

7.2 Exercises

Basic Concepts

1. How was the normal distribution developed?
2. Are the normal and uniform distributions probability models?
3. List the properties of the normal distribution.
4. What is the shape of the normal distribution?
5. What are the parameters of the normal distribution?
6. If the variance of a normal distribution is constant, what affect will changes in the mean have on the distribution?
7. If the mean of a normal distribution is constant, what effect will changes in the standard deviation have on the distribution?

Exercises

8. Sketch a normal curve and mark each of the following on the x -axis.
 - a. μ
 - b. $\mu + \sigma$
 - c. $\mu - \sigma$
9. Sketch a normal curve and use labels to illustrate the empirical rule.
10. Sketch three normal curves on a single axis that have the same standard deviation but different means.
11. Sketch three normal curves on a single axis that have the same mean, but different standard deviations.

7.3 Assessing Normality Graphically

The normal distribution is the most important continuous probability distribution. The distribution follows a bell-shaped curve, centered about its mean, and usually, outliers do not have a large impact on the value of the mean. Numerous statistical methods used to analyze data make assumptions about normality including t -tests, regression analysis, and analysis of variance, which is the reason we first test the normality of the data before performing any analysis. If the data follow a normal distribution, then we can use parametric procedures to analyze the data; if not, then we will use nonparametric methods to analyze the data.

As stated above, an assessment of normality is the prerequisite for many statistical tests. Typically, a visual check is sufficient to assess normality. In this section, we will discuss graphical techniques that can be used to assess the normality of the data. Graphically assessing normality has the advantage of using the good judgment and expertise of the analyst. Of course, the more expertise the analyst has, the less likely it is that there will be an incorrect interpretation of the data.

In this section, we will discuss the histogram, box plot, and normal probability plot which are graphical techniques used to assess the normality of data. There are many statistical software programs that can be used to create the histogram, box plot, and normal probability plot such as JMP, Excel, and Minitab. We will use JMP to graphically assess normality in the example that follows.

Histogram

As discussed in Chapter 3, a histogram is a graphical method that shows the distribution of a continuous random variable. Even though histograms resemble bar graphs, we analyze them quite differently given that we are using quantitative data. When analyzing the histogram, we can visually see the structure of the data—the shape (symmetric or skewed), the modality of the data, and the existence of outliers.