

1. How well materials conduct heat matters when designing houses. As a test of a new measurement process, 10 measurements are made on pieces of glass known to have conductivity 1. The average of the 10 measurements is **1.07**. For each of the boldface numbers, indicate whether it is a parameter or a statistic. Explain your answer.

2. What can teachers do to alleviate statistics anxiety in their students? To explore this question, statistics anxiety for students in two classes was compared. In one class, the instructor lectured in a formal manner, including dressing formally. In the other, the instructor was less formal, dressed informally, was more personal, used humor, and called on students by their first names. Anxiety was measured using a questionnaire. Higher scores indicate a greater level of anxiety. The mean anxiety score for students in the formal lecture class was **25.40**; in the informal class the mean was **20.41**. For each of the boldface numbers, indicate whether it is a parameter or a statistic. Explain your answer.

3. The summer monsoon rains in India follow approximately a Normal distribution with mean 852 millimeters (mm) of rainfall and standard deviation 82 mm. Rainfall is to be recorded each year for a decade and the mean rainfall  $\bar{x}$  computed. What are the mean and standard deviation of  $\bar{x}$ , the mean rainfall per year?

4. Shelia's doctor is concerned that she may suffer from gestational diabetes (high blood glucose levels during pregnancy). There is variation both in the actual glucose level and in the blood test that measures the level. A patient is classified as having gestational diabetes if the glucose level is above 140 milligrams per deciliter (mg/dl) one hour after having a sugary drink. Shelia's measured glucose level one hour after the sugary drink varies according to the Normal distribution with  $\mu = 122$  mg/dl and  $\sigma = 12$  mg/dl.

(a) If a single glucose measurement is made, what is the probability that Shelia is diagnosed as having gestational diabetes?

(b) If measurements are made on 4 separate days and the mean result is compared with the criterion 140 mg/dl, what is the probability that Shelia is diagnosed as having gestational diabetes?

5. Shelia's measured glucose level one hour after having a sugary drink varies according to the Normal distribution with  $\mu = 122$  mg/dl and  $\sigma = 12$  mg/dl. What is the level  $L$  such that there is probability only 0.05 that the mean glucose level of 4 test results falls above  $L$ ? (Hint: This requires a backward Normal calculation.)

6. Light vehicles sold in the United States must emit an average of no more than 0.07 grams per mile (g/mi) of nitrogen oxides (NOX). NOX emissions for one car model vary Normally with mean 0.05 g/mi and standard deviation 0.01 g/mi.

(a) What is the probability that a single car of this model emits more than 0.07 g/mi of NOX?

(b) A company has 25 cars of this model in its fleet. What is the probability that the average NOX level  $\bar{x}$  of these cars is above 0.07 g/mi?

7. In a study of exercise, a large group of male runners walk on a treadmill for 6 minutes. After this exercise, their heart rates vary with mean 8.8 beats per five seconds and standard deviation 1.0 beats per five seconds. This distribution takes only whole-number values, so it is certainly not Normal.

(a) Let  $\bar{x}$  be the mean number of beats per five seconds after measuring heart rate for 12 five-second intervals (a minute). What is the approximate distribution of  $\bar{x}$  according to the central limit theorem?

(b) What is the approximate probability that  $\bar{x}$  is less than 8?

(c) What is the approximate probability that the heart rate of a runner is less than 100 beats per minute? (Hint: Restate this event in terms of  $\bar{x}$ .)

8. Andrew plans to retire in 40 years. He plans to invest part of his retirement funds in stocks, so he seeks out information on past returns. He learns that from 1960 to 2009, the annual returns on U.S. common stocks had mean 10.8% and standard deviation 17.1%. The distribution of annual returns on common stocks is roughly symmetric, so the mean return over even a moderate number of years is close to Normal. What is the probability (assuming that the past pattern of variation continues) that the mean annual return on common stocks over the next 40 years will exceed 10%? What is the probability that the mean return will be less than 5%? Follow the four-step process as illustrated in Example 11.8.

9. To estimate the mean score  $\mu$  of those who took the Medical College Admission Test on your campus, you will obtain the scores of an SRS of students. From published information you know that the scores are approximately Normal with standard deviation about 6.4. How large an SRS must you take to reduce the standard deviation of the sample mean score to 1?

10. The numbers racket is a well-entrenched illegal gambling operation in most large cities. One version works as follows: you choose one of the 1000 three-digit numbers 000 to 999 and pay your local numbers runner a dollar to enter your bet. Each day, one three-digit number is chosen at random and pays off \$600. The mean payoff for the population of thousands of bets is  $\mu = 60$  cents. Joe makes one bet every day for many years. Explain what the law of large numbers says about Joe's results as he keeps on betting.