

## Chapter 7 Hypothesis Testing

### True/False Questions

1. The alternative hypothesis is the one that we hold true until it can be proven false.

Answer: False Type: Concept Difficulty: Easy

2. The probability of committing a type I error is  $\alpha$ .

Answer: True Type: Concept Difficulty: Easy

3. A type II error is the error that is committed if the null hypothesis is rejected when in fact it is true.

Answer: False Type: Concept Difficulty: Easy

4. The probability of rejecting the null hypothesis when the null hypothesis is false is called the power of the test.

Answer: True Type: Concept Difficulty: Easy

5. The power of a test is computed as  $1 - \alpha$ .

Answer: False Type: Concept Difficulty: Easy

6. When the null hypothesis is not rejected, then we can assume that the null hypothesis is certainly true.

Answer: False Type: Concept Difficulty: Easy

7. A two-tailed hypothesis test is always more powerful than a onetailed test.

Answer: False Type: Concept Difficulty: Medium

8. In stating the null and alternative hypotheses, the equal sign is always placed in the null hypothesis.

Answer: True Type: Concept Difficulty: Easy

9. The p-value of a hypothesis test is always less than alpha.

Answer: False Type: Concept Difficulty: Medium

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## Chapter 7 Hypothesis Testing

10. Increasing the sample size will increase the power of a test.

Answer: True Type: Concept Difficulty: Medium

11. The p-value is the chance that you are taking of making a type I error.

Answer: True Type: Concept Difficulty: Easy

12. The  $\alpha$  level is the chance that you are willing to take of making a type I error.

Answer: True Type: Concept Difficulty: Easy

13. One minus the p-value is the chance that you are taking of making a type I error.

Answer: False Type: Concept Difficulty: Easy

### Multiple Choice Questions

14. An advertiser is believed to exaggerate claims about a company's product, (high performance, larger measurable average). An agency wants to prove that this advertiser's claims are exaggerated. There are data available. The correct hypothesis test will be:
- A) two-tailed test
  - B) right-hand tailed test
  - C) left-hand tailed test
  - D) none of the above

Answer: C Type: Concept Difficulty: Medium

15. When conducting a test about the population mean with sample size 15, using sample mean and sample standard deviation, the test statistic is:
- A) z-value
  - B) t-value with  $df = n$ .
  - C) t-value with  $df = n + 1$ .
  - D) t-value with  $df = n - 1$ .
  - E) none of the above

Answer: D Type: Concept Difficulty: Easy

## Chapter 7 Hypothesis Testing

16. If I want to test the null hypothesis that the mean is 100 versus the alternative that it is greater than 100, and I get a sample mean of 90, which is true?
- A) I cannot say anything, I need to know the standard deviation and the sample size.
  - B) Always reject the null hypothesis.
  - C) Never reject the null hypothesis.
  - D) Reject the null if  $n > 30$ , otherwise fail to reject.
  - E) None of the above.

Answer: C Type: Concept Difficulty: Easy

17. The mean annual sales of a company in 36 of its sales offices over the country is \$23,860,000, with a standard deviation of \$2,150,000. A manager quotes the annual sales of the company to be \$25,000,000. Compute the p-value to test whether the sample data provide evidence to reject the executive's claim that the average annual sales are \$25,000,000.
- A) 0.2726
  - B) 0.3637
  - C) 0
  - D) 0.0007
  - E) 0.0014

Answer: E Type: Computation Difficulty: Medium

18. An increase in alpha, the level of significance, causes:
- A) An increase in the probability of the type I error to occur.
  - B) A decrease in the probability of type I error to occur.
  - C) No change in any of the type I or type II error.
  - D) A decrease in the probability of type I error to occur and an increase in the probability of type II to occur.
  - E) None of the above.

Answer: A Type: Concept Difficulty: Medium

19. If  $\alpha = .01$  for a two-tailed hypothesis test using the z test, the critical values are:
- A)  $\pm 1.90$
  - B)  $\pm 1.96$
  - C)  $\pm 2.00$
  - D)  $\pm 2.33$
  - E)  $\pm 2.58$

Answer: E Type: Computation Difficulty: Easy

## Chapter 7 Hypothesis Testing

20. Suppose that you carry out a statistical test and find that the test statistic is  $z = 2.0$  (Assume that the sample size is at least 30.) If the test is one-tailed, then the p-value is:
- A) -0.0124
  - B) 0.0062
  - C) .00228
  - D) 0.9876
  - E) 0.1212

Answer: C Type: Computation Difficulty: Medium

21. In a left-hand tailed test for the population proportion,  $p$ , carried out at  $\alpha = 0.05$ , using a large sample, the critical point is:
- A) -1.645
  - B) -1.96
  - C) -2.575
  - D) 1.96
  - E) 1.645

Answer: A Type: Computation Difficulty: Medium

22. If  $\alpha = 0.01$  for a one-tailed test, how large is the area of rejection?
- A) 0.05
  - B) 0.025
  - C) 0.01
  - D) 0.005
  - E) None of the above

Answer: C Type: Concept Difficulty: Easy

23. A test for the population proportion,  $p$ , uses the t distribution:
- A) if  $n < 30$
  - B) if  $n > 30$
  - C) if  $n \geq 30$
  - D) always
  - E) never

Answer: E Type: Concept Difficulty: Medium

## Chapter 7 Hypothesis Testing

24. I would like to test the null hypothesis that the population mean is 50 versus the alternative that it is not 50. My sample size is 6, and the sample mean is 38 with sample standard deviation of 16. At  $\alpha = 0.05$ , I should:
- A) strongly reject the null hypothesis
  - B) mildly reject the null hypothesis
  - C) fail to reject the null hypothesis
  - D) accept the alternative hypothesis
  - E) there is insufficient information to determine

Answer: C Type: Computation Difficulty: Medium

25. Suppose that  $n = 100$ , and that we want to test whether the population mean is equal to 20 versus the alternative that it is not equal to 20. The sample mean is found to be 18 and the sample standard deviation is 10. Compute the p-value for this test.
- A) 0.0228
  - B) 0.0456
  - C) 0.5532
  - D) 1.00
  - E) 0

Answer: B Type: Computation Difficulty: Medium

26. The proportion of defective items is not allowed to be over 15%. A buyer wants to test whether the proportion of defectives exceeds the allowable limit. The buyer takes a random sample of 100 items and finds that 19 are defective. State the null and alternative hypotheses for this test.
- A)  $H_0: p \leq .15, H_1: p > .15$
  - B)  $H_0: p < .15, H_1: p > .15$
  - C)  $H_0: p = .15, H_1: p \neq .15$
  - D)  $H_0: p < .15, H_1: p > .15$
  - E) none of the above

Answer: A Type: Concept Difficulty: Medium

## Chapter 7 Hypothesis Testing

27. The proportion of defective items is not allowed to be over 15%. A buyer wants to test whether the proportion of defectives exceeds the allowable limit. The buyer takes a random sample of 100 items and finds that 19 are defective. Find the p-value.
- A) 0.3686
  - B) 0.1314
  - C) 0.2628
  - D) 0.8686
  - E) none of the above

Answer: B Type: Computation Difficulty: Medium

28. A manufacturer claims that his tires last at least 40,000 miles. A test on 25 tires reveals that the mean life of a tire is 39,750 miles, with a standard deviation of 387 miles. Compute the test statistic.
- A)  $t = -0.65$
  - B)  $t = 3.23$
  - C)  $t = -3.23$
  - D)  $t = 0.65$
  - E) none of the above

Answer: C Type: Computation Difficulty: Medium

29. The average income in a certain area is assumed to be approximately \$25,000. A sample of size  $n = 36$  gives a mean of \$22,000 and a sample standard deviation of \$7,000. State the null and alternative hypotheses used to test whether the average income of this area is as assumed.
- A)  $H_0: \mu < 25,000, H_1: \mu \geq 25,000$
  - B)  $H_0: \mu = 22,000, H_1: \mu \neq 22,000$
  - C)  $H_0: \mu \leq 25,000, H_1: \mu > 25,000$
  - D)  $H_0: \mu \geq 22,000, H_1: \mu < 22,000$
  - E)  $H_0: \mu = 25,000, H_1: \mu \neq 25,000$

Answer: E Type: Concept Difficulty: Medium

## Chapter 7 Hypothesis Testing

30. If you want to carry out a statistical test at  $\alpha = 0.01$ , to test whether the population mean is equal to 500 or not, using a sample size of 300, with a test statistic of  $z = 1.97$ , your conclusion should be:
- A) do not reject the null hypothesis
  - B) reject the null hypothesis
  - C) not enough information to determine
  - D) only reject when the test statistic is negative
  - E) none of the above

Answer: A Type: Concept Difficulty: Easy

31. Given a p-value of 0.065, and using the customary  $\alpha = 5\%$ , the conclusion should be:
- A) do not reject the null hypothesis
  - B) reject the null hypothesis
  - C) not enough information to determine

Answer: A Type: Concept Difficulty: Medium

32. A random sample of 36 items gave a sample mean of 48 and a sample standard deviation of 12. Compute the p-value to test whether or not the population mean is equal to 50.
- A) 0.3413
  - B) -0.4772
  - C) 0.1587
  - D) 0.6826
  - E) 0.3174

Answer: E Type: Computation Difficulty: Medium

33. Conduct a test to determine whether or not the population proportion of voters in favor of proposal A is greater than 50%. In a random sample of 200 voters, 140 said that they were in favor of this proposal. Compute the test statistic.
- A)  $z = 6.17$
  - B)  $z = 19.80$
  - C)  $z = 5.66$
  - D)  $z = 7.07$
  - E) none of the above

Answer: C Type: Computation Difficulty: Medium

## Chapter 7 Hypothesis Testing

34. To test whether or not the population mean is at least 25, the test should be:
- A) left-hand tailed test
  - B) right-hand tailed test
  - C) two-tailed test

Answer: B Type: Concept Difficulty: Easy

35. I want to conduct a statistical test of whether or not the population mean is 50. My sample mean is 48, my sample standard deviation is 5, and my sample size is 100. The result is:
- A) not significant
  - B) significant
  - C) very significant
  - D) can't tell

Answer: C Type: Computation Difficulty: Medium

36. I want to conduct a statistical test of whether or not the population mean is 70. My sample mean is 71, my sample standard deviation is 5, and my sample size is 100. The result is:
- A) not significant
  - B) significant
  - C) very significant
  - D) can't tell

Answer: B Type: Computation Difficulty: Medium

37. I want to conduct a statistical test of whether or not the population mean is 150. My sample mean is 145, my sample standard deviation is 56, and my sample size is 100. The result is:
- A) not significant
  - B) significant
  - C) very significant
  - D) can't tell

Answer: A Type: Computation Difficulty: Medium

## Chapter 7 Hypothesis Testing

38. I want to conduct a statistical test of whether or not the population mean is 250. My sample mean is 262, my sample standard deviation is 5, and my sample size is 100. The result is:
- A) accept the null hypothesis
  - B) reject the null hypothesis
  - C) strongly reject the null hypothesis
  - D) can't tell

Answer: C Type: Computation Difficulty: Medium

39. When conducting a test about the population proportion with  $n = 50$ ,  $p = .05$ , and  $q = .95$ , the test statistic is:
- A) z-test
  - B) -value with  $df = n$ .
  - C) t-value with  $df = n + 1$ .
  - D) t-value with  $df = n - 1$ .
  - E) none of the above.

Answer: E Type: Concept Difficulty: Medium

40. Statistical significance is a measure of what?
- A) The chance of making a type-I error.
  - B) The chance of making a type-II error.
  - C) The chance you are willing to take of making a type-I error.
  - D) The chance you are willing to take of making a type-II error.
  - E) A and C above.
  - F) B and D above.

Answer: C Type: Concept Difficulty: Medium

41. A t-test is a ratio of what?
- A) The effect you are measuring over the confidence measurement of the mean.
  - B) The confidence measurement of the mean over the effect you are measuring.
  - C) a and b above.
  - D) None of the above.

Answer: A Type: Concept Difficulty: Medium

## Chapter 7 Hypothesis Testing

42. A random sample of 27 is selected from the population. What is the number of degrees of freedom used to determine the appropriate critical t-value?
- A) 20
  - B) 19
  - C) 26
  - D) T-test does not use degrees of freedom.

Answer: C Type: Computation Difficulty: Easy

Use the following to answer questions 43-45:

The profitability of a new broadband internet firm depends on the proportion of potential customers who haven't entered into agreements with rival broadband providers. The new firm will enter the market if it has compelling evidence, at  $\alpha = 0.05$ , that the proportion of customers who already have broadband access is less than 0.40. A sample size of 125 has been chosen.

43. Which of the following hypothesis pairs is most appropriate in this situation?
- A)  $H_0: p = 0.40$ ,  $H_1: p \neq 0.40$
  - B)  $H_0: p = 0.40$ ,  $H_1: p < 0.40$
  - C)  $H_0: p = 0.40$ ,  $H_1: p > 0.40$
  - D)  $H_0: p > 0.40$ ,  $H_1: p < 0.40$
  - E)  $H_0: p < 0.40$ ,  $H_1: p > 0.40$

Answer: B Type: Concept Difficulty: Easy

44. Suppose that the sample proportion observed is 0.32. The p-value of \_\_\_\_\_ for this test indicates the probability of incorrectly rejecting \_\_\_\_\_.
- A) 0.0336;  $H_0$
  - B) 0.0336;  $H_1$
  - C) 0.0672;  $H_0$
  - D) 0.0672;  $H_1$
  - E) None of the above

Answer: A Type: Computation Difficulty: Medium

## Chapter 7 Hypothesis Testing

45. Suppose the true population proportion in this situation is 0.39. With a sample size of 125, the broadband firm has a \_\_\_\_\_ probability of making a \_\_\_\_\_ error.
- A) 0.0778; Type I
  - B) 0.0778; Type II
  - C) 0.9222; Type I
  - D) 0.9222; Type II
  - E) 0.9505; Type II

Answer: D Type: Computation Difficulty: Hard

46. Suppose you are testing the following hypothesis pair:  $H_0: \mu \leq 100$  vs.  $H_1: \mu > 100$ . A sample average of less than 100 would sometimes lead to a \_\_\_\_\_ error but would never lead to a \_\_\_\_\_ error.
- A) Type I; Type II
  - B) Type II; Type I
  - C) Type I; p-value
  - D) p-value; Type II
  - E) Random; Non-Random

Answer: B Type: Concept Difficulty: Medium

Use the following to answer questions 47-49:

A process is considered to be performing acceptably if its mean is 200. Because it is expensive to shut down and reconfigure this process, such measures are undertaken only if there is compelling evidence that the process mean is *not* 200. Experience has shown that the process is normally distributed with a standard deviation of 40.

47. What is an appropriate alternate hypothesis in this setting?
- A)  $H_1: \mu = 200$
  - B)  $H_1: \mu < 200$
  - C)  $H_1: \mu > 200$
  - D)  $H_1: \mu \neq 200$
  - E) None of the above

Answer: B Type: Concept Difficulty: Easy

## Chapter 7 Hypothesis Testing

48. In this situation, a Type I error would be made when it is concluded that  $\mu$  is \_\_\_\_\_ 200 when in fact  $\mu$  \_\_\_\_\_ 200.
- A) Greater than; less than or equal to
  - B) Less than; greater than or equal to
  - C) Equal to; greater than
  - D) Not equal to; equals
  - E) Equals; not equal to

Answer: D Type: Concept Difficulty: Medium

49. Suppose in a random sample of size  $n = 16$  a sample average of 185 is observed. The p-value of this sample statistic is:
- A) 0.0668
  - B) 0.1336
  - C) 0.3520
  - D) 0.7039
  - E) None of the above

Answer: B Type: Computation Difficulty: Hard

50. A process improvement consultant has asserted that his techniques reduce variance in organizational processes. As evidence, he points to a process for which variance had been assumed to be 36 millimeters<sup>2</sup>. A random sample of 10 observations taken *after* the consultant's efforts indicated a sample standard deviation of 5 millimeters. Which of the following decisions is correct (assume  $\alpha = 0.05$ )?
- A) Reject  $H_0$ : The calculated  $\chi^2$  of 1.25 is less than the lower critical value for  $\chi^2$  of 2.70
  - B) Do not reject  $H_0$ : The calculated  $\chi^2$  of 1.25 is less than the upper critical value for  $\chi^2$  of 16.92
  - C) Do not reject  $H_0$ : The calculated  $\chi^2$  of 6.25 exceeds the lower critical value for  $\chi^2$  of 3.33
  - D) Reject  $H_0$ : The calculated  $\chi^2$  of 6.25 is less than the upper critical value for  $\chi^2$  of 16.92
  - E) Do not reject  $H_0$ : The calculated  $\chi^2$  of 6.25 exceeds the lower critical value for  $\chi^2$  of 2.70 but does not exceed the upper critical value for  $\chi^2$  of 19.02

Answer: C Type: Computation Difficulty: Hard

## Chapter 7 Hypothesis Testing

### Short Answer Questions

51. A major marketing consulting firm asserts that its promotional campaign for Noloss, an anti-baldness drug, has substantially increased Noloss' market share. Prior to the campaign, Noloss' market share was 18%. In a random sample of 120 prescriptions for baldness drugs filled by a pharmacy chain, 29 were for Noloss. Is this sufficient evidence, at  $\alpha = 0.05$ , that the promotions have increased Noloss' market share?

Answer:  $H_0: p = 0.18$ ,  $H_1: p > 0.18$  ... Reject  $H_0$ , since calculated  $Z = 1.76 > Z_{\text{crit}} = 1.645$  ...  $p\text{-value} = 0.0392$  ... It does appear that the marketing firm's effort have increased Noloss' market share. Type: Computation Difficulty: Medium

52. Suppose a bottle-filling operation is supposed to have a mean of 500ml. Assume it is normally distributed with a standard deviation of 4ml. A random sample of 16 bottles yields a sample average of 498.5. Is this sufficient evidence, at  $\alpha = 0.05$ , that the process mean is no longer 500 ml?

Answer:  $H_0: \mu = 500$ ,  $H_1: \mu \neq 500$  ... Do not reject  $H_0$ , since the calculated  $Z = -1.5 > Z_{\text{crit}} = -1.645$  ...  $p\text{-value} = 0.1336$  ... It does not appear that the process mean is not 500. Type: Computation Difficulty: Medium

53. Suppose a political consultant is interested in the proportion of the vote his candidate will receive. He will randomly sample voters and test hypotheses regarding  $p$ , the population proportion. The consultant knows he can control his risk of making a Type I error. What must he do to control his risk of making a Type II error?

Answer: One way of reducing the risk of a Type II error is to increase sample size. If the sample size cannot be increased, then the Type II error rate can be reduced by increasing  $\alpha$ , thereby increasing the Type I error rate. Type: Concept Difficulty: Medium

54. The mean annual sales of a company in 36 of its sales offices over the country are \$23,860,000, with a standard deviation of \$2,150,000. A manager quotes the annual sales of the company to be \$25,000,000. Does the sample data provide evidence to reject the executive's claim, that average annual sales are 25,000,000 at  $\alpha = .01$ ?

Answer: Reject null,  $z = 3.181$  :  $z = (23,860,000 - 25,000,000)/(2,150,000/6) = -3.181$   
Type: Computation Difficulty: Medium

## Chapter 7 Hypothesis Testing

55. It is claimed that the proportion of people who would vote for some candidate (A) is 45%. Workers for the opponent candidate want to prove that this claim is exaggerated. They take a random sample of 200 potential voters and find that 80 of them would vote for candidate A. Compute the test statistic.

Answer:

$$-1.42 = (.4 - .45) / \sqrt{.45(.55) / 200}$$

Type: Computation Difficulty: Medium

Use the following to answer questions 56-57:

A car rental company changes its promotional strategy. The mean number of cars rented per day before the change was 46. Over the next 25 days, the mean number of cars rented is found to be 51, with a standard deviation of 8.6. The management wants to know whether an increase in the cars rented per day has occurred, with a 5% level of significance.

56. Give the test statistic.

Answer:  $t = 2.907 = (51 - 46)/(8.6/5)$  Type: Computation Difficulty: Medium

57. State the p-value of this test.

Answer:  $<0.01$  Type: Computation Difficulty: Medium

58. A car manufacturer is considering a new carburetor and is interested in knowing if there is any increase in the fuel efficiency of the car. A sample of 25 cars installed with the new carburetor shows an average increase of 1.7 mpg, with standard deviation of 3.9 mpg. Does this data prove that the new carburetor is more fuel-efficient? (Use  $\alpha = 0.01$ ).

Answer:  $t = 2.179$ , do not reject  $H_0: t = 1.7/(3.9/5)$  Type: Computation  
Difficulty: Medium

59. A consumer magazine states that an adult uses more than 5 ml of shampoo per shower. A survey of 49 adults shows that the mean quantity of shampoo used is 4.8 ml, with a standard deviation of 0.7 ml. Are these results significant at the  $\alpha = 0.05$  level?

Answer:  $z = -2$ , reject the null:  $z = (4.8 - 5)/(0.7/7)$  Type: Computation  
Difficulty: Medium

## Chapter 7 Hypothesis Testing

Use the following to answer questions 60-61:

A manufacturer claims that his camera can take 7 photographs per second. A test over 49 cameras selected at random shows that the mean number of photographs in a second is 6.9 with a standard deviation of 0.58.

60. Does this test provide evidence to reject the manufacturer's claim, at  $\alpha = 0.05$ ?

Answer:  $z = -1.207$ , do not reject the null:  $z = (6.9 - 7)/(6.9/7)$  Type: Computation  
Difficulty: Medium

61. Compute the p-value to test this claim.

Answer:  $0.1131: 0.5 - 0.3869 - 0.1131$  Type: Computation Difficulty: Medium

Use the following to answer questions 62-63:

An aircraft manufacturer is attempting to determine if the average leg length of the adult male has changed from 44". A sample of 81 men was selected randomly and the average length was found to be 45.5", with a standard deviation of 5.5".

62. Test the null hypothesis that the average leg length of the male adult is 44", at  $\alpha = 0.05$ .

Answer:  $z = 2.45$ , reject the null:  $z = (45.5 - 44)/(5.5/9) = 2.45$  Type: Computation  
Difficulty: Medium

63. The manufacturer designs the aircraft for adults with a leg length variance of less than 40 inch<sup>2</sup>. Does this data provide enough evidence to indicate that the variance of the general adult male population is less than 40 inch<sup>2</sup>, at a 5% level of significance?

Answer:  $x = 60.5$ , do not reject the null:  $(5.5)^2(80)/(40) = 60.5$  Type: Computation  
Difficulty: Medium

64. In 25 randomly selected statistics courses, it is found that a mean of 9% of the students think the course material taught in the course is not practically useful, with a standard deviation of 4%. A professor remarks that less than 10% of the students think the class is useless. Does the data substantiate her claim at a 5% level of significance?

Answer:  $t = 1.25$ , do not reject the null:  $t = (0.10 - 0.09)/(0.04/5) = 1.25$   
Type: Computation Difficulty: Medium

## Chapter 7 Hypothesis Testing

65. A new medicine is given to 64 infected persons in different cities and a mean success rate is found to be 96% with standard deviation of 4.3%. State the null and alternative hypotheses to test the claim that the medicine is 98% effective.

Answer:  $H_0: \mu = .98$ ,  $H_1: \mu \neq .98$  Type: Concept Difficulty: Medium

66. A company guarantees that its box of nails never contains less than 100 nails. A sample of 25 boxes is found to have a mean of 101.2 nails per box, with a standard deviation of 4.5. Is this evidence sufficient to accept the company's claim, at  $\alpha = 0.05$ ?

Answer:  $t = 1.33$ , do not reject the null:  $t = (101.2 - 100)/(4.5/5) = 1.33$

Type: Computation Difficulty: Medium

67. A foreign visitor states that the inflation rate in his country is less than 5%. Data for the last ten years reveals the mean inflation rate to be 5.4% with a standard deviation of 1.2%. Does this data provide sufficient evidence to reject the claim? (Use  $\alpha = 0.1$ ).

Answer:  $t = 1.054$ , do not reject the null:  $t = (5.4 - 5)/(1.2/\sqrt{10}) = 1.054$

Type: Computation Difficulty: Medium

68. Test,  $H_0: \mu = 100$ , against  $H_1: \mu \neq 100$ , with  $n = 36$ , the sample mean = 110, and  $s = 10$ , and using  $\alpha = 0.05$ , the conclusion should be:

Answer:  $z = 6$ , reject the null:  $z = (110 - 100)/(10/6) = 6$  Type: Computation

Difficulty: Medium

69. An airline claims that it loses the check-in baggage for only 4% of its passengers. A survey of 100 passengers reveals that 4.5% of them had their baggage lost. The standard deviation was 2.1%. Does the survey data contain enough evidence to refute the airline's claim at  $\alpha = 0.05$ ?

Answer:  $z = 2.381$ , reject the null:  $z = (4.5 - 4)/2.1/10 = 2.381$  Type: Computation

Difficulty: Medium

Use the following to answer questions 70-71:

The credit department of a company calculates that it would only make a profit if the average balance in its accounts is more than \$1,500. An accountant samples 100 accounts and finds the sample mean to be \$1,560, with a standard deviation of \$175.

## Chapter 7 Hypothesis Testing

70. Does this data substantiate the claim that the company is making a profit, at a 5% level of significance?

Answer:  $z = 3.429$ , reject the null:  $z = (1,560 - 1,500)/(175/10) = 3.429$

Type: Computation Difficulty: Medium

71. What is the p-value to test the hypothesis that the company is making a profit?

Answer: close to zero, since  $z > 3.4$  Type: Computation Difficulty: Medium

Use the following to answer questions 72-73:

An elevator call button is depressed 64 times and the mean arrival time for the elevator is found to be 29.1 seconds, with a standard deviation of 3.1 seconds.

72. Test the null hypothesis that the arrival time of the elevator is more than 30 seconds. (Use  $\alpha = 0.05$ ).

Answer:  $z = -2.322$ , reject the null:  $z = (2.91 - 30)/(3.18) = -2.322$

Type: Computation Difficulty: Medium

73. Find the p-value to test the null hypothesis that the arrival time of the elevator is more than 30 seconds.

Answer:  $0.0102: 0.5000 - 0.4898 = 0.0102$  Type: Computation Difficulty: Medium

74. A machine produces a wire with a thickness of 2.5mm. A sample of 25 wire pieces produced over the week is examined and the mean is found to be 2.6mm, with a standard deviation of 0.42mm. The production manager wants to know whether a change has occurred in the thickness, with a 5% level of significance.

Answer:  $t = 1.19$ , do not reject the null:  $t = (2.6 - 2.5)/(0.42/5) = 1.19$

Type: Computation Difficulty: Medium

75. A company is selling a new adhesive which it claims will dry in 15 seconds. It is used for joining 25 different items and the mean drying time is found to be 14.4 seconds, with a standard deviation of 3.5 seconds. Does this sample data substantiate the company's claim?

Answer:  $z = -0.857$ , do not reject the null Type: Computation Difficulty: Medium

## Chapter 7 Hypothesis Testing

Use the following to answer questions 76-77:

The mean age of 100 MBA students is found to be 25.4 years, with a standard deviation of 4.9 years. A professor makes a claim that the age is more than 23 years.

76. Does the sample substantiate the claim? (Use  $\alpha = 0.05$ ).

Answer:  $z = 4.898$ , reject the null Type: Computation Difficulty: Medium

77. If the population standard deviation is 5.1, and the true mean is 25.2 years, is the power of the test very high, medium, or very low?

Answer: very high Type: Computation Difficulty: Hard

78. The police service in a town took a mean time of 7 minutes to reach the required spot after being summoned. From this week, new cars have been inducted into the service. Over a sample of 16 emergencies, the mean arrival time has been found to be 6.7 minutes, with a standard deviation of 1.2 minutes. Have the new cars been effective in reducing the travel time? (Use alpha = 0.05).

Answer:  $t = 1$ , do not reject the null Type: Computation Difficulty: Medium

79. You just received the results from the engineering department on the time it takes to produce your major product. The results stated that, with a sample of 81 items, the mean production time was 44.25 minutes with a standard deviation of 4 minutes. Last year it took 45 minutes, at a .05 level of confidence; can you state that production has decreased?

Answer: With  $z = -1.6875$  and 80 degrees of freedom, you can say that productivity has significantly increased. Type: Computation Difficulty: Hard



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