

1. Hypotheses. Write the null and alternative hypotheses you would use to test each of the following situations.

- 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.
- Is a coin fair?
- 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.

- There's a 22% chance that the ads worked.
- There's a 78% chance that the ads worked.
- There's a 22% chance that the poll they conducted is correct.
- There's a 22% chance that natural sampling variation could produce poll results like these if there's really no change in public opinion.

5. Relief. A company's old antacid formula provided relief for 70% of the people who used it. The company tests a new formula to see if it is better, and gets a P-value of 0.27. Is it reasonable to conclude that the new formula and the old one are equally effective? Explain.

11. Dowsing. In a rural area only about 30% of the wells that are drilled find adequate water at a depth of 100 feet or less. A local man claims to be able to find water by "dowsing"—using a forked stick to indicate where the well should be drilled. You check with 80 of his customers and find that 27 have wells less than 100 feet deep. What do you conclude about his claim? (We consider a P-value of around 5% to represent strong evidence.)

- Write appropriate hypotheses.
- Check the necessary assumptions.
- Perform the mechanics of the test. What is the P-value?
- Explain carefully what the P-value means in this context.
- What's your conclusion?

12. 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? (We consider a P-value of around 5% to represent strong evidence.)

- Write appropriate hypotheses.
- Check the necessary assumptions.
- Perform the mechanics of the test. What is the P-value?
- Explain carefully what the P-value means in this context.
- What's your conclusion?
- Do environmental chemicals cause congenital abnormalities?

17. Pollution. A company with a fleet of 150 cars found that the emissions systems of 7 out of the 22 they tested failed to meet pollution control guidelines. Is this strong evidence that more than 20% of the fleet might be out of compliance? Test an appropriate hypothesis and state your conclusion. Be sure the appropriate assumptions and conditions are satisfied before you proceed.

19. Twins. In 2001 a national vital statistics report indicated that about 3% of all births produced twins. Is the rate of twin births the same among very young mothers? Data from a large city hospital found only 7 sets of twins were born to 469 teenage girls. Test an appropriate hypothesis and state your conclusion. Be sure the appropriate assumptions and conditions are satisfied before you proceed.