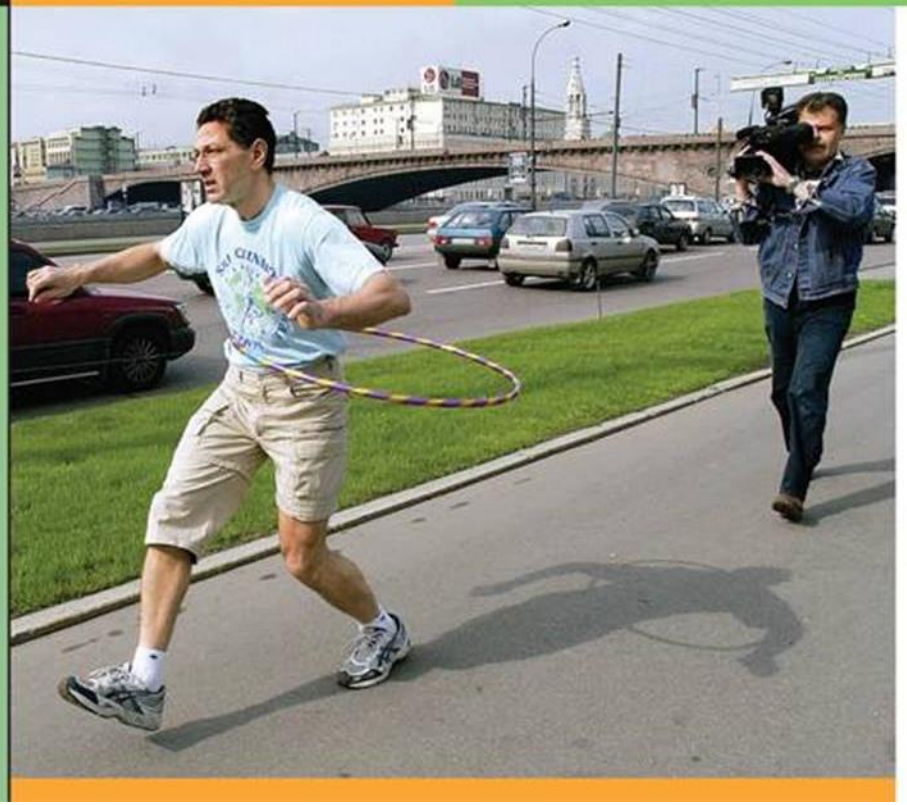
Organizing Data

2



Section 2.2

Bar Graphs, Circle Graphs, and Time-Series Graphs

Focus Points

- Determine types of graphs appropriate for specific data.
- Construct bar graphs, Pareto charts, circle graphs, and time-series graphs.
- Interpret information displayed in graphs.

Bar Graphs, Circle Graphs, and Time-Series Graphs

Histograms provide a useful visual display of the distribution of data.

However, the data must be quantitative. In this section, we examine other types of graphs, some of which are suitable for qualitative or category data as well.

Let's start with *bar graphs*. These are graphs that can be used to display quantitative or qualitative data.

Bar Graphs, Circle Graphs, and Time-Series Graphs

Features of a Bar Graph

1. Bars can be vertical or horizontal.
2. Bars are of uniform width and uniformly spaced.
3. The lengths of the bars represent values of the variable being displayed, the frequency of occurrence, or the percentage of occurrence. The same measurement scale is used for the length of each bar.
4. The graph is well annotated with title, labels for each bar, and vertical scale or actual value for the length of each bar.

Example 4 – *Bar Graph*

Figure 2-11 shows two bar graphs depicting the life expectancies for men and women born in the designated year. Let's analyze the features of these graphs.

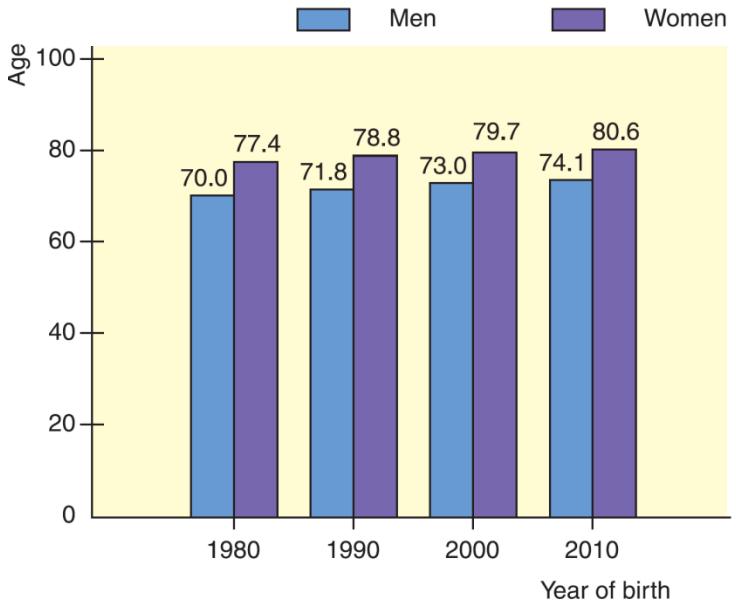


Figure 2-11 (a)

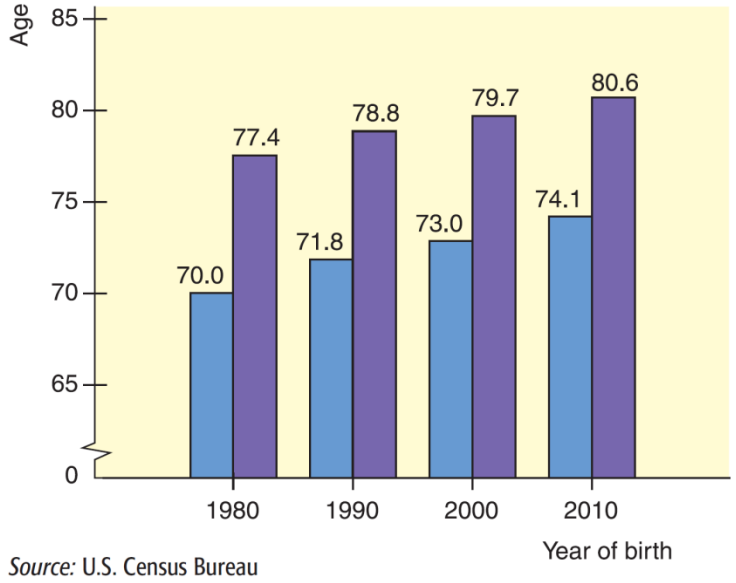


Figure 2-11 (b)

Life Expectancy

Example 4 – *Solution*

The graphs are called *clustered bar graphs* because there are two bars for each year of birth.

One bar represents the life expectancy for men, and the other represents the life expectancy for women.

The height of each bar represents the life expectancy (in years).

Bar Graphs, Circle Graphs, and Time-Series Graphs

An important feature illustrated in Figure 2-11(b) is that of a *changing scale*. Notice that the scale between 0 and 65 is compressed.

The changing scale amplifies the apparent difference between life expectancies for men and women, as well as the increase in life expectancies from those born in 1980 to the projected span of those born in 2010.

Changing Scale

Whenever you use a change in scale in a graphic, warn the viewer by using a squiggle ⌇ on the changed axis. Sometimes, if a single bar is unusually long, the bar length is compressed with a squiggle in the bar itself.

Bar Graphs, Circle Graphs, and Time-Series Graphs

A **Pareto chart** is a bar graph in which the bar height represents frequency of an event. In addition, the bars are arranged from left to right according to decreasing height.

Another popular pictorial representation of data is the *circle graph* or *pie chart*. It is relatively safe from misinterpretation and is especially useful for showing the division of a total quantity into its component parts.

The total quantity, or 100%, is represented by the entire circle. Each wedge of the circle represents a component part of the total.

Bar Graphs, Circle Graphs, and Time-Series Graphs

These proportional segments are usually labeled with corresponding percentages of the total.

In a **circle graph** or **pie chart,** wedges of a circle visually display proportional parts of the total population that share a common characteristic.

Bar Graphs, Circle Graphs, and Time-Series Graphs

We will use a *time-series graph*. A time-series graph is a graph showing data measurements in chronological order.

To make a time-series graph, we put time on the horizontal scale and the variable being measured on the vertical scale. In a basic time-series graph, we connect the data points by line segments.

In a **time-series graph,** data are plotted in order of occurrence at regular intervals over a period of time.

Example 5 – *Time-Series Graph*

Suppose you have been in the walking/jogging exercise program for 20 weeks, and for each week you have recorded the distance you covered in 30 minutes. Your data log is shown in Table 2-14.

Week	1	2	3	4	5	6	7	8	9	10
Distance	1.5	1.4	1.7	1.6	1.9	2.0	1.8	2.0	1.9	2.0
Week	11	12	13	14	15	16	17	18	19	20
Distance	2.1	2.1	2.3	2.3	2.2	2.4	2.5	2.6	2.4	2.7

Distance (in Miles) Walked/Jogged in 30 Minutes

Table 2-14

Example 5(a) – *Time-Series Graph* cont'd

Make a time-series graph.

Solution:

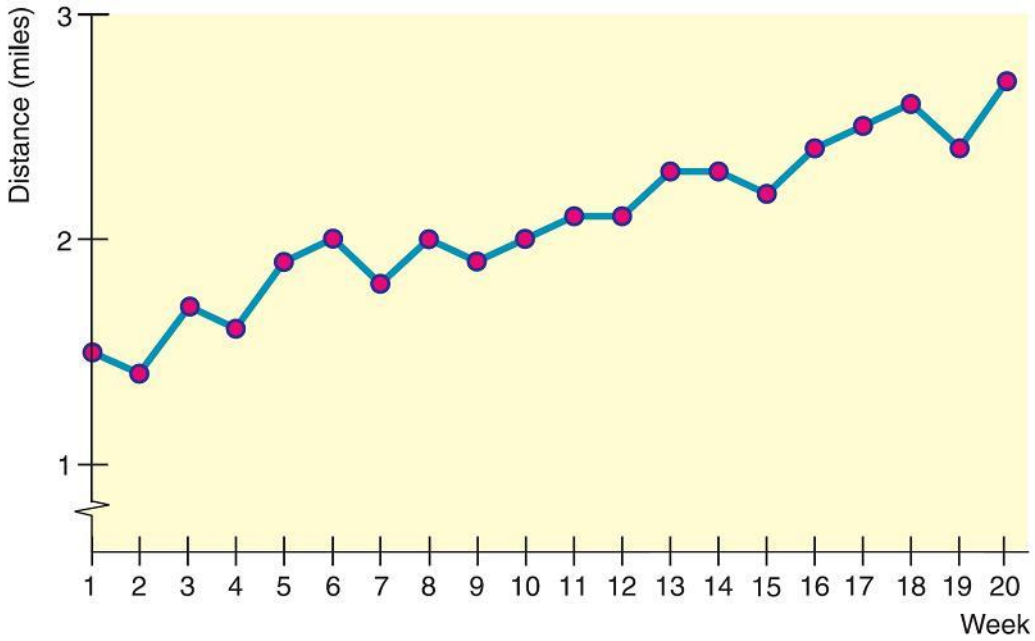
The data are appropriate for a time-series graph because they represent the same measurement (distance covered in a 30-minute period) taken at different times.

The measurements are also recorded at equal time intervals (every week). To make our time-series graph, we list the weeks in order on the horizontal scale. Above each week, plot the distance covered that week on the vertical scale.

Example 5(a) – *Solution*

cont'd

Then connect the dots. Figure 2-14 shows the time-series graph. Be sure the scales are labeled.



Time-Series Graph of Distance (in Miles) Walked/Jogged in 30 Minutes

Figure 2-14

Example 5(b) – *Time-Series Graph* cont'd

From looking at Figure 2-14, can you detect any patterns?

Solution:

There seems to be an upward trend in distance covered. The distances covered in the last few weeks are about a mile farther than those for the first few weeks.

However, we cannot conclude that this trend will continue. Perhaps you have reached your goal for this training activity and now wish to maintain a distance of about 2.5 miles in 30 minutes.

Bar Graphs, Circle Graphs, and Time-Series Graphs

Data sets composed of similar measurements taken at regular intervals over time are called *time series*.

Time series are often used in economics, finance, sociology, medicine, and any other situation in which we want to study or monitor a similar measure over a period of time. A time-series graph can reveal some of the main features of a time series.

Time-series data consist of measurements of the same variable for the same subject taken at regular intervals over a period of time.

Bar Graphs, Circle Graphs, and Time-Series Graphs

Procedure:

HOW TO DECIDE WHICH TYPE OF GRAPH TO USE

Bar graphs are useful for quantitative or qualitative data. With qualitative data, the frequency or percentage of occurrence can be displayed. With quantitative data, the measurement itself can be displayed, as was done in Figure 2-11. Watch that the measurement scale is consistent or that a jump scale squiggle is used.

Pareto charts identify the frequency of events or categories in decreasing order of frequency of occurrence.

Circle graphs display how a *total* is dispersed into several categories. The circle graph is very appropriate for qualitative data, or any data for which percentage of occurrence makes sense. Circle graphs are most effective when the number of categories or wedges is 10 or fewer.

Time-series graphs display how data change over time. It is best if the units of time are consistent in a given graph. For instance, measurements taken every day should not be mixed on the same graph with data taken every week.

For any graph: Provide a title, label the axes, and identify units of measure. As Edward Tufte suggests in his book *The Visual Display of Quantitative Information*, don't let artwork or skewed perspective cloud the clarity of the information displayed.