Chapter 9: Fundamentals of Hypothesis Testing - One-Sample

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

1) The value that separates a rejection region from a non-rejection region is called the ________.

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

2) True or False: Suppose, in testing a hypothesis about a mean, the Z test statistic is computed to be 2.04. The null hypothesis should be rejected if the chosen level of significance is 0.01 and a two-tail test is used.
A) True  B) False

SCENARIO 9-3

An appliance manufacturer claims to have developed a compact microwave oven that consumes a mean of no more than 250 W. From previous studies, it is believed that power consumption for microwave ovens is normally distributed with a population standard deviation of 15 W. A consumer group has decided to try to discover if the claim appears true. They take a sample of 20 microwave ovens and find that they consume a mean of 257.3 W.

3) Referring to Scenario 9-3, the population of interest is
A) the mean power consumption in all such microwave ovens.
B) the power consumption in the 20 microwave ovens.
C) the mean power consumption in the 20 microwave ovens.
D) the power consumption in all such microwave ovens.

4) Referring to Scenario 9-3, the parameter of interest is
A) the mean power consumption of all such microwave ovens.
B) 250.
C) 257.3.
D) the mean power consumption of the 20 microwave ovens.

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

5) Referring to Scenario 9-3, for a test with a level of significance of 0.05, the critical value would be ________.

6) Referring to Scenario 9.3, the value of the test statistic is ________.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

7) If the $p$-value is less than $\alpha$ in a two-tail test,
   A) a one-tail test should be used.
   B) no conclusion should be reached.
   C) the null hypothesis should not be rejected.
   D) the null hypothesis should be rejected.

8) True or False: The smaller the $p$-value, the stronger is the evidence against the null hypothesis.
   A) True
   B) False

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

SCENARIO 9-3

An appliance manufacturer claims to have developed a compact microwave oven that consumes a mean of no more than 250 W. From previous studies, it is believed that power consumption for microwave ovens is normally distributed with a population standard deviation of 15 W. A consumer group has decided to try to discover if the claim appears true. They take a sample of 20 microwave ovens and find that they consume a mean of 257.3 W.

9) Referring to Scenario 9-3, the $p$-value of the test is ________.

10) Referring to Scenario 9-4, the $p$-value of the test is ________.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

SCENARIO 9-6

The quality control engineer for a furniture manufacturer is interested in the mean amount of force necessary to produce cracks in stressed oak furniture. She performs a two-tail test of the null hypothesis that the mean for the stressed oak furniture is 650. The calculated value of the Z-test statistic is a positive number that leads to a p-value of 0.080 for the test.

11) Referring to Scenario 9-6, suppose the engineer had decided that the alternative hypothesis to test was that the mean was greater than 650. What would be the p-value of this one-tail test?
   A) 0.960             B) 0.840             C) 0.040             D) 0.160

12) Referring to Scenario 9-6, suppose the engineer had decided that the alternative hypothesis to test was that the mean was less than 650. What would be the p-value of this one-tail test?
   A) 0.040             B) 0.840             C) 0.960             D) 0.160

13) True or False: Referring to Scenario 9-6, if the test is performed with a level of significance of 0.10, the null hypothesis would be rejected.
   A) True             B) False

14) True or False: Referring to Scenario 9-6, if the test is performed with a level of significance of 0.10, the engineer can conclude that the mean amount of force necessary to produce cracks in stressed oak furniture is 650.
   A) True             B) False

15) True or False: Referring to Scenario 9-6, if the test is performed with a level of significance of 0.05, the null hypothesis would be rejected.
   A) True             B) False

16) True or False: Referring to Scenario 9-6, if the test is performed with a level of significance of 0.05, the engineer can conclude that the mean amount of force necessary to produce cracks in stressed oak furniture is 650.
   A) True             B) False
17) True or False: Referring to Scenario 9-6, suppose the engineer had decided that the alternative hypothesis to test was that the mean was greater than 650. Then if the test is performed with a level of significance of 0.05, the null hypothesis would be rejected.  
A) True  B) False

18) True or False: Referring to Scenario 9-6, suppose the engineer had decided that the alternative hypothesis to test was that the mean was less than 650. Then if the test is performed with a level of significance of 0.05, the null hypothesis would be rejected.  
A) True  B) False

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

19) If a researcher does not reject a true null hypothesis, she has made a ______ decision.

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

20) Which of the following statements is not true about the level of significance in a hypothesis test?  
A) The significance level is also called the $\alpha$ level.  
B) The significance level is another name for Type II error.  
C) The larger the level of significance, the more likely you are to reject the null hypothesis.  
D) The level of significance is the maximum risk we are willing to accept in making a Type I error.

21) A Type I error is committed when  
A) you don't reject a null hypothesis that is false.  
B) you don't reject a null hypothesis that is true.  
C) you reject a null hypothesis that is true.  
D) you reject a null hypothesis that is false.

22) If a test of hypothesis has a Type I error probability ($\alpha$) of 0.01, it means that  
A) if the null hypothesis is false, you reject it 1% of the time.  
B) if the null hypothesis is false, you don't reject it 1% of the time.  
C) if the null hypothesis is true, you reject it 1% of the time.  
D) if the null hypothesis is true, you don't reject it 1% of the time.
23) True or False: For a given level of significance, if the sample size is increased but the summary statistics remain the same, the probability of committing a Type I error will increase.
   A) True  B) False

24) True or False: For a given sample size, the probability of committing a Type II error will increase when the probability of committing a Type I error is reduced.
   A) True  B) False

25) For a given level of significance ($\alpha$), if the sample size $n$ is increased, the probability of a Type II error ($\beta$)
   A) will remain the same.  B) will increase.  C) cannot be determined.  D) will decrease.

26) You know that the probability of committing a Type II error ($\beta$) is 5%, you can tell that the power of the test is
   A) 97.5%.  B) 2.5%.  C) 95%.  D) unknown.

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

27) If a researcher does not reject a false null hypothesis, she has made a ______ error.

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

28) The symbol for the power of a statistical test is
   A) $\beta$.  B) $\alpha$.  C) $1 - \alpha$.  D) $1 - \beta$.

29) The symbol for the level of significance of a statistical test is
   A) $\alpha$.  B) $1 - \alpha$.  C) $1 - \beta$.  D) $\beta$.

30) The symbol for the confidence coefficient of a statistical test is
   A) $1 - \alpha$.  B) $\alpha$.  C) $\beta$.  D) $1 - \beta$. 
31) If, as a result of a hypothesis test, you reject the null hypothesis when it is false, then you have committed
   A) a Type I error.  
   B) an acceptance error.  
   C) a Type II error.  
   D) no error.

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

SCENARIO 9-10

A manufacturer produces light bulbs that have a mean life of at least 500 hours when the production process is working properly. Based on past experience, the population standard deviation is 50 hours and the light bulb life is normally distributed. The operations manager stops the production process if there is evidence that the population mean light bulb life is below 500 hours.

32) Referring to Scenario 9-10, if you select a sample of 100 light bulbs and are willing to have a level of significance of 0.10, the probability of a Type II error is _____ if the population mean bulb life is 490 hours.

33) Referring to Scenario 9-10, if you select a sample of 100 light bulbs and are willing to have a level of significance of 0.10, the probability of a Type I error is _____ if the population mean bulb life is 510 hours.

34) Referring to Scenario 9-10, if you select a sample of 100 light bulbs and are willing to have a level of significance of 0.10, the confidence coefficient of the test is _____ if the population mean bulb life is 510 hours.

35) Referring to Scenario 9-10, if you select a sample of 100 light bulbs and are willing to have a level of significance of 0.05, the probability of the operations manager failing to stop the process when the process is not working properly is _____ if the population mean bulb life is 490 hours.

36) Referring to Scenario 9-10, if you select a sample of 100 light bulbs and are willing to have a level of significance of 0.05, the probability of the operations manager incorrectly stopping the process when the process is in fact working properly is _____.

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37) Referring to Scenario 9-10, if you select a sample of 100 light bulbs and are willing to have a level of significance of 0.05, the probability of the operations manager not stopping the process when the process is in fact working properly is in fact below 500 hours is _____.

38) Referring to Scenario 9-10, if you select a sample of 100 light bulbs and are willing to have a level of significance of 0.01, the probability of the operations manager failing to stop the process if the population mean bulb life is 490 hours is _____.

39) Referring to Scenario 9-10, if you select a sample of 100 light bulbs and are willing to have a level of significance of 0.01, the probability of the operations manager incorrectly stopping the process if the population mean bulb life is 510 hours is _____.

40) Referring to Scenario 9-10, if you select a sample of 100 light bulbs and are willing to have a level of significance of 0.01, the probability of the operations manager not stopping the process if the population mean bulb life is 510 hours is _____.

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

41) Which of the following would be an appropriate null hypothesis?
   I. The mean of a population is equal to 55.
   II. The mean of a sample is equal to 55.
   III. The mean of a population is greater than 55.
   A) Only I and III are appropriate.    B) I only
   C) III only                     D) II only

42) Which of the following would be an appropriate null hypothesis?
   A) The population proportion is not less than 0.65.
   B) The sample proportion is less than 0.65.
   C) The sample proportion is no less than 0.65.
   D) The population proportion is less than 0.65.
43) Which of the following would be an appropriate alternative hypothesis?
   A) The mean of a population is equal to 55.
   B) The mean of a sample is greater than 55.
   C) The mean of a population is greater than 55.
   D) The mean of a sample is equal to 55.

44) Which of the following would be an appropriate alternative hypothesis?
   A) The population proportion is not less than 0.65.
   B) The sample proportion is not less than 0.65.
   C) The population proportion is less than 0.65.
   D) The sample proportion is less than 0.65.

45) True or False: The statement of the null hypothesis always contains an equality.
   A) True  B) False

SCENARIO 9-3

An appliance manufacturer claims to have developed a compact microwave oven that consumes a mean of no more than 250 W. From previous studies, it is believed that power consumption for microwave ovens is normally distributed with a population standard deviation of 15 W. A consumer group has decided to try to discover if the claim appears true. They take a sample of 20 microwave ovens and find that they consume a mean of 257.3 W.

46) Referring to Scenario 9-3, the appropriate hypotheses to determine if the manufacturer’s claim appears reasonable are
   A) $H_0: \mu \leq 250$ versus $H_1: \mu > 250$.
   B) $H_0: \mu \geq 250$ versus $H_1: \mu < 250$.
   C) $H_0: \mu = 250$ versus $H_1: \mu \neq 250$.
   D) $H_0: \mu \geq 257.3$ versus $H_1: \mu < 257.3$.

47) True or False: Referring to Scenario 9-3, for this test to be valid, it is necessary that the power consumption for microwave ovens has a normal distribution.
   A) True  B) False
48) True or False: A sample is used to obtain a 95% confidence interval for the mean of a population. The confidence interval goes from 15 to 19. If the same sample had been used to test the null hypothesis that the mean of the population is equal to 20 versus the alternative hypothesis that the mean of the population differs from 20, the null hypothesis could be rejected at a level of significance of 0.05.
   A) True  B) False

49) True or False: A sample is used to obtain a 95% confidence interval for the mean of a population. The confidence interval goes from 15 to 19. If the same sample had been used to test the null hypothesis that the mean of the population is equal to 20 versus the alternative hypothesis that the mean of the population differs from 20, the null hypothesis could be rejected at a level of significance of 0.10.
   A) True  B) False

50) True or False: A sample is used to obtain a 95% confidence interval for the mean of a population. The confidence interval goes from 15 to 19. If the same sample had been used to test the null hypothesis that the mean of the population is equal to 20 versus the alternative hypothesis that the mean of the population differs from 20, the null hypothesis could be accepted at a level of significance of 0.01.
   A) True  B) False

51) An entrepreneur is considering the purchase of a coin-operated laundry. The current owner claims that over the past 5 years, the mean daily revenue was $675 with a population standard deviation of $75. A sample of 30 days reveals a daily mean revenue of $625. If you were to test the null hypothesis that the daily mean revenue was $675, which test would you use?
   A) t test of a population proportion
   B) Z test of a population proportion
   C) t test of population mean
   D) Z test of a population mean
An appliance manufacturer claims to have developed a compact microwave oven that consumes a mean of no more than 250 W. From previous studies, it is believed that power consumption for microwave ovens is normally distributed with a population standard deviation of 15 W. A consumer group has decided to try to discover if the claim appears true. They take a sample of 20 microwave ovens and find that they consume a mean of 257.3 W.

52) True or False: Referring to Scenario 9-3, the null hypothesis will be rejected at 5% level of significance.
   A) True  B) False

53) True or False: Referring to Scenario 9-3, the null hypothesis will be rejected at 1% level of significance.
   A) True  B) False

54) You have created a 95% confidence interval for μ with the result 10 ≤ μ ≤ 15. What decision will you make if you test \( H_0: \mu = 16 \) versus \( H_1: \mu \neq 16 \) at \( \alpha = 0.05 \)?
   A) We cannot tell what our decision will be from the information given.
   B) Do not reject \( H_0 \) in favor of \( H_1 \).
   C) Reject \( H_0 \) in favor of \( H_1 \).
   D) Fail to reject \( H_0 \) in favor of \( H_1 \).

55) You have created a 95% confidence interval for μ with the result 10 ≤ μ ≤ 15. What decision will you make if we test \( H_0: \mu = 16 \) versus \( H_1: \mu \neq 16 \) at \( \alpha = 0.01 \)?
   A) You cannot tell what our decision will be from the information given.
   B) Reject \( H_0 \) in favor of \( H_1 \).
   C) Do not reject \( H_0 \) in favor of \( H_1 \).
   D) Fail to reject \( H_0 \) in favor of \( H_1 \).

56) If an economist wishes to determine whether there is evidence that mean family income in a community equals $50,000
   A) a one-tail test should be utilized.
   B) a two-tail test should be utilized.
   C) either a one-tail or two-tail test could be used with equivalent results.
   D) None of the above.
57) A manager of the credit department for an oil company would like to determine whether the mean monthly balance of credit card holders is equal to $75. An auditor selects a random sample of 100 accounts and finds that the mean owed is $83.40 with a sample standard deviation of $23.65. If you were to conduct a test to determine whether the auditor should conclude that there is evidence that the mean balance is different from $75, which test would you use?

A) t test of population mean  
B) Z test of a population mean  
C) Z test of a population proportion  
D) t test of a population proportion

58) A manager of the credit department for an oil company would like to determine whether the mean monthly balance of credit card holders is equal to $75. An auditor selects a random sample of 100 accounts and finds that the mean owed is $83.40 with a sample standard deviation of $23.65. If you wanted to test whether the mean balance is different from $75 and decided to reject the null hypothesis, what conclusion could you reach?

A) There is not evidence that the mean balance is not $75.  
B) There is evidence that the mean balance is not $75.  
C) There is not evidence that the mean balance is $75.  
D) There is evidence that the mean balance is $75.

59) If an economist wishes to determine whether there is evidence that mean family income in a community exceeds $50,000

A) a two-tail test should be utilized.  
B) a one-tail test should be utilized.  
C) either a one-tail or two-tail test could be used with equivalent results.  
D) None of the above.

60) True or False: Suppose, in testing a hypothesis about a mean, the p-value is computed to be 0.043. The null hypothesis should be rejected if the chosen level of significance is 0.05.

A) True  
B) False
SCENARIO 9-5

A bank tests the null hypothesis that the mean age of the bank’s mortgage holders is less than or equal to 45 years, versus an alternative that the mean age is greater than 45 years. They take a sample and calculate a p-value of 0.0202.

61) True or False: Referring to Scenario 9-5, the null hypothesis would be rejected at a significance level of $\alpha = 0.05$.
   A) True       B) False

62) True or False: Referring to Scenario 9-5, the null hypothesis would be rejected at a significance level of $\alpha = 0.01$.
   A) True       B) False

63) True or False: Referring to Scenario 9-5, the bank can conclude that the mean age is greater than 45 at a significance level of $\alpha = 0.01$.
   A) True       B) False

64) Referring to Scenario 9-5, if the same sample was used to test the opposite one-tail test, what would be that test’s p-value?
   A) 0.9596       B) 0.9798       C) 0.0202       D) 0.0404

SCENARIO 9-9

The president of a university claimed that the entering class this year appeared to be larger than the entering class from previous years but their mean SAT score is lower than previous years. He took a sample of 20 of this year’s entering students and found that their mean SAT score is 1,501 with a standard deviation of 53. The university’s record indicates that the mean SAT score for entering students from previous years is 1,520. He wants to find out if his claim is supported by the evidence at a 5% level of significance.

65) Referring to Scenario 9-9, the parameter the president is interested in is
   A) the mean number of entering students to all U.S. universities this year.
   B) the mean SAT score of the entering students to his university this year.
   C) the mean SAT score of the entering students to all U.S. universities this year.
   D) the mean number of entering students to his university this year.
66) Referring to Scenario 9-9, the population the president is interested in is
A) the SAT scores of all students entering universities in the U.S. this year.
B) all entering students to his university this year.
C) all SAT test centers in the U.S. this year.
D) all entering students to all universities in the U.S this year.

67) How many tissues should the Kimberly Clark Corporation package of Kleenex contain? Researchers determined that 60 tissues is the mean number of tissues used during a cold. Suppose a random sample of 100 Kleenex users yielded the following data on the number of tissues used during a cold: \( \bar{X} = 52, S = 22 \). Give the null and alternative hypotheses to determine if the number of tissues used during a cold is less than 60.
A) \( H_0: \bar{X} \geq 60 \) and \( H_1: \bar{X} < 60 \).
B) \( H_0: \mu \geq 60 \) and \( H_1: \mu < 60 \).
C) \( H_0: \bar{X} = 52 \) and \( H_1: \bar{X} \neq 52 \).
D) \( H_0: \mu \leq 60 \) and \( H_1: \mu > 60 \).

68) How many tissues should the Kimberly Clark Corporation package of Kleenex contain? Researchers determined that 60 tissues is the mean number of tissues used during a cold. Suppose a random sample of 100 Kleenex users yielded the following data on the number of tissues used during a cold: \( \bar{X} = 52, S = 22 \). Suppose the alternative you wanted to test was \( H_1: \mu < 60 \). State the correct rejection region for \( \alpha = 0.05 \).
A) Reject \( H_0 \) if \( t < -1.6604 \).
B) Reject \( H_0 \) if \( t > 1.9842 \) or \( z < -1.9842 \).
C) Reject \( H_0 \) if \( t < -1.9842 \).
D) Reject \( H_0 \) if \( t > 1.6604 \).

69) How many tissues should the Kimberly Clark Corporation package of Kleenex contain? Researchers determined that 60 tissues is the mean number of tissues used during a cold. Suppose a random sample of 100 Kleenex users yielded the following data on the number of tissues used during a cold: \( \bar{X} = 52, S = 22 \). Suppose the test statistic does fall in the rejection region at \( \alpha = 0.05 \). Which of the following conclusion is correct?
A) At \( \alpha = 0.05 \), there is not sufficient evidence to conclude that the mean number of tissues used during a cold is 60 tissues.
B) At \( \alpha = 0.05 \), there is sufficient evidence to conclude that the mean number of tissues used during a cold is 60 tissues.
C) At \( \alpha = 0.10 \), there is sufficient evidence to conclude that the mean number of tissues used during a cold is not 60 tissues.
D) At \( \alpha = 0.05 \), there is insufficient evidence to conclude that the mean number of tissues used during a cold is not 60 tissues.
The owner of a local nightclub has recently surveyed a random sample of \( n = 250 \) customers of the club. She would now like to determine whether or not the mean age of her customers is greater than 30. If so, she plans to alter the entertainment to appeal to an older crowd. If not, no entertainment changes will be made. If she wants to have a level of significance at 0.01, what rejection region should she use?

A) Reject \( H_0 \) if \( t < -2.3263 \).

B) Reject \( H_0 \) if \( t > 2.3263 \).

C) Reject \( H_0 \) if \( t < -2.5758 \).

D) Reject \( H_0 \) if \( t > 2.5758 \).

The owner of a local nightclub has recently surveyed a random sample of \( n = 250 \) customers of the club. She would now like to determine whether or not the mean age of her customers is greater than 30. If so, she plans to alter the entertainment to appeal to an older crowd. If not, no entertainment changes will be made. Suppose she found that the sample mean was 30.45 years and the sample standard deviation was 5 years. If she wants to have a level of significance at 0.01 what conclusion can she make?

A) There is not sufficient evidence that the mean age of her customers is not greater than 30.

B) There is sufficient evidence that the mean age of her customers is greater than 30.

C) There is not sufficient evidence that the mean age of her customers is greater than 30.

D) There is sufficient evidence that the mean age of her customers is not greater than 30.
Microsoft Excel was used on a set of data involving the number of defective items found in a random sample of 46 cases of light bulbs produced during a morning shift at a plant. A manager wants to know if the mean number of defective bulbs per case is greater than 20 during the morning shift. She will make her decision using a test with a level of significance of 0.10. The following information was extracted from the Microsoft Excel output for the sample of 46 cases:

- \( n = 46; \) Arithmetic Mean = 28.00; Standard Deviation = 25.92; Standard Error = 3.82;
- Null Hypothesis: \( H_0: \mu \leq 20; \alpha = 0.10; \) df = 45; \( T \) Test Statistic = 2.09;
- One-Tail Test Upper Critical Value = 1.3006; \( p \)-value = 0.021; Decision = Reject.

72) Referring to Scenario 9-1, the parameter the manager is interested in is

A) the proportion of cases with defective light bulbs produced at the plant.
B) the mean number of defective light bulbs per case produced at the plant.
C) the mean number of defective light bulbs per case produced during the morning shift.
D) the mean number of defective light bulbs per case among the 46 cases.

73) Referring to Scenario 9-1, state the alternative hypothesis for this study.

74) Referring to Scenario 9-1, what critical value should the manager use to determine the rejection region?

A) 1.6794
B) 1.3011
C) 0.6800
D) 1.3006

75) True or False: Referring to Scenario 9-1, the null hypothesis would be rejected.

A) True
B) False
76) True or False: Referring to Scenario 9-1, the null hypothesis would be rejected if a 5% probability of committing a Type I error is allowed.
   A) True  B) False

77) True or False: Referring to Scenario 9-1, the null hypothesis would be rejected if a 1% probability of committing a Type I error is allowed.
   A) True  B) False

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

78) Referring to Scenario 9-1, the lowest level of significance at which the null hypothesis can be rejected is ________.

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

79) True or False: Referring to Scenario 9-1, the evidence proves beyond a doubt that the mean number of defective bulbs per case is greater than 20 during the morning shift.
   A) True  B) False

80) True or False: Referring to Scenario 9-1, the manager can conclude that there is sufficient evidence to show that the mean number of defective bulbs per case is greater than 20 during the morning shift using a level of significance of 0.10.
   A) True  B) False

81) True or False: Referring to Scenario 9-1, the manager can conclude that there is sufficient evidence to show that the mean number of defective bulbs per case is greater than 20 during the morning shift with no more than a 5% probability of incorrectly rejecting the true null hypothesis.
   A) True  B) False

82) True or False: Referring to Scenario 9-1, the manager can conclude that there is sufficient evidence to show that the mean number of defective bulbs per case is greater than 20 during the morning shift with no more than a 1% probability of incorrectly rejecting the true null hypothesis.
   A) True  B) False
83) True or False: Referring to Scenario 9-1, if these data were used to perform a two-tail test, the $p$-value would be 0.042.
   A) True  
   B) False

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

SCENARIO 9-9

The president of a university claimed that the entering class this year appeared to be larger than the entering class from previous years but their mean SAT score is lower than previous years. He took a sample of 20 of this year’s entering students and found that their mean SAT score is 1,501 with a standard deviation of 53. The university’s record indicates that the mean SAT score for entering students from previous years is 1,520. He wants to find out if his claim is supported by the evidence at a 5% level of significance.

84) Referring to Scenario 9-9, state the null hypothesis for this study.

85) Referring to Scenario 9-9, state the alternative hypothesis for this study.

86) Referring to Scenario 9-9, what critical value should the president use to determine the rejection region?

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

87) True or False: Referring to Scenario 9-9, the null hypothesis would be rejected.
   A) True  
   B) False

88) True or False: Referring to Scenario 9-9, the null hypothesis would be rejected if a 10% probability of committing a Type I error is allowed.
   A) True  
   B) False

89) True or False: Referring to Scenario 9-9, the null hypothesis would be rejected if a 1% probability of committing a Type I error is allowed.
   A) True  
   B) False
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

90) Referring to Scenario 9-9, the lowest level of significance at which the null hypothesis can still be rejected is ________.

91) Referring to Scenario 9-9, the highest level of significance at which the null hypothesis cannot be rejected is ________.

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

92) True or False: Referring to Scenario 9-9, the evidence proves beyond a doubt that the mean SAT score of the entering class this year is lower than previous years.
   A) True
   B) False

93) True or False: Referring to Scenario 9-9, the president can conclude that the mean SAT score of the entering class this year is lower than previous years using a level of significance of 0.10.
   A) True
   B) False

94) True or False: Referring to Scenario 9-9, the president can conclude that there is sufficient evidence to show that the mean SAT score of the entering class this year is lower than previous years with no more than a 5% probability of incorrectly rejecting the true null hypothesis.
   A) True
   B) False

95) True or False: Referring to Scenario 9-9, the president can conclude that there is sufficient evidence to show that the mean SAT score of the entering class this year is lower than previous years with no more than a 10% probability of incorrectly rejecting the true null hypothesis.
   A) True
   B) False

96) True or False: Referring to Scenario 9-9, if these data were used to perform a two-tail test, the p-value would be 0.1254.
   A) True
   B) False
97) Referring to Scenario 9-9, which of the following best describes the Type I error?

A) The president concludes that the mean SAT score of the entering students is not higher than previous years when it is indeed higher.
B) The president concludes that the mean SAT score of the entering students is not lower than previous years when it is indeed lower.
C) The president concludes that the mean SAT score of the entering students is higher than previous years when it is indeed not higher.
D) The president concludes that the mean SAT score of the entering students is lower than previous years when it is indeed not lower.

98) Referring to Scenario 9-9, which of the following best describes the Type II error?

A) The president concludes that the mean SAT score of the entering students is not lower than previous years when it is indeed lower.
B) The president concludes that the mean SAT score of the entering students is lower than previous years when it is indeed not lower.
C) The president concludes that the mean SAT score of the entering students is higher than previous years when it is indeed not higher.
D) The president concludes that the mean SAT score of the entering students is not higher than previous years when it is indeed higher.

SCENARIO 9-7

A major home improvement store conducted its biggest brand recognition campaign in the company's history. A series of new television advertisements featuring well-known entertainers and sports figures was launched. A key metric for the success of television advertisements is the proportion of viewers who "like the ads a lot." A study of 1,189 adults who viewed the ads reported that 230 indicated that they "like the ads a lot." The percentage of a typical television advertisement receiving the "like the ads a lot" score is believed to be 22%. Company officials wanted to know if there is evidence that the series of television advertisements are less successful than the typical ad (i.e., if there is evidence that the population proportion of "like the ads a lot" for the company’s ads is less than 0.22) at a 0.01 level of significance.

99) Referring to Scenario 9-7, the parameter the company officials is interested in is:

A) the mean number of viewers who "like the ads a lot."
B) the total number of viewers who "like the ads a lot."
C) the proportion of viewers who "like the ads a lot."
D) the mean number of company officials who "like the ads a lot."
A survey claims that 9 out of 10 doctors recommend aspirin for their patients with headaches. To test this claim against the alternative that the actual proportion of doctors who recommend aspirin is less than 0.90, a random sample of 100 doctors results in 83 who indicate that they recommend aspirin. The value of the test statistic in this problem is approximately equal to:

A) -1.86  
B) -4.12  
C) -2.33  
D) -0.07

A survey claims that 9 out of 10 doctors recommend aspirin for their patients with headaches. To test this claim against the alternative that the actual proportion of doctors who recommend aspirin is less than 0.90, a random sample of 100 doctors was selected. Suppose you reject the null hypothesis. What conclusion can you reach?

A) There is not sufficient evidence that the proportion of doctors who recommend aspirin is less than 0.90.  
B) There is not sufficient evidence that the proportion of doctors who recommend aspirin is not less than 0.90.  
C) There is sufficient evidence that the proportion of doctors who recommend aspirin is not less than 0.90.  
D) There is sufficient evidence that the proportion of doctors who recommend aspirin is less than 0.90.

A pizza chain is considering opening a new store in an area that currently does not have any such stores. The chain will open if there is evidence that more than 5,000 of the 20,000 households in the area have a favorable view of its chain. It conducts a telephone poll of 300 randomly selected households in the area and finds that 96 have a favorable view. The value of the test statistic in this problem is approximately equal to:

A) 2.80  
B) 1.30  
C) 1.94  
D) 2.60

A pizza chain is considering opening a new store in an area that currently does not have any such stores. The chain will open if there is evidence that more than 5,000 of the 20,000 households in the area have a favorable view of its chain. It conducts a telephone poll of 300 randomly selected households in the area and finds that 96 have a favorable view. The decision on the hypothesis test using a 5% level of significance is:

A) to accept $H_0$ in favor of $H_1$.  
B) to reject $H_0$ in favor of $H_1$.  
C) We cannot tell what the decision should be from the information given.  
D) to fail to reject $H_0$ in favor of $H_1$.  

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The marketing manager for an automobile manufacturer is interested in determining the proportion of new compact-car owners who would have purchased a GPS navigation system if it had been available for an additional cost of $300. The manager believes from previous information that the proportion is 0.30. Suppose that a survey of 200 new compact-car owners is selected and 79 indicate that they would have purchased the GPS navigation system. If you were to conduct a test to determine whether there is evidence that the proportion is different from 0.30, which test would you use?

A) Z test of a population mean
B) t test of population mean
C) Z test of a population proportion
D) t test of a population proportion

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

SCENARIO 9-7

A major home improvement store conducted its biggest brand recognition campaign in the company's history. A series of new television advertisements featuring well-known entertainers and sports figures was launched. A key metric for the success of television advertisements is the proportion of viewers who "like the ads a lot." A study of 1,189 adults who viewed the ads reported that 230 indicated that they "like the ads a lot." The percentage of a typical television advertisement receiving the "like the ads a lot" score is believed to be 22%. Company officials wanted to know if there is evidence that the series of television advertisements are less successful than the typical ad (i.e. if there is evidence that the population proportion of "like the ads a lot" for the company’s ads is less than 0.22) at a 0.01 level of significance.

105) Referring to Scenario 9-7, state the null hypothesis for this study.

106) Referring to Scenario 9-7, state the alternative hypothesis for this study.

107) Referring to Scenario 9-7, what critical value should the company officials use to determine the rejection region?
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

108) Referring to Scenario 9-7, the null hypothesis will be rejected if the test statistic is
   A) less than -2.3263.  
   B) greater than -2.3263.  
   C) greater than 2.3263. 
   D) less than 2.3263.  

109) True or False: Referring to Scenario 9-7, the null hypothesis would be rejected.
   A) True  
   B) False  

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

110) Referring to Scenario 9-7, the lowest level of significance at which the null hypothesis can be rejected is ________.

111) Referring to Scenario 9-7, the largest level of significance at which the null hypothesis will not be rejected is ________.

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

112) True or False: Referring to Scenario 9-7, the company officials can conclude that there is sufficient evidence to show that the series of television advertisements are less successful than the typical ad using a level of significance of 0.01.
   A) True  
   B) False  

113) True or False: Referring to Scenario 9-7, the company officials can conclude that there is sufficient evidence to show that the series of television advertisements are less successful than the typical ad using a level of significance of 0.05.
   A) True  
   B) False  

114) True or False: Referring to Scenario 9-7, the value of β is 0.90.
   A) True  
   B) False
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

115) Referring to Scenario 9-7, what will be the $p$-value if these data were used to perform a two-tail test?

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

SCENARIO 9-3

An appliance manufacturer claims to have developed a compact microwave oven that consumes a mean of no more than 250 W. From previous studies, it is believed that power consumption for microwave ovens is normally distributed with a population standard deviation of 15 W. A consumer group has decided to try to discover if the claim appears true. They take a sample of 20 microwave ovens and find that they consume a mean of 257.3 W.

116) True or False: Referring to Scenario 9-3, the consumer group can conclude that there is enough evidence that the manufacturer’s claim is not true when allowing for a 5% probability of committing a Type I error.

A) True
B) False

117) True or False: In a hypothesis test, it is irrelevant whether the test is a one-tail or two-tail test.

A) True
B) False

118) True or False: In testing a hypothesis, you should always raise the question concerning the purpose of the study, survey or experiment.

A) True
B) False

119) True or False: A proper methodology in performing hypothesis tests is to ask whether a random sample can be selected from the population of interest.

A) True
B) False

120) True or False: "What conclusions and interpretations can you reach from the results of the hypothesis test?" is not an important question to ask when performing a hypothesis test.

A) True
B) False
121) True or False: "Is the intended sample size large enough to achieve the
desired power of the test for the level of significance chosen?" should be
among the questions asked when performing a hypothesis test.
A) True  B) False

122) True or False: In instances in which there is insufficient evidence to reject the
null hypothesis, you must make it clear that this does not prove that the null hypothesis is true.
A) True  B) False

123) True or False: In instances in which there is insufficient evidence to reject the
null hypothesis, you must make it clear that this has proven that the null hypothesis is true.
A) True  B) False

124) True or False: In conducting research, you should document both good and bad results.
A) True  B) False

125) True or False: You should report only the results of hypothesis tests that show statistical significance and omit those for which there is insufficient evidence in the findings.
A) True  B) False

126) True or False: In a hypothesis test, it is irrelevant whether the test is a one-tail or two-tail test.
A) True  B) False

127) True or False: In testing a hypothesis, you should always raise the question concerning the purpose of the study, survey or experiment.
A) True  B) False

128) True or False: A proper methodology in performing hypothesis tests is to ask whether a random sample can be selected from the population of interest.
A) True  B) False
129) True or False: "What conclusions and interpretations can you reach from the results of the hypothesis test?" is not an important question to ask when performing a hypothesis test.
   A) True   B) False

130) True or False: "Is the intended sample size large enough to achieve the desired power of the test for the level of significance chosen?" should be among the questions asked when performing a hypothesis test
   A) True   B) False

131) True or False: In instances in which there is insufficient evidence to reject the null hypothesis, you must make it clear that this does not prove that the null hypothesis is true.
   A) True   B) False

132) True or False: In instances in which there is insufficient evidence to reject the null hypothesis, you must make it clear that this has proven that the null hypothesis is true.
   A) True   B) False

133) True or False: In conducting research, you should document both good and bad results.
   A) True   B) False

134) True or False: You should report only the results of hypothesis tests that show statistical significance and omit those for which there is insufficient evidence in the findings.
   A) True   B) False
Answer Key
Testname: CH9-FUNDAMENTALS OF HYPOTHESIS TESTING- ONE-SAMPLE

1) critical value
2) B
3) D
4) A
5) \(Z = 1.645\)
6) 2.18
7) D
8) A
9) 0.0148 using Excel or 0.0146 using Table E.2
10) 0.0668
11) C
12) C
13) A
14) B
15) B
16) B
17) A
18) B
19) correct
20) B
21) C
22) C
23) B
24) A
25) D
26) C
27) Type II
28) D
29) A
30) A
31) D
32) 0.2362
33) 0.10
34) 0.90
35) 0.3612
36) 0.05
37) 0.95
38) 0.6279
39) 0.01
40) 0.99
41) B
42) A
43) C
44) C
45) A
Answer Key
Testname: CH9-FUNDAMENTALS OF HYPOTHESIS TESTING- ONE-SAMPLE

46) A
47) A
48) A
49) A
50) B
51) D
52) A
53) B
54) C
55) A
56) B
57) A
58) B
59) B
60) A
61) A
62) B
63) B
64) B
65) B
66) B
67) B
68) A
69) C
70) B
71) C
72) C
73) $H_1$: $\mu > 20$
74) D
75) A
76) A
77) B
78) 0.021
79) B
80) A
81) A
82) B
83) A
84) $H_0$: $\mu \geq 1520$
85) $H_1$: $\mu < 1520$
86) -1.7291
87) B
88) A
89) B
90) 0.0627
Answer Key

Testname: CH9-FUNDAMENTALS OF HYPOTHESIS TESTING- ONE-SAMPLE

91) 0.0627
92) B
93) A
94) B
95) A
96) A
97) D
98) A
99) C
100) C
101) D
102) A
103) B
104) C
105) $H_1: \pi \geq 0.22$
106) $H_1: \pi < 0.22$
107) -2.3263
108) A
109) B
110) 0.0135 or 0.0136 using Table E.2
111) 0.0135 or 0.0136 using Table E.2
112) B
113) A
114) B
115) 0.027
116) A
117) B
118) A
119) A
120) B
121) A
122) A
123) B
124) A
125) B
126) B
127) A
128) A
129) B
130) A
131) A
132) B
133) A
134) B

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