

## Statistical Reasoning

### Hypothesis Tests

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

#### Writing the Null and Alternative Hypothesis for Hypothesis Tests

Each of the following situations requires a significance test about a population mean  $\mu$ . State the appropriate null hypothesis  $H_0$  and alternative hypothesis  $H_a$  for each case.

1. The mean area of the several thousand apartments in a new development is advertised to be 1250 square feet. A tenant group thinks that the apartments are smaller than advertised. They hire an engineer to measure a sample of apartments to test their suspicion.

$H_0: \mu_{\text{apt}} = 1250 \text{ Ft}^2$

$H_a: \mu_{\text{apt}} < 1250 \text{ Ft}^2$

2. The examinations in a large accounting class are scaled after grading so that the mean score is 50. A self-confident teaching assistant thinks that his students have a higher mean score than the class as a whole. His students this semester can be considered a sample from the population of all students he might teach, so he compares their mean score with 50.

$H_0: \mu_{\text{grade}} = 50$

$H_a: \mu_{\text{grade}} > 50$

3. The diameter of a spindle in a small motor is supposed to be 5 mm. If the spindle is either too small or too large, the motor will not perform properly. The manufacturer measures the diameter in a sample of motors to determine whether the mean diameter has moved away from the target.

$H_0: \mu_{\text{diameter}} = 5 \text{ mm}$

$H_a: \mu_{\text{diameter}} \neq 5 \text{ mm}$

4. A sociologist asks a large sample of high school students which academic subject they like best. She suspects that a higher percentage of males than females will name mathematics as their favorite subject.

$H_0: P_{\text{males}} = P_{\text{females}}$

$H_a: P_{\text{males}} > P_{\text{females}}$

5. An education researcher randomly divides sixth-grade students into two groups for P.E. class. He teaches both groups basketball skills, using the same methods of instruction in both classes. He encourages Group A with compliments and other positive behavior but acts cool and neutral toward Group B. He hopes to show that positive teacher attitudes result in a higher mean score on a test of basketball skills than do neutral attitudes.

$H_0: \mu_{\text{Bball score group A}} = \mu_{\text{Bball group B}}$

$H_a: \mu_{\text{Bball group A}} > \mu_{\text{Bball group B}}$

6. An Amazon reviewer points out that customers would probably have paid more this year than last, even without a super sale, because the economy was more prosperous and interest rates are lower.

$H_0: \mu_{\text{this year}} = \mu_{\text{last year}}$

$H_a: \mu_{\text{this year}} > \mu_{\text{last year}}$

7. An economist believes that among employed young adults there is a strong relationship between average income and average amount deposited into savings accounts. She gathers income and savings data from a sample of employed persons in her city aged 25 to 34 to test this. (if there is no clear direction, then choose an alternative of "not equal").

H<sub>0</sub>:  $\mu_{\text{income}} = \mu_{\text{savings}}$

H<sub>a</sub>:  $\mu_{\text{income}} \neq \mu_{\text{savings}}$

8. A manufacturer of small appliances employs a market research firm to estimate retail sales of its products by gathering information from a sample of retail stores. This month a SRS of 75 stores in the Midwest sales region finds that these stores sold an average of 24 of the manufacturer's hand mixers, with a standard deviation 11. A manager at a particular store has been unimpressed with his branch and believes they are below the average.

H<sub>0</sub>:  $\mu_{\text{sales}} = 24 \text{ hand mixers}$

H<sub>a</sub>:  $\mu_{\text{sales}} < 24 \text{ hand mixers}$

9. A bank wonders whether omitting the annual credit card fee for customers who charge at least \$2,400 in a year would increase the amount charged on its credit card. The bank makes this offer to a SRS of 200 of its existing credit card holders. It then compares how much these customers charge this year with the amount they charged last year. The mean increase is \$332, and the standard deviation is \$108. The Acworth branch believes they are more consistent than the other branches and have a smaller standard deviation.

H<sub>0</sub>:  $\mu_{\text{last years charges}} = \mu_{\text{this years charges}}$

H<sub>a</sub>:  $\mu_{\text{last years charges}} < \mu_{\text{this years charges}}$

10. Justin flipped a penny from 1985 eight times and got the results T, T, T, T, T, T, T, T. He believes the penny might be defective and the probability of landing on Tails this way is greater than 50%.

H<sub>0</sub>:  $P_{\text{tails}} = 50\%$

H<sub>a</sub>:  $P_{\text{tails}} > 50\%$

11. According to the Federal Housing Finance Board, the mean price of a single-family home in 2005 was \$299,800. A real estate broker believes that because of recent down turn in home sales that the mean price has decreased since then.

H<sub>0</sub>:  $\mu_{\text{house}} = \$299,800$

H<sub>a</sub>:  $\mu_{\text{house}} < \$299,800$

12. According to the 2005 U.S. Census Bureau, at least 10.2% of registered births in the United States in 2005 were to teenage mothers. A sociologist believes that this percentage has increased since then.

H<sub>0</sub>:  $P_{\text{teenage mothers}} = 10.2\%$

H<sub>a</sub>:  $P_{\text{teenage mothers}} > 10.2\%$

13. Plant growers believe that plants watered with Gatorade will grow taller than plants watered with PowerAde.

H<sub>0</sub>:  $\mu_{\text{gatorade}} = \mu_{\text{powerade}}$

H<sub>a</sub>:  $\mu_{\text{gatorade}} > \mu_{\text{powerade}}$