

## Chapter 19

**11. Errors** For each of the following situations, state whether a Type I, a Type II, or neither error has been made. Explain briefly.

- a) A bank wants to know if the enrollment on their website is above 30% based on a small sample of customers. They test  $H_0: p = 0.3$  vs.  $H_A: p > 0.3$  and reject the null hypothesis. Later, they find out that actually 28% of all customers enrolled.
- b) A student tests 100 students to determine whether other students on their campus prefer Coke or Pepsi and finds no evidence that preference for Coke is not 0.5. Later, a marketing company tests all students on campus and finds no difference.
- c) A human resource analyst wants to know if the applicants this year score, on average, higher on their placement exam than the 52.5 points the candidates averaged last year. They sample 50 recent tests and find the average to be 54.1 points. They fail to reject the null hypothesis that the mean is 52.5 points. At the end of the year, they find that the candidates this year had a mean of 55.3 points.
- d) A pharmaceutical company tests whether a drug lifts the headache relief rate from the 25% achieved by the placebo. They fail to reject the null hypothesis because the P-value is 0.465. Further testing shows that the drug actually relieves headaches in 38% of people.

**33. Testing cars** A clean air standard requires that vehicle exhaust emissions not exceed specified limits for various pollutants. Many states require that cars be tested annually to be sure they meet these standards. Suppose state regulators double-check a random sample of cars that a suspect repair shop has certified as okay. They will revoke the shop's license if they find significant evidence that the shop is certifying vehicles that do not meet standards.

- a) In this context, what is a Type I error?
- b) In this context, what is a Type II error?
- c) Which type of error would the shop's owner consider more serious?
- d) Which type of error might environmentalists consider more serious?