** shown in **Example 4** has age groups represented on the **x-axis** and proportions on the **y-axis**.

Example 4

By the end of 2011, in the United States, Facebook had over 146 million users. The table shows three age groups, the number of users in each age group and the proportion (%) of users in each age group. **Source:** ***http://www.kenburbary.com/2011/03/facebook-demographics-revisited-2011-statistics-2/***

Age groups	Number of Facebook users	Proportion (%) of Facebook users
13 - 25	65,082,280	45%
26 - 44	53,300,200	36%
45 - 64	27,885,100	19%

Table 3

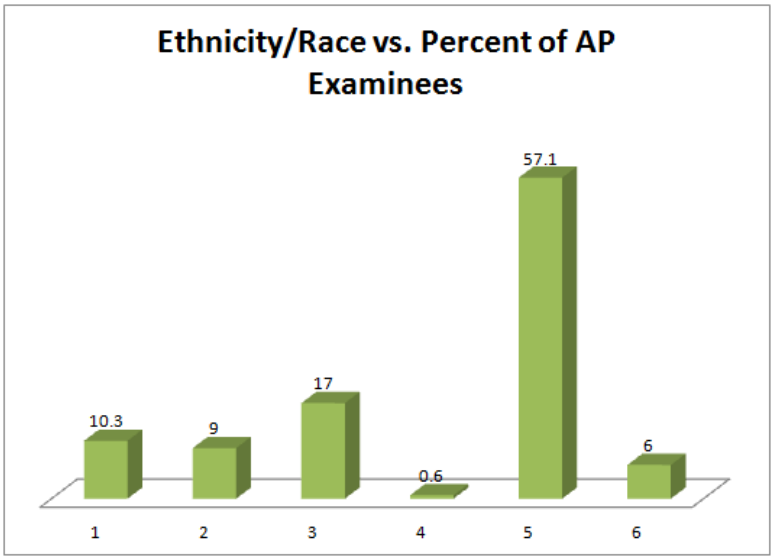


Example 5

The columns in the table below contain the race/ethnicity of U.S. Public Schools: High School Class of 2011, percentages for the Advanced Placement Examinee Population for that class and percentages for the Overall Student Population. The 3-dimensional graph shows the Race/Ethnicity of U.S. Public Schools (qualitative data) on the **x-axis** and Advanced Placement Examinee Population percentages on the **y-axis**. (**Source: http://www.collegeboard.com** and **Source: http://apreport.collegeboard.org/goals-and-findings/promoting-equity**)

Race/Ethnicity	**AP Examinee Population**	**Overall Student Population**
1 = Asian, Asian American or Pacific Islander	10.3%	5.7%
2 = Black or African American	9.0%	14.7%
3 = Hispanic or Latino	17.0%	17.6%
4 = American Indian or Alaska Native	0.6%	1.1%
5 = White	57.1%	59.2%
6 = Not reported/other	6.0%	1.7%

Table 4



Go to Outcomes of Education Figure 22[1] for an example of a bar graph that shows unemployment rates of persons 25 years and older for 2009.

NOTE: This book contains instructions for constructing a **histogram** and a **box plot** for the TI-83+ and TI-84 calculators. You can find additional instructions for using these calculators on the Texas Instruments (TI) website[2] .

[1] http://nces.ed.gov/pubs2011/2011015_5.pdf
[2] http://education.ti.com/educationportal/sites/US/sectionHome/support.html

Solutions to Exercises in this Module

Solution to Example 2, Problem (p. 2)
The value 12.3 may be an outlier. Values appear to concentrate at 3 and 4 kilometers.

Stem	**Leaf**
1	1 5
2	3 5 7
3	2 3 3 5 8
4	0 2 5 5 7 8
5	5 6
6	5 7
7	
8	
9	
10	
11	
12	3

Table 5

Glossary

Definition 1: Outlier
An observation that does not fit the rest of the data.