

## 3.4: Scatterplots (2 of 5)

### Learning Objectives

- Use a scatterplot to display the relationship between two quantitative variables. Describe the overall pattern (form, direction, and strength) and striking deviations from the pattern.

### Interpreting the Scatterplot

How do we describe the relationship between two quantitative variables using a scatterplot? We describe the overall pattern and deviations from that pattern.

This is the same way we described the distribution of one quantitative variable using a dotplot or a histogram in *Summarizing Data Graphically and Numerically*. To describe the overall pattern of the distribution of one quantitative variable, we describe the shape, center, and spread. We also describe deviations from the pattern (outliers).

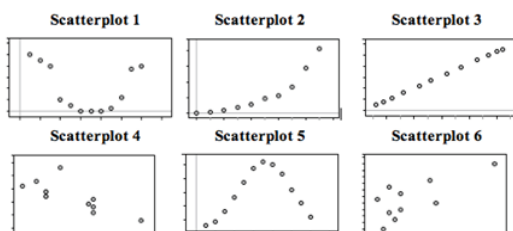
Similarly, in a scatterplot, we describe the overall pattern with descriptions of **direction**, **form**, and **strength**. Deviations from the pattern are still called outliers.

- A *positive (or increasing) relationship* means that an increase in one of the variables is associated with an increase in the other. A *negative (or decreasing) relationship* means that an increase in one of the variables is associated with a decrease in the other.
- The form of the relationship is its general shape. To identify the form, describe the shape of the data in the scatterplot. In practice, forms that we commonly use have mathematical equations. We look at a few of these equations in this course. For now, we simply describe the shape of the pattern in the scatterplot. Here are a couple of forms that are quite common: **Linear** form: The data points appear scattered about a line. We use a line to summarize the pattern in the data. We study the equation for a line in this module.
- In the top scatterplot, the data points closely follow the linear pattern. This is an example of a *strong linear* relationship. In the bottom scatterplot, the data points also follow a linear pattern, but the points are not as close to the line. The data is more scattered about the line. This is an example of a *weaker linear* relationship.

Labeling a relationship as strong or weak is not very precise. We develop a more precise way to measure the strength of a relationship shortly.

*Outliers* are points that deviate from the pattern of the relationship. In the scatterplot below, there is one outlier.

### Learn By Doing



Fill in the letter of the description that matches each scatterplot.

Descriptions:

- A:** X = month (January = 1), Y = rainfall (inches) in Napa, CA in 2010 (Note: Napa has rain in the winter months and months with little to no rainfall in summer.)
- B:** X = month (January = 1), Y = average temperature in Boston MA in 2010 (Note: Boston has cold winters and hot summers.)
- C:** X = year (in five-year increments from 1970), Y = Medicare costs (in \$) (Note: the yearly increase in Medicare costs has gotten bigger and bigger over time.)
- D:** X = average temperature in Boston MA (°F), Y = average temperature in Boston MA (°C) each month in 2010
- E:** X = chest girth (cm), Y = shoulder girth (cm) for a sample of men
- F:** X = engine displacement (liters), Y = city miles per gallon for a sample of cars (Note: engine displacement is roughly a measure of engine size. Large engines use more gas.)

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