1. **Hypotheses.** Write the null and alternative hypotheses you would use to test each of the following situations:
   a) A governor is concerned about his "negatives"—the percentage of state residents who express disapproval of his job performance. His political committee pays for a series of TV ads, hoping that they can keep the negatives below 30%. They will use follow-up polling to assess the ads' effectiveness.
   b) Is a coin fair?
   c) Only about 20% of people who try to quit smoking succeed. Sellers of a motivational tape claim that listening to the recorded messages can help people quit.

3. **Negatives.** After the political ad campaign described in Exercise 1a, pollsters check the governor's negatives. They test the hypothesis that the ads produced no change against the alternative that the negatives are now below 30% and find a P-value of 0.22. Which conclusion is appropriate? Explain.
   a) There's a 22% chance that the ads worked.
   b) There's a 78% chance that the ads worked.
   c) There's a 22% chance that the poll they conducted is correct.
   d) There's a 22% chance that natural sampling variation could produce poll results like these if there's really no change in public opinion.

4. **Dice.** The seller of a loaded die claims that it will favor the outcome 6. We don't believe that claim, and roll the die 200 times to test an appropriate hypothesis. Our P-value turns out to be 0.03. Which conclusion is appropriate? Explain.
   a) There's a 3% chance that the die is fair.
   b) There's a 97% chance that the die is fair.
   c) There's a 3% chance that a loaded die could randomly produce the results we observed, so it's reasonable to conclude that the die is fair.
   d) There's a 3% chance that a fair die could randomly produce the results we observed, so it's reasonable to conclude that the die is loaded.

14. **Abnormalities.** In the 1980s it was generally believed that congenital abnormalities affected about 5% of the nation's children. Some people believe that the increase in the number of chemicals in the environment has led to an increase in the incidence of abnormalities. A recent study examined 384 children and found that 46 of them showed signs of an abnormality. Is this strong evidence that the risk has increased?
   a) Write appropriate hypotheses.
   b) Check the necessary assumptions.
   c) Perform the mechanics of the test. What is the P-value?
   d) Explain carefully what the P-value means in this context.
   e) What's your conclusion?
   f) Do environmental chemicals cause congenital abnormalities?

35. **John Wayne.** Like a lot of other Americans, John Wayne died of cancer. But is there more to this story? In 1955 Wayne was in Utah shooting the film *The Conqueror*. Across the state line, in Nevada, the United States military was testing atomic bombs. Radioactive fallout from those tests drifted across the filming location. A total of 46 of the 220 people working on the film eventually died of cancer. Cancer experts estimate that one would expect only about 30 cancer deaths in a group this size.
   a) Is the death rate observed in the movie crew unusually high?
   b) Does this prove that exposure to radiation increases the risk of cancer?

CH 20

1. **One sided or two?** In each of the following situations, is the alternative hypothesis one-sided or two-sided? What are the hypotheses?
   a) A business student conducts a taste test to see whether students prefer Diet Coke or Diet Pepsi.
   b) PepsiCo recently reformulated Diet Pepsi in an attempt to appeal to teenagers. They run a taste test to see if the new formula appeals to teenagers more than the standard formula.
   c) A budget override in a small town requires a two-thirds majority to pass. A local newspaper conducts a poll to see if there's evidence it will pass.
   d) One financial theory states that the stock market will go up or down with equal probability. A student collects data over several years to test the theory.

3. **P-value.** A medical researcher has tested a new treatment for poison ivy against the traditional ointment. He concludes that the new treatment, with a P-value of 0.047, is more effective. Explain what the P-value means in this context.

6. **Alpha again.** Environmentalists concerned about the impact of high-frequency radio transmissions on birds found that there was no evidence of a higher mortality rate among hatchlings in nests near cell towers. They based this conclusion on a test using $\alpha = 0.05$. Would they have made the same decision at $\alpha = 0.10$? How about $\alpha = 0.01$? Explain.

13. **Loans.** Before lending someone money, banks must decide whether they believe the applicant will repay the loan. One strategy used is a point system. Loan officers assess information about the applicant, totaling points they award for the person's income level, credit history, current debt burden, and so on. The higher the point total, the more convinced the bank is that it's safe to make the loan. Any applicant with a lower point total than a certain cutoff score is denied a loan.

    We can think of this decision as a hypothesis test. Since the bank makes its profit from the interest collected on repaid loans, their null hypothesis is that the applicant will repay the loan and therefore should get the money. Only if the person's score falls below the minimum cutoff will the bank reject the null and deny the loan. This system is reasonably reliable, but, of course, sometimes there are mistakes.
   a) When a person defaults on a loan, which type of error did the bank make?
   b) Which kind of error is it when the bank misses an opportunity to make a loan to someone who would have repaid it?
   c) Suppose the bank decides to lower the cutoff score from 250 points to 200. Is that analogous to choosing a higher or lower value of α for a hypothesis test? Explain.
   d) What impact does this change in the cutoff value have on the chance of each type of error?

CH 21