and 20 men. The women averaged 14,704 words per day with a standard deviation of 6215. For men the mean was 15,022 and the standard deviation was 7864. ▦ TALKM

(a) Answer the questions from the previous exercise for the Mexican study.

(b) The means for both men and women are higher for the Mexican study than for the U.S. study. What conclusions can you draw from this observation?

1.120 Total scores. Here are the total scores of 10 students in an introductory statistics course: ▦ STAT

> 62   93   54   76   73   98   64   55   80   71

Previous experience with this course suggests that these scores should come from a distribution that is approximately Normal with mean 72 and standard deviation 10.

(a) Using these values for μ and σ, standardize the scores of these 10 students.

(b) If the grading policy is to give a grade of A to the top 15% of scores based on the Normal distribution with mean 72 and standard deviation 10, what is the cutoff for an A in terms of a standardized score?

(c) Which of the 10 students earned a grade of A in the course? Show your work.

1.121 Assign more grades. Refer to the previous exercise. The grading policy says that the cutoffs for the other grades correspond to the following: bottom 5% receive F, next 10% receive D, next 40% receive C, and next 30% receive B. These cutoffs are based on the $N(72, 10)$ distribution.

(a) Give the cutoffs for the grades in this course in terms of standardized scores.

(b) Give the cutoffs in terms of actual total scores.

(c) Do you think that this method of assigning grades is a good one? Give reasons for your answer.

1.122 A uniform distribution. If you ask a computer to generate "random numbers" between 0 and 1, you will get observations from a **uniform distribution.** Figure 1.32 graphs the density curve for a uniform distribution. Use areas under this density curve to answer the following questions.
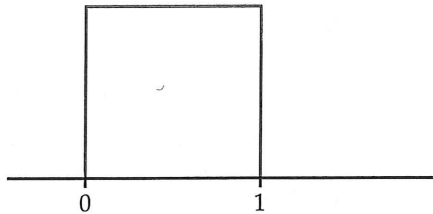

FIGURE 1.32 The density curve of a uniform distribution, for Exercise 1.122.

(a) Why is the total area under this curve equal to 1?

(b) What proportion of the observations lie below 0.34?

(c) What proportion of the observations lie between 0.34 and 0.60?

1.123 Use a different range for the uniform distribution. Many random number generators allow users to specify the range of the random numbers to be produced. Suppose that you specify that the outcomes are to be distributed uniformly between 0 and 5. Then the density curve of the outcomes has constant height between 0 and 5, and height 0 elsewhere.

(a) What is the height of the density curve between 0 and 5? Draw a graph of the density curve.

(b) Use your graph from (a) and the fact that areas under the curve are proportions of outcomes to find the proportion of outcomes that are less than 1.

(c) Find the proportion of outcomes that lie between 0.5 and 2.5.

1.124 Find the mean, the median, and the quartiles. What are the mean and the median of the uniform distribution in Figure 1.32? What are the quartiles?

1.125 Three density curves. Figure 1.33 displays three density curves, each with three points marked on it. At which of these points on each curve do the mean and the median fall?

🚀 **1.126 Use the *Normal Curve* applet.** Use the *Normal Curve* applet for the standard Normal distribution to say how many standard deviations above and below the mean the quartiles of any Normal distribution lie.

🚀 **1.127 Use the *Normal Curve* applet.** The 68–95–99.7 rule for Normal distributions is a useful approximation. You can use the *Normal Curve* applet on the text website, **whfreeman.com/ips8e,** to see how accurate the rule is. Drag one flag across the other so that the applet shows the area under the curve between the two flags.
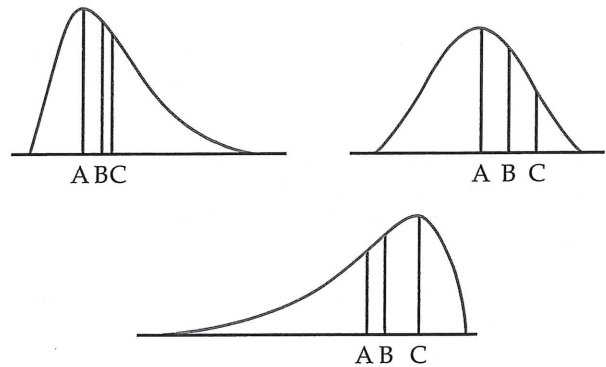

FIGURE 1.33 Three density curves, for Exercise 1.125.

(a) Place the flags one standard deviation on either side of the mean. What is the area between these two values? What does the 68–95–99.7 rule say this area is?

(b) Repeat for locations two and three standard deviations on either side of the mean. Again compare the 68–95–99.7 rule with the area given by the applet.

1.128 Find some proportions. Using either Table A or your calculator or software, find the proportion of observations from a standard Normal distribution that satisfies each of the following statements. In each case, sketch a standard Normal curve and shade the area under the curve that is the answer to the question.

(a) $Z > 1.55$

(b) $Z < 1.55$

(c) $Z > -0.70$

(d) $-0.70 < Z < 1.55$

1.129 Find more proportions. Using either Table A or your calculator or software, find the proportion of observations from a standard Normal distribution for each of the following events. In each case, sketch a standard Normal curve and shade the area representing the proportion.

(a) $Z \leq -1.7$

(b) $Z \geq -1.7$

(c) $Z > 1.9$

(d) $-1.7 < Z < 1.9$

1.130 Find some values of z. Find the value z of a standard Normal variable Z that satisfies each of the following conditions. (If you use Table A, report the value of z that comes closest to satisfying the condition.) In each case, sketch a standard Normal curve with your value of z marked on the axis.

(a) 28% of the observations fall below z.

(b) 60% of the observations fall above z.

1.131 Find more values of z. The variable Z has a standard Normal distribution.

(a) Find the number z that has cumulative proportion 0.78.

(b) Find the number z such that the event $Z > z$ has proportion 0.22.

1.132 Find some values of z. The Wechsler Adult Intelligence Scale (WAIS) is the most common IQ test. The scale of scores is set separately for each age group, and the scores are approximately Normal with mean 100 and standard deviation 15. People with WAIS scores below 70 are considered developmentally disabled when, for example, applying for Social Security disability benefits. What percent of adults are developmentally disabled by this criterion?

1.133 High IQ scores. The Wechsler Adult Intelligence Scale (WAIS) is the most common IQ test. The scale of scores is set separately for each age group, and the scores are approximately Normal with mean 100 and standard deviation 15. The organization MENSA, which calls itself "the high-IQ society," requires a WAIS score of 130 or higher for membership. What percent of adults would qualify for membership?

There are two major tests of readiness for college, the ACT and the SAT. ACT scores are reported on a scale from 1 to 36. The distribution of ACT scores is approximately Normal with mean $\mu = 21.5$ and standard deviation $\sigma = 5.4$. SAT scores are reported on a scale from 600 to 2400. The distribution of SAT scores is approximately Normal with mean $\mu = 1498$ and standard deviation $\sigma = 316$. Exercises 1.134 to 1.143 are based on this information.

1.134 Compare an SAT score with an ACT score. Jessica scores 1825 on the SAT. Ashley scores 28 on the ACT. Assuming that both tests measure the same thing, who has the higher score? Report the z-scores for both students.

1.135 Make another comparison. Joshua scores 17 on the ACT. Anthony scores 1030 on the SAT. Assuming that both tests measure the same thing, who has the higher score? Report the z-scores for both students.

1.136 Find the ACT equivalent. Jorge scores 2060 on the SAT. Assuming that both tests measure the same thing, what score on the ACT is equivalent to Jorge's SAT score?

1.137 Find the SAT equivalent. Alyssa scores 32 on the ACT. Assuming that both tests measure the same thing, what score on the SAT is equivalent to Alyssa's ACT score?

1.138 Find an SAT percentile. Reports on a student's ACT or SAT results usually give the percentile as well as the actual score. The percentile is just the cumulative proportion stated as a percent: the percent of all scores that were lower than or equal to this one. Renee scores 2040 on the SAT. What is her percentile?

1.139 Find an ACT percentile. Reports on a student's ACT or SAT results usually give the percentile as well as the actual score. The percentile is just the cumulative proportion stated as a percent: the percent of all scores that were lower than or equal to this one. Joshua scores 17 on the ACT. What is his percentile?

1.140 How high is the top 15%? What SAT scores make up the top 15% of all scores?

1.141 How low is the bottom 10%? What SAT scores make up the bottom 10% of all scores?

1.142 Find the ACT quintiles. The quintiles of any distribution are the values with cumulative proportions 0.20, 0.40, 0.60, and 0.80. What are the quintiles of the distribution of ACT scores?

1.143 Find the SAT quartiles. The quartiles of any distribution are the values with cumulative proportions 0.25 and 0.75. What are the quartiles of the distribution of SAT scores?

1.144 Do you have enough "good cholesterol?" High-density lipoprotein (HDL) is sometimes called the "good cholesterol" because low values are associated with a higher risk of heart disease. According to the American Heart Association, people over the age of 20 years should have at least 40 milligrams per deciliter (mg/dl) of HDL cholesterol.[40] U.S. women aged 20 and over have a mean HDL of 55 mg/dl with a standard deviation of 15.5 mg/dl. Assume that the distribution is Normal.

(a) What percent of women have low values of HDL (40 mg/dl or less)?

(b) HDL levels of 60 mg/dl and higher are believed to protect people from heart disease. What percent of women have protective levels of HDL?

(c) Women with more than 40 mg/dl but less than 60 mg/dl of HDL are in the intermediate range, neither very good or very bad. What proportion are in this category?

1.145 Men and HDL cholesterol. HDL cholesterol levels for men have a mean of 46 mg/dl with a standard deviation of 13.6 mg/dl. Answer the questions given in the previous exercise for the population of men.

1.146 Diagnosing osteoporosis. Osteoporosis is a condition in which the bones become brittle due to loss of minerals. To diagnose osteoporosis, an elaborate apparatus measures bone mineral density (BMD). BMD is usually reported in standardized form. The standardization is based on a population of healthy young adults. The World Health Organization (WHO) criterion for osteoporosis is a BMD 2.5 standard deviations below the mean for young adults. BMD measurements in a population of people similar in age and sex roughly follow a Normal distribution.

(a) What percent of healthy young adults have osteoporosis by the WHO criterion?

(b) Women aged 70 to 79 are of course not young adults. The mean BMD in this age is about −2 on the standard scale for young adults. Suppose that the standard deviation is the same as for young adults. What percent of this older population has osteoporosis?

1.147 Deciles of Normal distributions. The **deciles** of any distribution are the 10th, 20th, . . . , 90th percentiles. The first and last deciles are the 10th and 90th percentiles, respectively.

(a) What are the first and last deciles of the standard Normal distribution?

(b) The weights of 9-ounce potato chip bags are approximately Normal with mean 9.12 ounces and standard deviation 0.15 ounce. What are the first and last deciles of this distribution?

1.148 Quartiles for Normal distributions. The quartiles of any distribution are the values with cumulative proportions 0.25 and 0.75.

(a) What are the quartiles of the standard Normal distribution?

(b) Using your numerical values from (a), write an equation that gives the quartiles of the $N(\mu, \sigma)$ distribution in terms of μ and σ.

1.149 IQR for Normal distributions. Continue your work from the previous exercise. The interquartile range IQR is the distance between the first and third quartiles of a distribution.

(a) What is the value of the IQR for the standard Normal distribution?

(b) There is a constant c such that $IQR = c\sigma$ for any Normal distribution $N(\mu, \sigma)$. What is the value of c?

1.150 Outliers for Normal distributions. Continue your work from the previous two exercises. The percent of the observations that are suspected outliers according to the $1.5 \times IQR$ rule is the same for any Normal distribution. What is this percent?

1.151 Deciles of HDL cholesterol. The **deciles** of any distribution are the 10th, 20th, . . . , 90th percentiles. Refer to Exercise 1.144 where we assumed that the distribution of HDL cholesterol in U.S. women aged 20 and over is Normal with mean 55 mg/dl and standard deviation 15.5 mg/dl. Find the deciles for this distribution.

The remaining exercises for this section require the use of software that will make Normal quantile plots.

1.152 Longleaf pine trees. Exercise 1.72 (page 50) gives the diameter at breast height (DBH) for 40 longleaf pine trees from the Wade Tract in Thomas County, Georgia. Make a Normal quantile plot for these data and write a short paragraph interpreting what it describes. PINES

1.153 Three varieties of flowers. The study of tropical flowers and their hummingbird pollinators (Exercise 1.88, page 52) measured the lengths of three varieties of *Heliconia* flowers. We expect that such biological measurements will have roughly Normal distributions. HELICON

(a) Make Normal quantile plots for each of the three flower varieties. Which distribution is closest to Normal?

(b) The other two distributions show the same kind of mild deviation from Normality. In what way are these distributions non-Normal?

(c) Compute the mean for each variety. For each flower, subtract the mean for its variety. Make a single data set