

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Assume that a simple random sample has been selected from a normally distributed population. Find the test statistic  $t$ .

- 1) Test the claim that for the population of female college students, the mean weight is given by  $\mu = 132$  lb. Sample data are summarized as  $n = 20$ ,  $\bar{x} = 137$  lb, and  $s = 14.2$  lb. Use a significance level of  $\alpha = 0.1$ . Find the test statistic  $t$ . 1) \_\_\_\_\_
- A) 1.57                      B) 20                      C) 14.2                      D) 1.729                      E) -1.57

- 2) Test the claim that for the adult population of one town, the mean annual salary is given by  $\mu = \$30,000$ . Sample data are summarized as  $n = 17$ ,  $\bar{x} = \$22,298$ , and  $s = \$14,200$ . Use a significance level of  $\alpha = 0.05$ . Find the test statistic  $t$ . 2) \_\_\_\_\_
- A) -1.57                      B) 1.57                      C) 0.05                      D) 2.24                      E) -2.24

Provide an appropriate response.

- 3) A soft drink company claims the mean caffeine content of its HoP ToP soda is 40 milligrams per one 8-ounce bottle. To verify this claim, a random sample of 30 bottles is found to have a mean caffeine content of 39.2 milligrams with a standard deviation of 7.5 milligrams. Calculate the test statistic  $t$  for this for the population mean. 3) \_\_\_\_\_
- A) 0.075  
B) -0.56  
C) -0.58  
D) 1.96  
E) None of the above.

Assume that a simple random sample has been selected from a normally distributed population. State the final conclusion.

- 4) Test the claim that for the population of female college students, the mean weight is given by  $\mu = 132$  lb. Sample data are summarized as  $n = 20$ ,  $\bar{x} = 137$  lb, and  $s = 14.2$  lb. Use a significance level of  $\alpha = 0.1$ .  
 $H_0 : \mu = 132$      $H_a : \mu \neq 132$   
State your conclusion about  $H_0$ . 4) \_\_\_\_\_
- A) Reject  $H_0$   
B) Do not reject  $H_a$   
C) Reject  $H_a$   
D) Do not reject  $H_0$   
E) Cannot draw a conclusion with information given.

- 5) Test the claim that for the adult population of one town, the mean annual salary is given by  $\mu = \$30,000$ . Sample data are summarized as  $n = 17$ ,  $\bar{x} = \$22,298$ , and  $s = \$14,200$ . Use a significance level of  $\alpha = 0.05$ .  
 $H_0 : \mu = 30,000$      $H_0 : \mu \neq 30,000$   
State your conclusion about  $H_0$ . 5) \_\_\_\_\_
- A) Reject  $H_a$   
B) Do not reject  $H_a$   
C) Do not reject  $H_0$   
D) Cannot draw a conclusion for information given.  
E) Reject  $H_0$

Select the most appropriate answer.

- 6) The test statistic for testing  $H_0: \mu = 100$  against  $H_a: \mu \neq 100$  was  $t = 3.3$ , with P-value 0.001. Then, 6) \_\_\_\_\_
- A) this must be wrong, because a large t test statistic must have a large P-value.
  - B) there is strong evidence that  $\mu > 100$ .
  - C) there is not strong evidence that  $\mu = 100$ .
  - D) there is not strong evidence that  $\mu < 100$ .
  - E) there is not enough information here to draw a conclusion.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

- 7) Recent findings have suggested that neonatal sex differences exist in behavioral and physiological reactions to stress. One study (M. Davis and E. Emory, *Child Development*, Vol. 66, 1995, pp. 14-27) evaluated changes in the heart rate for a sample of infants placed in a stressful situation. For the 15 female infants, the following is a printout for the data on the change in heart rate. 7) \_\_\_\_\_

Variable	Number of Cases	Mean	SD	SE of Mean	t-value	df	2-Tail Sig
CHANGE	15	10.70	17.70	4.570	2.341	14	0.0346

- a. State the hypotheses.
- b. State the test statistic.
- c. State the P-value.
- d. Interpret the P-value in context.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Classify the significance test as two-tailed, left-tailed, or right-tailed.

- 8) In the past, the mean running time for a certain type of flashlight battery has been 9.3 hours. The manufacturer has introduced a change in the production method and wants to perform a significance test to determine whether the mean running time has changed as a result. 8) \_\_\_\_\_
- A) Middle-tailed
  - B) Right-tailed
  - C) Left-tailed
  - D) Two-tailed
  - E) Neither
- 9) At one school, the average amount of time that ninth-graders spend watching television each week is 21.6 hours. The principal introduces a campaign to encourage the students to watch less television. One year later, the principal wants to perform a significance test to determine whether the average amount of time spent watching television per week has decreased from the previous mean of 21.6 hours. 9) \_\_\_\_\_
- A) Right-tailed
  - B) Middle-tailed
  - C) Two-tailed
  - D) Left-tailed
  - E) Neither

- 10) A health insurer has determined that the "reasonable and customary" fee for a certain medical procedure is \$1500. They suspect that the average fee charged by one particular clinic for this procedure is higher than \$1500. The insurer wants to perform a significance test to determine whether their suspicion is correct. 10) \_\_\_\_\_
- A) Left-tailed
  - B) Middle-tailed
  - C) Right-tailed
  - D) Two-tailed
  - E) Neither

- 11) In 1990, the average duration of long-distance telephone calls originating in one town was 15.3 minutes. A long-distance telephone company wants to perform a significance test to determine whether the average duration of long-distance phone calls has changed from the 1990 mean of 15.3 minutes. 11) \_\_\_\_\_
- A) Two-tailed
  - B) Left-tailed
  - C) Middle-tailed
  - D) Right-tailed
  - E) Neither

Select the most appropriate answer.

- 12) If an agronomist wishes to determine whether there is evidence that the average number of bales of cotton produced in a certain county equals 500, 12) \_\_\_\_\_
- A) either a one-sided or a two-sided test could be used with equivalent results.
  - B) a left-tailed test should be used.
  - C) a two-tailed test should be used.
  - D) a right-tailed test should be used.
  - E) more information is necessary to determine what type of test should be used.

- 13) If an agronomist wishes to determine whether there is evidence that the average number of bales of cotton produced in a certain county exceeds 500, 13) \_\_\_\_\_
- A) a left-tailed test should be used.
  - B) a two-tailed test should be used.
  - C) either a one-sided or a two-sided test could be used with equivalent results.
  - D) a right-tailed test should be used.
  - E) more information is necessary to determine what type of test should be used.

For the given significance test, explain the meaning of a Type I error, a Type II error, or a correct decision as specified.

- 14) In the past, the mean running time for a certain type of radio battery has been 9.8 hours. The manufacturer has introduced a change in the production method and wants to perform a significance test to determine whether the mean running time has increased as a result. The hypotheses are: 14) \_\_\_\_\_

$$H_0 : \mu = 9.8 \text{ hours}$$

$$H_a : \mu > 9.8 \text{ hours}$$

Explain the meaning of a Type I error.

- A) Concluding that  $\mu = 9.8$  hours when in fact  $\mu > 9.8$  hours
- B) Concluding that  $\mu > 9.8$  hours when in fact  $\mu > 9.8$  hours
- C) Concluding that  $\mu > 9.8$  hours when in fact  $\mu = 9.8$  hours
- D) Concluding that  $\mu = 9.8$  hours when in fact  $\mu < 9.8$  hours
- E) Concluding that  $\mu < 9.8$  hours when in fact  $\mu > 9.8$  hours

- 15) A manufacturer claims that the mean amount of juice in its 16 ounce bottles is 16.1 ounces. A consumer advocacy group wants to perform a significance test to determine whether the mean amount is actually less than this. The hypotheses are: 15) \_\_\_\_\_
- $H_0 : \mu = 16.1$  ounces  
 $H_a : \mu < 16.1$  ounces

Explain the meaning of a Type I error.

- A) Failing to reject the hypothesis that  $\mu = 16.1$  ounces when in fact  $\mu < 16.1$  ounces
- B) Concluding that  $\mu = 16.1$  ounces when in fact  $\mu < 16.1$  ounces
- C) Concluding that  $\mu < 16.1$  ounces when in fact  $\mu < 16.1$  ounces
- D) Concluding that  $\mu < 16.1$  ounces when in fact  $\mu = 16.1$  ounces
- E) Failing to reject the hypothesis that  $\mu = 16.1$  ounces when in fact  $\mu = 16.1$  ounces

Provide an appropriate response.

- 16) A state university wants to increase its retention rate of 4% for graduating students from the previous year. After implementing several new programs during the last two years, the university reevaluated its retention rate. Identify the Type I error in this context. 16) \_\_\_\_\_
- A) The university concludes that retention is on the rise, but in fact the new programs do not help retention.
  - B) The university stops all new programs, but in fact retention is on the rise and the programs help.
  - C) The product of the university's sample size and sample proportion was less than 10.
  - D) The university sampled all students at the university.
  - E) The university concludes that retention is on the rise since the retention rate can only increase.

- 17) A weight loss center provided a loss for 72% of its participants. The center's leader decides to test a new weight loss strategy. Identify the Type I error in this context. 17) \_\_\_\_\_
- A) The center concludes that proportion of weight loss is increasing since the weight loss level can only increase.
  - B) The center sampled all participants at the weight loss center.
  - C) The center stops the new strategy, but in fact weight loss is increasing and the strategy helps.
  - D) The product of the center's sample size and sample proportion was less than 10.
  - E) The center concludes that the proportion of participants losing weight is increasing, but in fact the new strategy does not help weight loss.

- 18) The U.S. Department of Labor and Statistics released the current unemployment rate of 5.3% for the month in the U.S. and claims the unemployment has not changed in the last two months. However, the state's statistics reveal that there is a reduction in the U.S. unemployment rate. Identify the Type II error in this context. 18) \_\_\_\_\_
- A) The product of the states sample size and sample proportion was less than 10.
  - B) The statewide report concludes that unemployment is on the decline, but in fact there is no change in unemployment.
  - C) The statewide report shows there in no change in unemployment, but in fact the unemployment rate is decreasing.
  - D) The statewide report concludes that unemployment is declining since the unemployment rate can only decrease.
  - E) The statewide report sampled only a dozen unemployed workers.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 19) A social psychologist plans to conduct an experiment with a random sample of 49 children from a school district. Before conducting the experiment, the psychologist checks how this sample compares to national norms on several variables. The IQ scores for the 49 children have  $\bar{x} = 103$  and  $s = 14$ . Nationally, the population mean IQ equals 100. Is it plausible that the mean  $\mu$  of the population of children in the school district from which these students were sampled equals 100? 19) \_\_\_\_\_
- a. Show all five steps of a test of  $H_0: \mu = 100$  against  $H_a: \mu \neq 100$  using a significance level of 0.05.
- b. If the decision in (a) is an error, what type of error is it, Type I or Type II? Why?
- c. What conclusion applies for each of the following significance levels: (i)  $\alpha = 0.20$ , (ii)  $\alpha = 0.10$ , (iii)  $\alpha = 0.01$ . Why is  $\alpha = 0.20$  rare in practice?

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Classify the conclusion of the significance test as a Type I error, a Type II error, or No error.

- 20) A manufacturer claims that the mean amount of juice in its 16 ounce bottles is 16.1 ounces. A consumer advocacy group wants to perform a significance test to determine whether the mean amount is actually less than this. The hypotheses are: 20) \_\_\_\_\_
- $H_0: \mu = 16.1$  ounces  
 $H_a: \mu < 16.1$  ounces
- Suppose that the results of the sample lead to rejection of the null hypothesis. Classify that conclusion as a Type I error, a Type II error, or a correct decision, if in fact the mean amount of juice,  $\mu$ , is less than 16.1 ounces.
- A) Type I error                      B) No error                      C) Type II error                      D) Neither
- 21) In the past, the mean running time for a certain type of flashlight battery has been 9.6 hours. The manufacturer has introduced a change in the production method and wants to perform a significance test to determine whether the mean running time has increased as a result. The hypotheses are: 21) \_\_\_\_\_
- $H_0: \mu = 9.6$  hours  
 $H_a: \mu > 9.6$  hours
- Suppose that the results of the sample lead to nonrejection of the null hypothesis. Classify that conclusion as a Type I error, a Type II error, or a correct decision, if in fact the mean running time has increased.
- A) No error                      B) Type I error                      C) Type II error                      D) Neither
- 22) In the past, the mean running time for a certain type of flashlight battery has been 9.5 hours. The manufacturer has introduced a change in the production method and wants to perform a significance test to determine whether the mean running time has increased as a result. The hypotheses are: 22) \_\_\_\_\_
- $H_0: \mu = 9.5$  hours  
 $H_a: \mu > 9.5$  hours
- Suppose that the results of the sample lead to rejection of the null hypothesis. Classify that conclusion as a Type I error, a Type II error, or a correct decision, if in fact the mean running time has not increased.
- A) No error                      B) Type I error                      C) Type II error                      D) Neither

## Answer Key

Testname: 9\_3&9\_4

- 1) A
- 2) E
- 3) C
- 4) D
- 5) E
- 6) B
- 7) a.  $H_0: \mu = 0$ ,  $H_a: \mu \neq 0$ ; b.  $t = 2.341$ ; c. P-value = 0.0346; d. the approximate probability that  $\bar{x}$  takes a value of greater than or equal to 10.70 or less than or equal to -10.70 if  $H_0$  is true is 0.0346.
- 8) D
- 9) D
- 10) C
- 11) A
- 12) C
- 13) D
- 14) C
- 15) D
- 16) A
- 17) E
- 18) C
- 19) a. 1) Assumptions: (1) quantitative variable with  $\mu =$  population mean IQ, (2) random sample, (3) Since  $n \geq 30$ , the sampling distribution of the sample mean is approximately normal by the central limit theorem; 2)  $H_0: \mu = 100$ ,  $H_a: \mu \neq 100$ ; 3)  $t = 1.5$ ; 4)  $0.10 < \text{P-value} < 0.20$ ; 5) At  $\alpha = 0.05$ , P-value  $> \alpha$ , fail to reject  $H_0$ , there is not sufficient evidence that  $\mu \neq 100$ ; b. If the decision in (a) is an error, it would be a Type II error. The only way one can make a Type II error is to fail to reject a false null hypothesis and the only way one can make a Type I error is to reject a true null hypothesis; c. (i) P-value  $< \alpha$ , reject  $H_0$ , there is sufficient evidence that  $\mu \neq 100$ , (ii and iii) P-value  $> \alpha$ , fail to reject  $H_0$ , there is not sufficient evidence that  $\mu \neq 100$ . A significance level of 0.20 is rare in practice, because the significance level is the probability of making a Type I error given  $H_0$  is true.
- 20) B
- 21) C
- 22) B