CHAPTER 9—HYPOTHESIS TESTS

MULTIPLE CHOICE

1. The sum of the values of α and β
   a. always add up to 1.0
   b. always add up to 0.5
   c. is the probability of Type II error
   d. None of these alternatives is correct.

   ANS: D PTS: 1 TOP: Hypothesis Tests

2. What type of error occurs if you fail to reject H_0 when, in fact, it is not true?
   a. Type II
   b. Type I
   c. either Type I or Type II, depending on the level of significance
   d. either Type I or Type II, depending on whether the test is one tail or two tail

   ANS: A PTS: 1 TOP: Hypothesis Tests

3. An assumption made about the value of a population parameter is called a
   a. hypothesis
   b. conclusion
   c. confidence
   d. significance

   ANS: A PTS: 1 TOP: Hypothesis Tests

4. The probability of committing a Type I error when the null hypothesis is true is
   a. the confidence level
   b. β
   c. greater than 1
   d. the Level of Significance

   ANS: D PTS: 1 TOP: Hypothesis Tests

5. In hypothesis testing,
   a. the smaller the Type I error, the smaller the Type II error will be
   b. the smaller the Type I error, the larger the Type II error will be
   c. Type II error will not be effected by Type I error
   d. the sum of Type I and Ttype II errors must equal to 1

   ANS: B PTS: 1 TOP: Hypothesis Tests

6. In hypothesis testing, the tentative assumption about the population parameter is
   a. the alternative hypothesis
   b. the null hypothesis
   c. either the null or the alternative
   d. None of these alternatives is correct.

   ANS: B PTS: 1 TOP: Hypothesis Tests

7. For a lower tail test, the *p*-value is the probability of obtaining a value for the test statistic
   a. at least as small as that provided by the sample

b. at least as large as that provided by the sample
c. at least as small as that provided by the population
d. at least as large as that provided by the population.

ANS: A PTS: 1 TOP: Hypothesis Tests

8. The *p*-value is a probability that measures the support (or lack of support) for the
a. null hypothesis
b. alternative hypothesis
c. either the null or the alternative hypothesis
d. sample statistic

ANS: A PTS: 1 TOP: Hypothesis Tests

9. The *p*-value
a. is the same as the Z statistic
b. measures the number of standard deviations from the mean
c. is a distance
d. is a probability

ANS: D PTS: 1 TOP: Hypothesis Tests

10. For a two-tail test, the *p*-value is the probability of obtaining a value for the test statistic as
a. likely as that provided by the sample
b. unlikely as that provided by the sample
c. likely as that provided by the population
d. unlikely as that provided by the population

ANS: B PTS: 1 TOP: Hypothesis Tests

11. In hypothesis testing if the null hypothesis is rejected,
a. no conclusions can be drawn from the test
b. the alternative hypothesis is true
c. the data must have been accumulated incorrectly
d. the sample size has been too small

ANS: B PTS: 1 TOP: Hypothesis Tests

12. The level of significance is the
a. maximum allowable probability of Type II error
b. maximum allowable probability of Type I error
c. same as the confidence coefficient
d. same as the *p*-value

ANS: B PTS: 1 TOP: Hypothesis Tests

13. The power curve provides the probability of
a. correctly accepting the null hypothesis
b. incorrectly accepting the null hypothesis
c. correctly rejecting the alternative hypothesis
d. correctly rejecting the null hypothesis

ANS: D PTS: 1 TOP: Hypothesis Tests

14. A Type II error is committed when
a. a true alternative hypothesis is mistakenly rejected

b. a true null hypothesis is mistakenly rejected
c. the sample size has been too small
d. not enough information has been available

ANS: A PTS: 1 TOP: Hypothesis Tests

15. The error of rejecting a true null hypothesis is
a. a Type I error
b. a Type II error
c. is the same as β
d. committed when not enough information is available

ANS: A PTS: 1 TOP: Hypothesis Tests

16. The level of significance in hypothesis testing is the probability of
a. accepting a true null hypothesis
b. accepting a false null hypothesis
c. rejecting a true null hypothesis
d. None of these alternatives is correct.

ANS: C PTS: 1 TOP: Hypothesis Tests

17. The level of significance
a. can be any positive value
b. can be any value
c. is (1 - confidence level)
d. can be any value between -1.96 to 1.96

ANS: C PTS: 1 TOP: Hypothesis Tests

18. In hypothesis testing if the null hypothesis has been rejected when the alternative hypothesis has been true,
a. a Type I error has been committed
b. a Type II error has been committed
c. either a Type I or Type II error has been committed
d. the correct decision has been made

ANS: D PTS: 1 TOP: Hypothesis Tests

19. The probability of making a Type I error is denoted by
a. α
b. β
c. $1 - \alpha$
d. $1 - \beta$

ANS: A PTS: 1 TOP: Hypothesis Tests

20. The probability of making a Type II error is denoted by
a. α
b. β
c. $1 - \alpha$
d. $1 - \beta$

ANS: B PTS: 1 TOP: Hypothesis Tests

21. When the following hypotheses are being tested at a level of significance of α

H_0: $\mu \geq 500$
H_a: $\mu < 500$

the null hypothesis will be rejected if the *p*-value is
a. $\leq \alpha$
b. $> \alpha$
c. $> \alpha/2$
d. $\leq 1 - \alpha/2$

ANS: A PTS: 1 TOP: Hypothesis Tests

22. When the *p*-value is used for hypothesis testing, the null hypothesis is rejected if
a. *p*-value $\leq \alpha$
b. $\alpha <$ *p*-value
c. *p*-value $\geq \alpha$
d. *p*-value $= 1 - \alpha$

ANS: A PTS: 1 TOP: Hypothesis Tests

23. In order to test the following hypotheses at an α level of significance

H_0: $\mu \leq 800$
H_a: $\mu > 800$

the null hypothesis will be rejected if the test statistic Z is
a. $\geq Z_\alpha$
b. $< Z_\alpha$
c. $< -Z_\alpha$
d. $= \alpha$

ANS: A PTS: 1 TOP: Hypothesis Tests

24. Which of the following does **not** need to be known in order to compute the *p*-value?
a. knowledge of whether the test is one-tailed or two-tailed
b. the value of the test statistic
c. the level of significance
d. None of these alternatives is correct.

ANS: C PTS: 1 TOP: Hypothesis Tests

25. In the hypothesis testing procedure, α is
a. the level of significance
b. the critical value
c. the confidence level
d. 1 - level of significance

ANS: A PTS: 1 TOP: Hypothesis Tests

26. If a hypothesis test leads to the rejection of the null hypothesis,
a. a Type II error must have been committed
b. a Type II error may have been committed

c. a Type I error must have been committed
d. a Type I error may have been committed

ANS: D PTS: 1 TOP: Hypothesis Tests

27. As the test statistic becomes larger, the *p*-value
a. gets smaller
b. becomes larger
c. stays the same, since the sample size has not been changed
d. becomes negative

ANS: A PTS: 1 TOP: Hypothesis Tests

28. The *p*-value ranges between
a. zero and infinity
b. minus infinity to plus infinity
c. zero to one
d. -1 to +1

ANS: C PTS: 1 TOP: Hypothesis Tests

29. For a lower bounds one-tailed test, the test statistic *z* is determined to be zero. The *p*-value for this test is
a. zero
b. -0.5
c. +0.5
d. 1.00

ANS: C PTS: 1 TOP: Hypothesis Tests

30. In a two-tailed hypothesis test situation, the test statistic is determined to be t = -2.692. The sample size has been 45. The *p*-value for this test is
a. -0.005
b. +0.005
c. -0.01
d. +0.01

ANS: D PTS: 1 TOP: Hypothesis Tests

31. In a lower one-tail hypothesis test situation, the *p*-value is determined to be 0.2. If the sample size for this test is 51, the *t* statistic has a value of
a. 0.849
b. -0.849
c. 1.299
d. -1.299

ANS: B PTS: 1 TOP: Hypothesis Tests

32. If a hypothesis is rejected at the 5% level of significance, it
a. will always be rejected at the 1% level
b. will always be accepted at the 1% level
c. will never be tested at the 1% level
d. may be rejected or not rejected at the 1% level

ANS: D PTS: 1 TOP: Hypothesis Tests

33. If a hypothesis is not rejected at the 5% level of significance, it
    a. will also not be rejected at the 1% level
    b. will always be rejected at the 1% level
    c. will sometimes be rejected at the 1% level
    d. None of these alternatives is correct.

    ANS: A PTS: 1 TOP: Hypothesis Tests

34. If the probability of a Type I error (α) is 0.05, then the probability of a Type II error (β) must be
    a. 0.05
    b. 0.95
    c. 0.025
    d. None of these alternatives is correct.

    ANS: D PTS: 1 TOP: Hypothesis Tests

35. If the level of significance of a hypothesis test is raised from .01 to .05, the probability of a Type II error
    a. will also increase from .01 to .05
    b. will not change
    c. will decrease
    d. will increase

    ANS: C PTS: 1 TOP: Hypothesis Tests

36. If a hypothesis is rejected at 95% confidence, it
    a. will always be accepted at 90% confidence
    b. will always be rejected at 90% confidence
    c. will sometimes be rejected at 90% confidence
    d. None of these alternatives is correct.

    ANS: B PTS: 1 TOP: Hypothesis Tests

37. For a two-tailed test at 86.12% confidence, Z =
    a. 1.96
    b. 1.48
    c. 1.09
    d. 0.86

    ANS: B PTS: 1 TOP: Hypothesis Tests

38. For a one-tailed test (lower tail) at 93.7% confidence, Z =
    a. -1.86
    b. -1.53
    c. -1.96
    d. -1.645

    ANS: B PTS: 1 TOP: Hypothesis Tests

39. Read the Z statistic from the normal distribution table and circle the correct answer. A one-tailed test (upper tail) at 87.7% confidence; Z =
    a. 1.54
    b. 1.96
    c. 1.645
    d. 1.16

ANS: D PTS: 1 TOP: Hypothesis Tests

40. For a two-tailed test, a sample of 20 at 80% confidence, t =
    a. 1.328
    b. 2.539
    c. 1.325
    d. 2.528

    ANS: A PTS: 1 TOP: Hypothesis Tests

41. For a one-tailed test (upper tail), a sample size of 18 at 95% confidence, t =
    a. 2.12
    b. -2.12
    c. -1.740
    d. 1.740

    ANS: D PTS: 1 TOP: Hypothesis Tests

42. For a one-tailed test (lower tail), a sample size of 10 at 90% confidence, t =
    a. 1.383
    b. 2.821
    c. -1.383
    d. -2.821

    ANS: C PTS: 1 TOP: Hypothesis Tests

43. A two-tailed test is performed at 95% confidence. The *p*-value is determined to be 0.09. The null hypothesis
    a. must be rejected
    b. should not be rejected
    c. could be rejected, depending on the sample size
    d. has been designed incorrectly

    ANS: B PTS: 1 TOP: Hypothesis Tests

44. For a two-tailed test at 98.4% confidence, Z =
    a. 1.96
    b. 1.14
    c. 2.41
    d. 0.8612

    ANS: C PTS: 1 TOP: Hypothesis Tests

45. For a one-tailed test (lower tail) at 89.8% confidence, Z =
    a. -1.27
    b. -1.53
    c. -1.96
    d. -1.64

    ANS: A PTS: 1 TOP: Hypothesis Tests

46. For a one-tailed test (upper tail) at 93.7% confidence, Z =
    a. 1.50
    b. 1.96
    c. 1.645
    d. 1.53

ANS: D PTS: 1 TOP: Hypothesis Tests

47. For a one-tailed test (upper tail), a sample size of 26 at 90% confidence, t =
a. 1.316
b. -1.316
c. -1.740
d. 1.740

ANS: A PTS: 1 TOP: Hypothesis Tests

48. For a one-tailed test (lower tail) with 22 degrees of freedom at 95% confidence, the value of t =
a. -1.383
b. 1.383
c. -1.717
d. -1.721

ANS: C PTS: 1 TOP: Hypothesis Tests

49. For a one-tailed hypothesis test (upper tail) the *p*-value is computed to be 0.034. If the test is being conducted at 95% confidence, the null hypothesis
a. could be rejected or not rejected depending on the sample size
b. could be rejected or not rejected depending on the value of the mean of the sample
c. is not rejected
d. is rejected

ANS: D PTS: 1 TOP: Hypothesis Tests

50. In a two-tailed hypothesis test the test statistic is determined to be Z = -2.5. The *p*-value for this test is
a. -1.25
b. 0.4938
c. 0.0062
d. 0.0124

ANS: D PTS: 1 TOP: Hypothesis Tests

51. In a one-tailed hypothesis test (lower tail) the test statistic is determined to be -2. The *p*-value for this test is
a. 0.4772
b. 0.0228
c. 0.0056
d. 0.5228

ANS: B PTS: 1 TOP: Hypothesis Tests

52. The average manufacturing work week in metropolitan Chattanooga was 40.1 hours last year. It is believed that the recession has led to a reduction in the average work week. To test the validity of this belief, the hypotheses are
a. H_0: $\mu < 40.1$ H_a: $\mu \geq 40.1$
b. H_0: $\mu \geq 40.1$ H_a: $\mu < 40.1$
c. H_0: $\mu > 40.1$ H_a: $\mu \leq 40.1$
d. H_0: $\mu = 40.1$ H_a: $\mu \neq 40.1$

ANS: B PTS: 1 TOP: Hypothesis Tests

53. The average monthly rent for one-bedroom apartments in Chattanooga has been $700. Because of the downturn in the real estate market, it is believed that there has been a decrease in the average rental. The correct hypotheses to be tested are

a. H_0: $\mu \geq 700$ H_a: $\mu < 700$
b. H_0: $\mu = 700$ H_a: $\mu \neq 700$
c. H_0: $\mu > 700$ H_a: $\mu \leq 700$
d. H_0: $\mu < 700$ H_a: $\mu \geq 700$

ANS: A PTS: 1 TOP: Hypothesis Tests

54. A machine is designed to fill toothpaste tubes with 5.8 ounces of toothpaste. The manufacturer does not want any underfilling or overfilling. The correct hypotheses to be tested are

a. H_0: $\mu \neq 5.8$ H_a: $\mu = 5.8$
b. H_0: $\mu = 5.8$ H_a: $\mu \neq 5.8$
c. H_0: $\mu > 5.8$ H_a: $\mu \leq 5.8$
d. H_0: $\mu \geq 5.8$ H_a: $\mu < 5.8$

ANS: B PTS: 1 TOP: Hypothesis Tests

55. The average hourly wage of computer programmers with 2 years of experience has been $21.80. Because of high demand for computer programmers, it is believed there has been a significant increase in the average wage of computer programmers. To test whether or not there has been an increase, the correct hypotheses to be tested are

a. H_0: $\mu < 21.80$ H_a: $\mu \geq 21.80$
b. H_0: $\mu = 21.80$ H_a: $\mu \neq 21.80$
c. H_0: $\mu > 21.80$ H_a: $\mu \leq 21.80$
d. H_0: $\mu \leq 21.80$ H_a: $\mu > 21.80$

ANS: D PTS: 1 TOP: Hypothesis Tests

56. A student believes that the average grade on the final examination in statistics is at least 85. She plans on taking a sample to test her belief. The correct set of hypotheses is

a. H_0: $\mu < 85$ H_a: $\mu \geq 85$
b. H_0: $\mu \leq 85$ H_a: $\mu > 85$
c. H_0: $\mu \geq 85$ H_a: $\mu < 85$
d. H_0: $\mu > 85$ H_a: $\mu \leq 85$

ANS: C PTS: 1 TOP: Hypothesis Tests

57. In the past, 75% of the tourists who visited Chattanooga went to see Rock City. The management of Rock City recently undertook an extensive promotional campaign. They are interested in determining whether the promotional campaign actually **increased** the proportion of tourists visiting Rock City. The correct set of hypotheses is

a. H_0: $P > 0.75$ H_a: $P \leq 0.75$
b. H_0: $P < 0.75$ H_a: $P \geq 0.75$
c. H_0: $P \geq 0.75$ H_a: $P < 0.75$
d. H_0: $P \leq 0.75$ H_a: $P > 0.75$

ANS: D PTS: 1 TOP: Hypothesis Tests

58. The average life expectancy of tires produced by the Whitney Tire Company has been 40,000 miles. Management believes that due to a new production process, the life expectancy of their tires has increased. In order to test the validity of their belief, the correct set of hypotheses is

a. $H_0: \mu < 40{,}000$ $H_a: \mu \geq 40{,}000$
b. $H_0: \mu \leq 40{,}000$ $H_a: \mu > 40{,}000$
c. $H_0: \mu > 40{,}000$ $H_a: \mu \leq 40{,}000$
d. $H_0: \mu \geq 40{,}000$ $H_a: \mu < 40{,}000$

ANS: B PTS: 1 TOP: Hypothesis Tests

59. A soft drink filling machine, when in perfect adjustment, fills the bottles with 12 ounces of soft drink. Any over filling or under filling results in the shutdown and readjustment of the machine. To determine whether or not the machine is properly adjusted, the correct set of hypotheses is
a. $H_0: \mu < 12$ $H_a: \mu \leq 12$
b. $H_0: \mu \leq 12$ $H_a: \mu > 12$
c. $H_0: \mu \neq 12$ $H_a: \mu = 12$
d. $H_0: \mu = 12$ $H_a: \mu \neq 12$

ANS: D PTS: 1 TOP: Hypothesis Tests

60. The academic planner of a university thinks that at least 35% of the entire student body attends summer school. The correct set of hypotheses to test his belief is
a. $H_0: P > 0.35$ $H_a: P \geq 0.35$
b. $H_0: P \leq 0.35$ $H_a: P > 0.35$
c. $H_0: P \geq 0.35$ $H_a: P < 0.35$
d. $H_0: P > 0.35$ $H_a: P \leq 0.35$

ANS: C PTS: 1 TOP: Hypothesis Tests

61. The manager of an automobile dealership is considering a new bonus plan in order to increase sales. Currently, the mean sales rate per salesperson is five automobiles per month. The correct set of hypotheses for testing the effect of the bonus plan is
a. $H_0: \mu < 5$ $H_a: \mu \leq 5$
b. $H_0: \mu \leq 5$ $H_a: \mu > 5$
c. $H_0: \mu > 5$ $H_a: \mu \leq 5$
d. $H_0: \mu \geq 5$ $H_a: \mu < 5$

ANS: B PTS: 1 TOP: Hypothesis Tests

62. Your investment executive claims that the average yearly rate of return on the stocks she recommends is at least 10.0%. You plan on taking a sample to test her claim. The correct set of hypotheses is
a. $H_0: \mu < 10.0\%$ $H_a: \mu \geq 10.0\%$
b. $H_0: \mu \leq 10.0\%$ $H_a: \mu > 10.0\%$
c. $H_0: \mu > 10.0\%$ $H_a: \mu \leq 10.0\%$
d. $H_0: \mu \geq 10.0\%$ $H_a: \mu < 10.0\%$

ANS: D PTS: 1 TOP: Hypothesis Tests

63. A weatherman stated that the average temperature during July in Chattanooga is 80 degrees or less. A sample of 32 Julys is taken. The correct set of hypotheses is
a. $H_0: \mu \geq 80$ $H_a: \mu < 80$
b. $H_0: \mu \leq 80$ $H_a: \mu > 80$
c. $H_0: \mu \neq 80$ $H_a: \mu = 80$
d. $H_0: \mu < 80$ $H_a: \mu > 80$

ANS: B PTS: 1 TOP: Hypothesis Tests

64. The school's newspaper reported that the proportion of students majoring in business is at least 30%. You plan on taking a sample to test the newspaper's claim. The correct set of hypotheses is
a. H_0: $P < 0.30$ H_a: $P \geq 0.30$
b. H_0: $P \leq 0.30$ H_a: $P > 0.30$
c. H_0: $P \geq 0.30$ H_a: $P < 0.30$
d. H_0: $P > 0.30$ H_a: $P \leq 0.30$

ANS: C PTS: 1 TOP: Hypothesis Tests

NARRBEGIN: Exhibit 09-01
Exhibit 9-1

$n = 36$ $\bar{x} = 24.6$ $S = 12$ H_0: $\mu \leq 20$
H_a: $\mu > 20$

NARREND

65. Refer to Exhibit 9-1. The test statistic is
a. 2.3
b. 0.38
c. -2.3
d. -0.38

ANS: A PTS: 1 TOP: Hypothesis Tests

66. Refer to Exhibit 9-1. The *p*-value is between
a. 0.005 to 0.01
b. 0.01 to 0.025
c. 0.025 to 0.05
d. 0.05 to 0.10

ANS: B PTS: 1 TOP: Hypothesis Tests

67. Refer to Exhibit 9-1. If the test is done at 95% confidence, the null hypothesis should
a. not be rejected
b. be rejected
c. Not enough information is given to answer this question.
d. None of these alternatives is correct.

ANS: B PTS: 1 TOP: Hypothesis Tests

NARRBEGIN: Exhibit 09-02
Exhibit 9-2

$n = 64$ $\bar{x} = 50$ $s = 16$ H_0: $\mu \geq 54$
H_a: $\mu < 54$

NARREND

68. Refer to Exhibit 9-2. The test statistic equals
a. -4
b. -3
c. -2

d. -1

ANS: C PTS: 1 TOP: Hypothesis Tests

69. Refer to Exhibit 9-2. The *p*-value is between
a. .005 to .01
b. .01 to .025
c. .025 to .05
d. .05 to .01

ANS: B PTS: 1 TOP: Hypothesis Tests

70. Refer to Exhibit 9-2. If the test is done at 95% confidence, the null hypothesis should
a. not be rejected
b. be rejected
c. Not enough information is given to answer this question.
d. None of these alternatives is correct.

ANS: B PTS: 1 TOP: Hypothesis Tests

NARRBEGIN: Exhibit 09-03
Exhibit 9-3

$n = 49$ $\bar{x} = 54.8$ $s = 28$ $H_0: \mu \leq 50$ $H_a: \mu > 50$

NARREND

71. Refer to Exhibit 9-3. The test statistic is
a. 0.1714
b. 0.3849
c. -1.2
d. 1.2

ANS: D PTS: 1 TOP: Hypothesis Tests

72. Refer to Exhibit 9-3. The *p*-value is between
a. 0.01 to 0.025
b. 0.025 to 0.05
c. .05 to 0.1
d. 0.1 to 0.2

ANS: D PTS: 1 TOP: Hypothesis Tests

73. Refer to Exhibit 9-3. If the test is done at the 5% level of significance, the null hypothesis should
a. not be rejected
b. be rejected
c. Not enough information given to answer this question.
d. None of these alternatives is correct.

ANS: A PTS: 1 TOP: Hypothesis Tests

NARRBEGIN: Exhibit 09-04
Exhibit 9-4

The manager of a grocery store has taken a random sample of 100 customers. The average length of time it took the customers in the sample to check out was 3.1 minutes with a standard deviation of 0.5 minutes. We want to test to determine whether or not the mean waiting time of all customers is significantly more than 3 minutes.
NARREND

74. Refer to Exhibit 9-4. The test statistic is
    a. 1.96
    b. 1.64
    c. 2.00
    d. 0.056

    ANS: C PTS: 1 TOP: Hypothesis Tests

75. Refer to Exhibit 9-4. The *p*-value is between
    a. .005 to .01
    b. .01 to .025
    c. .025 to .05
    d. .05 to .10

    ANS: B PTS: 1 TOP: Hypothesis Tests

76. Refer to Exhibit 9-4. At 95% confidence, it can be concluded that the mean of the population is
    a. significantly greater than 3
    b. not significantly greater than 3
    c. significantly less than 3
    d. significantly greater then 3.18

    ANS: A PTS: 1 TOP: Hypothesis Tests

NARRBEGIN: Exhibit 09-05
Exhibit 9-5
A random sample of 100 people was taken. Eighty-five of the people in the sample favored Candidate A. We are interested in determining whether or not the proportion of the population in favor of Candidate A is significantly more than 80%.
NARREND

77. Refer to Exhibit 9-5. The test statistic is
    a. 0.80
    b. 0.05
    c. 1.25
    d. 2.00

    ANS: C PTS: 1 TOP: Hypothesis Tests

78. Refer to Exhibit 9-5. The *p*-value is
    a. 0.2112
    b. 0.05
    c. 0.025
    d. 0.1056

    ANS: D PTS: 1 TOP: Hypothesis Tests

79. Refer to Exhibit 9-5. At 95% confidence, it can be concluded that the proportion of the population in favor of candidate A

a. is significantly greater than 80%
b. is not significantly greater than 80%
c. is significantly greater than 85%
d. is not significantly greater than 85%

ANS: B PTS: 1 TOP: Hypothesis Tests

NARRBEGIN: Exhibit 09-06

Exhibit 9-6

A random sample of 16 students selected from the student body of a large university had an average age of 25 years and a standard deviation of 2 years. We want to determine if the average age of all the students at the university is significantly more than 24. Assume the distribution of the population of ages is normal.

NARREND

80. Refer to Exhibit 9-6. The test statistic is
a. 1.96
b. 2.00
c. 1.645
d. 0.05

ANS: B PTS: 1 TOP: Hypothesis Tests

81. Refer to Exhibit 9-6. The *p*-value is between
a. .005 to .01
b. .01 to .025
c. .025 to .05
d. .05 to .10

ANS: C PTS: 1 TOP: Hypothesis Tests

82. Refer to Exhibit 9-6. At 95% confidence, it can be concluded that the mean age is
a. not significantly different from 24
b. significantly different from 24
c. significantly less than 24
d. significantly more than 24

ANS: D PTS: 1 TOP: Hypothesis Tests

NARRBEGIN: Exhibit 09-07

Exhibit 9-7

A random sample of 16 statistics examinations from a large population was taken. The average score in the sample was 78.6 with a variance of 64. We are interested in determining whether the average grade of the population is significantly more than 75. Assume the distribution of the population of grades is normal.

NARREND

83. Refer to Exhibit 9-7. The test statistic is
a. 0.45
b. 1.80
c. 3.6
d. 8

ANS: B PTS: 1 TOP: Hypothesis Tests

84. Refer to Exhibit 9-7. The *p*-value is between
a. .005 to .01
b. .01 to .025
c. .025 to .05
d. .05 to 0.1

ANS: C PTS: 1 TOP: Hypothesis Tests

85. Refer to Exhibit 9-7. At 95% confidence, it can be concluded that the average grade of the population
a. is not significantly greater than 75
b. is significantly greater than 75
c. is not significantly greater than 78.6
d. is significantly greater than 78.6

ANS: B PTS: 1 TOP: Hypothesis Tests

NARRBEGIN: Exhibit 09-08
Exhibit 9-8
The average gasoline price of one of the major oil companies in Europe has been $1.25 per liter. Recently, the company has undertaken several efficiency measures in order to reduce prices. Management is interested in determining whether their efficiency measures have actually **reduced** prices. A random sample of 49 of their gas stations is selected and the average price is determined to be $1.20 per liter. Furthermore, assume that the standard deviation of the population (σ) is $0.14.
NARREND

86. Refer to Exhibit 9-8. The standard error has a value of
a. 0.14
b. 7
c. 2.5
d. 0.02

ANS: D PTS: 1 TOP: Hypothesis Tests

87. Refer to Exhibit 9-8. The value of the test statistic for this hypothesis test is
a. 1.96
b. 1.645
c. -2.5
d. -1.645

ANS: C PTS: 1 TOP: Hypothesis Tests

88. Refer to Exhibit 9-8. The *p*-value for this problem is
a. 0.4938
b. 0.0062
c. 0.0124
d. 0.05

ANS: B PTS: 1 TOP: Hypothesis Tests

NARRBEGIN: Exhibit 09-09
Exhibit 9-9

The sales of a grocery store had an average of $8,000 per day. The store introduced several advertising campaigns in order to ***increase*** sales. To determine whether or not the advertising campaigns have been effective in increasing sales, a sample of 64 days of sales was selected. It was found that the average was $8,300 per day. From past information, it is known that the standard deviation of the ***population*** is $1,200.
NARREND

89. Refer to Exhibit 9-9. The correct null hypothesis for this problem is
    a. $\mu \leq 8000$
    b. $\mu > 8000$
    c. $\mu = 8000$
    d. $\mu > 8250$

    ANS: A PTS: 1 TOP: Hypothesis Tests

90. Refer to Exhibit 9-9. The value of the test statistic is
    a. 250
    b. 8000
    c. 8250
    d. 2.0

    ANS: D PTS: 1 TOP: Hypothesis Tests

91. Refer to Exhibit 9-9. The *p*-value is
    a. 2.00
    b. 0.9772
    c. 0.0228
    d. 0.5475

    ANS: C PTS: 1 TOP: Hypothesis Tests

PROBLEM

1. The Department of Economic and Community Development (DECD) reported that in 2009 the average number of new jobs created per county was 450. The department also provided the following information regarding a sample of 5 counties in 2010.

County	New Jobs Created In 2010
Bradley	410
Rhea	480
Marion	407
Grundy	428
Sequatchie	400

   a. Compute the sample average and the standard deviation for 2010.
   b. We want to determine whether there has been a **significant decrease** in the average number of jobs created. Provide the null and the alternative hypotheses.
   c. Compute the test statistic.
   d. Compute the *p*-value; and at 95% confidence, test the hypotheses. Assume the population is normally distributed.

   ANS:

a. $\bar{x} = 425$ and $s = 32.44$ (rounded)
b. H_o: $\mu \geq 450$
   H_a: $\mu < 450$
c. Test statistic $t = -1.724$
d. *P*-value is between 0.05 and 0.1; do not reject H_o. There is no evidence of a significant decrease.

PTS: 1 TOP: Hypothesis Tests

2. The Bureau of Labor Statistics reported that the average yearly income of dentists in the year 2009 was $110,000. A sample of 81 dentists, which was taken in 2010, showed an average yearly income of $120,000. Assume the standard deviation of the ***population*** of dentists in 2010 is $36,000.

   a. We want to test to determine if there has been a significant ***increase*** in the average yearly income of dentists. Provide the null and the alternative hypotheses.
   b. Compute the test statistic.
   c. Determine the *p*-value; and at 95% confidence, test the hypotheses.

   ANS:
   a. H_o: $\mu \leq \$110{,}000$
      H_a: $\mu > \$110{,}000$
   b. $Z = 2.5$
   c. *p*-value = 0.0062
      Since the *p*-value = 0.0062 < 0.05, reject H_o. Therefore, there has been a significant increase.

   PTS: 1 TOP: Hypothesis Tests

3. A tire manufacturer has been producing tires with an average life expectancy of 26,000 miles. Now the company is advertising that its **new** tires' life expectancy has increased. In order to test the legitimacy of the advertising campaign, an independent testing agency tested a sample of 6 of their tires and has provided the following data.

Life Expectancy (In Thousands of Miles)
28
27
25
28
29
25

   a. Determine the mean and the standard deviation.
   b. At 99% confidence using the critical value approach, test to determine whether or not the tire company is using legitimate advertising. Assume the population is normally distributed.
   c. Repeat the test using the *p*-value approach.

   ANS:
   a. $\bar{x} = 27$, $s = 1.67$
   b. H_o: $\mu \leq 26000$
      H_a: $\mu > 26000$
      Since $t = 1.47 < 3.365$, do not reject H_o and conclude that there is insufficient evidence to support the manufacturer's claim.

c. p-value > 0.1; do not reject H_o

PTS: 1 TOP: Hypothesis Tests

4. A producer of various kinds of batteries has been producing "D" size batteries with a life expectancy of 87 hours. Due to an improved production process, management believes that there has been an increase in the life expectancy of their "D" size batteries. A sample of 36 batteries showed an average life of 88.5 hours. Assume from past information that it is known that the ***standard deviation of the population*** is 9 hours.

   a. Give the null and the alternative hypotheses.
   b. Compute the test statistic.
   c. At 99% confidence using the critical value approach, test management's belief.
   d. What is the p-value associated with the sample results? What is your conclusion based on the p-value?

   ANS:
   a. H_o: $\mu \leq 87$
      H_a: $\mu > 87$

   b. 1.00
   c. Since $Z = 1 < 2.33$, do not reject H_o and conclude that there is insufficient evidence to support the corporation's claim.
   d. p-value > 0.1587; therefore do not reject H_o

   PTS: 1 TOP: Hypothesis Tests

5. Some people who bought X-Game gaming systems complained about having received defective systems. The industry standard for such systems has been ninety-eight percent non-defective systems. In a sample of 120 units sold, 6 units were defective.

   a. Compute the proportion of defective items in the sample.
   b. Compute the standard error of $\bar{p}$.
   c. At 95% confidence using the critical value approach, test to see if the percentage of defective systems produced by X-Game has exceeded the industry standard.
   d. Show that the p-value approach results in the same conclusion as that of part b.

   ANS:

   a. 0.05
   b. 0.0128
   c. Test statistic $Z = 2.35 > 1.645$; reject H_o; the number of defects has exceeded the industry standard.
   d. p-value (.0094) < 0.05; reject H_o.

   PTS: 1 TOP: Hypothesis Tests

6. Choo Choo Paper Company makes various types of paper products. One of their products is a 30 mils thick paper. In order to ensure that the thickness of the paper meets the 30 mils specification, random cuts of paper are selected and the thickness of each cut is measured. A sample of 256 cuts had a mean thickness of 30.3 mils with a standard deviation of 4 mils.

a. Compute the standard error of the mean.
b. At 95% confidence using the critical value approach, test to see if the mean thickness is significantly more than 30 mils.
c. Show that the *p*-value approach results in the same conclusion as that of part b.

ANS:

a. 0.25
b. Test statistics $t = 1.2 < 1.645$; do not reject H_o.
c. *p*-value (.1151) is between 0.1 and 0.2; do not reject H_o.

PTS: 1 TOP: Hypothesis Tests

7. Last year, 50% of MNM, Inc. employees were female. It is believed that there has been a reduction in the percentage of females in the company. This year, in a random sample of 400 employees, 180 were female.

a. Give the null and the alternative hypotheses.
b. At 95% confidence using the critical value approach, determine if there has been a significant reduction in the proportion of females.
c. Show that the *p*-value approach results in the same conclusion as that of Part b.

ANS:

a. H_o: $p \geq 0.5$
   H_a: $p < 0.5$
b. Test statistic $Z = -2.0 < -1.645$; reject H_o; the proportion of female employees is significantly less than 50%.
c. *p*-value = $0.0228 < 0.05$; reject H_o.

PTS: 1 TOP: Hypothesis Tests

8. Last year, a soft drink manufacturer had 21% of the market. In order to increase their portion of the market, the manufacturer has introduced a new flavor in their soft drinks. A sample of 400 individuals participated in the taste test and 100 indicated that they like the taste. We are interested in determining if more than 21% of the population will like the new soft drink.

a. Set up the null and the alternative hypotheses.
b. Determine the test statistic.
c. Determine the *p*-value.
d. At 95% confidence, test to determine if more than 21% of the population will like the new soft drink.

ANS:

a. H_o: $p \leq 0.21$
   H_a: $p > 0.21$
b. Test statistic $Z = 1.96$
c. *p*-value = 0.025
d. *p*-value = $0.025 < .05$; therefore, reject H_o; more than 21% like the new drink.

PTS: 1 TOP: Hypothesis Tests

9. In the past, the average age of employees of a large corporation has been 40 years. Recently, the company has been hiring older individuals. In order to determine whether there has been an **increase** in the average age of all the employees, a sample of 64 employees was selected. The average age in the sample was 45 years with a standard deviation of 16 years. Let $\alpha = .05$.

    a. State the null and the alternative hypotheses.
    b. Compute the test statistic.
    c. Using the *p*-value approach, test to determine whether or not the mean age of all employees is significantly more than 40 years.

    ANS:

    a. $H_0: \mu \leq 40$
       $H_a: \mu > 40$
    b. $t = 2.5$
    c. *p*-value (.007518) is between .005 and .01; reject H_0

    PTS: 1 TOP: Hypothesis Tests

10. The average gasoline price of one of the major oil companies has been $2.20 per gallon. Because of cost reduction measures, it is believed that there has been a significant **reduction** in the average price. In order to test this belief, we randomly selected a sample of 36 of the company's gas stations and determined that the average price for the stations in the sample was $2.14. Assume that the standard deviation of the **population** (σ) is $0.12.

    a. State the null and the alternative hypotheses.
    b. Compute the test statistic.
    c. What is the *p*-value associated with the above sample results?
    d. At 95% confidence, test the company's claim.

    ANS:

    a. $H_0: \mu \geq 2.20$
       $H_a: \mu < 2.20$
    b. $Z = -3$
    c. *p*-value = almost zero (0.0013)
    d. *p*-value < .05; reject H_0; the average price has been reduced.

    PTS: 1 TOP: Hypothesis Tests

11. A sample of 81 account balances of a credit company showed an average balance of $1,200 with a standard deviation of $126.

    a. Formulate the hypotheses that can be used to determine whether the mean of all account balances is significantly different from $1,150.
    b. Compute the test statistic.
    c. Using the *p*-value approach, what is your conclusion? Let $\alpha = .05$.

    ANS:

    a. $H_0: \mu = 1150$
       $H_a: \mu \neq 1150$

b. $t = 3.57$
c. p-value (almost zero) <.005; therefore, reject H_0

PTS: 1 TOP: Hypothesis Tests

12. From a population of cans of coffee marked "12 ounces," a sample of 50 cans was selected and the contents of each can were weighed. The sample revealed a mean of 11.8 ounces with a standard deviation of 0.5 ounces.

a. Formulate the hypotheses to test to see if the mean of the population is at least 12 ounces.
b. Compute the test statistic.
c. Using the p-value approach, what is your conclusion? Let $\alpha = .05$.

ANS:

a. $H_0: \mu \geq 12$
$H_a: \mu < 12$
b. $t = -2.83$
c. p-value (.0034) < .005; therefore, reject H_0

PTS: 1 TOP: Hypothesis Tests

13. A lathe is set to cut bars of steel into lengths of 6 centimeters. The lathe is considered to be in perfect adjustment if the average length of the bars it cuts is 6 centimeters. A sample of 121 bars is selected randomly and measured. It is determined that the average length of the bars in the sample is 6.08 centimeters with a standard deviation of 0.44 centimeters.

a. Formulate the hypotheses to determine whether or not the lathe is in perfect adjustment.
b. Compute the test statistic.
c. Using the p-value approach, what is your conclusion? Let $\alpha = .05$.

ANS:

a. $H_0: \mu = 6$
$H_a: \mu \neq 6$
b. $t = 2$
c. p-value (.0456) is between 0.02 and 0.05; therefore, reject H_0

PTS: 1 TOP: Hypothesis Tests

14. Ahmadi, Inc. has been manufacturing small automobiles that have averaged 50 miles per gallon of gasoline in highway driving. The company has developed a more efficient engine for its small cars and now advertises that its new small cars average more than 50 miles per gallon in highway driving. An independent testing service road-tested 64 of the automobiles. The sample showed an average of 51.5 miles per gallon with a standard deviation of 4 miles per gallon.

a. Formulate the hypotheses to determine whether or not the manufacturer's advertising campaign is legitimate.
b. Compute the test statistic.
c. What is the p-value associated with the sample results and what is your conclusion? Let $\alpha = .05$.

ANS:

a. $H_0: \mu \leq 50$
   $H_a: \mu > 50$
b. $t = 3$
c. *p*-value (.0019) is less than .005; reject H_0

PTS: 1 TOP: Hypothesis Tests

15. A soft drink filling machine, when in perfect adjustment, fills the bottles with 12 ounces of soft drink. A random sample of 49 bottles is selected, and the contents are measured. The sample yielded a mean content of 11.88 ounces with a standard deviation of 0.35 ounces.

    a. Formulate the hypotheses to test to determine if the machine is in perfect adjustment.
    b. Compute the value of the test statistic.
    c. Compute the *p*-value and give your conclusion regarding the adjustment of the machine. Let $\alpha = .05$.

    ANS:

    a. $H_0: \mu = 12$
       $H_a: \mu \neq 12$
    b. $t = -2.4$
    c. *p*-value is between 0.01 and 0.025; therefore, reject H_0

    PTS: 1 TOP: Hypothesis Tests

16. "D" size batteries produced by MNM Corporation have had a life expectancy of 87 hours. Because of an improved production process, it is believed that there has been an **increase** in the life expectancy of its "D" size batteries. A sample of 36 batteries showed an average life of 88.5 hours. Assume from past information that it is known that the standard deviation of the **population** is 9 hours.

    a. Formulate the hypotheses for this problem.
    b. Compute the test statistic.
    c. What is the *p*-value associated with the sample results? What is your conclusion based on the p-value? Let $\alpha = .05$.

    ANS:

    a. $H_0: \mu \leq 87$
       $H_a: \mu > 87$
    b. $Z = 1$
    c. *p*-value = 0.1587; therefore, do not reject H_0

    PTS: 1 TOP: Hypothesis Tests

17. At a local university, a sample of 49 evening students was selected in order to determine whether the average age of the evening students is significantly different from 21. The average age of the students in the sample was 23 with a standard deviation of 3.5.

    a. Formulate the hypotheses for this problem.
    b. Compute the test statistic.

c. Determine the *p*-value and test these hypotheses. Let $\alpha = .05$.

ANS:

a. $H_0: \mu = 21$
   $H_a: \mu \neq 21$
b. $t = 4$
c. *p*-value is almost zero; therefore, reject H_0

PTS: 1 TOP: Hypothesis Tests

18. In order to determine the average price of hotel rooms in Atlanta, a sample of 64 hotels was selected. It was determined that the average price of the rooms in the sample was $108.50 with a standard deviation of $16.

a. Formulate the hypotheses to determine whether or not the average room price is significantly different from $112.
b. Compute the test statistic.
c. At 95% confidence using the *p*-value approach, test the hypotheses. Let $\alpha = 0.1$.

ANS:

a. $H_0: \mu = 112$
   $H_a: \mu \neq 112$
b. $t = -1.75$
c. *p*-value is between 0.025 and 0.05; therefore, do not reject H_0

PTS: 1 TOP: Hypothesis Tests

19. Identify the null and alternative hypotheses for the following problems.

a. The manager of a restaurant believes that it takes a customer less than or equal to 25 minutes to eat lunch.
b. Economists have stated that the marginal propensity to consume is at least 90¢ out of every dollar.
c. It has been stated that 75 out of every 100 people who go to the movies on Saturday night buy popcorn.

ANS:

a. $H_0: \mu \leq 25$
   $H_a: \mu > 25$
b. $H_0: p \geq 0.9$
   $H_a: p < 0.9$
c. $H_0: p = 0.75$
   $H_a: p \neq 0.75$

PTS: 1 TOP: Hypothesis Tests

20. A student believes that the average grade on the statistics final examination was 87. A sample of 36 final examinations was taken. The average grade in the sample was 83.96 with a standard deviation of 12.

a. State the null and alternative hypotheses.
b. Using the critical value approach, test the hypotheses at the 5% level of significance.
c. Using the *p*-value approach, test the hypotheses at the 5% level of significance.

ANS:

a. H_0: $\mu = 87$
   H_a: $\mu \neq 87$
b. test statistic t = -1.52, critical t = ± 2.03; do not reject H_0
c. *p*-value is between .05 and 0.1; therefore, do not reject H_0

PTS: 1 TOP: Hypothesis Tests

21. A carpet company advertises that it will deliver your carpet within 15 days of purchase. A sample of 49 past customers is taken. The average delivery time in the sample was 16.2 days. The standard deviation of the **population** (σ) is known to be 5.6 days.

a. State the null and alternative hypotheses.
b. Using the critical value approach, test to determine if their advertisement is legitimate. Let $\alpha = .05$.
c. Using the *p*-value approach, test the hypotheses at the 5% level of significance.

ANS:

a. H_0: $\mu \leq 15$
   H_a: $\mu > 15$
b. test statistic Z = 1.5 < 1.645; therefore do not reject H_0
c. Do not reject H_0; *p*-value is (.5 - .4332) = 0.0668

PTS: 1 TOP: Hypothesis Tests

22. A sample of 30 cookies is taken to test the claim that each cookie contains at least 9 chocolate chips. The average number of chocolate chips per cookie in the sample was 7.8 with a standard deviation of 3.

a. State the null and alternative hypotheses.
b. Using the critical value approach, test the hypotheses at the 5% level of significance.
c. Using the *p*-value approach, test the hypothesis at the 5% level of significance.
d. Compute the probability of a Type II error if the true number of chocolate chips per cookie is 8.

ANS:

a. H_0: $\mu \geq 9$
   H_a: $\mu < 9$
b. test statistic t = -2.190 < -1.699; reject H_0
c. reject H_0; the *p*-value is between .01 to .025
d. A Type II error has not been committed since H_0 was rejected.

PTS: 1 TOP: Hypothesis Tests

23. A group of young businesswomen wish to open a high fashion boutique in a vacant store but only if the average income of households in the area is at least $25,000. A random sample of 9 households showed the following results.

$28,000	$24,000	$26,000	$25,000
$23,000	$27,000	$26,000	$22,000
$24,000			

Assume the population of incomes is normally distributed.

a. Compute the sample mean and the standard deviation.
b. State the hypotheses for this problem.
c. Compute the test statistic.
d. At 95% confidence using the *p*-value approach, what is your conclusion?

ANS:

a. $\bar{x} = 25{,}000 \quad s = 1{,}936.49$
b. $H_0: \mu \geq 25{,}000$
   $H_a: \mu < 25{,}000$
c. test statistic $t = 0$
d. *p*-value = 0.5; do not reject H_0, the boutique should be opened.

PTS: 1 TOP: Hypothesis Tests

24. Nancy believes that the average running time of movies is equal to 140 minutes. A sample of 4 movies was taken and the following running times were obtained. Assume the population of the running times is normally distributed.

150	150	180	170

a. Compute the sample mean and the standard deviation.
b. State the null and alternative hypotheses.
c. Using the critical value approach, test the hypotheses at the 10% level of significance.
d. Using the *p*-value approach, test the hypotheses at the 10% level of significance.

ANS:

a. $\bar{x} = 162.5 \quad s = 15$
b. $H_0: \mu = 140$
   $H_a: \mu \neq 140$
c. Reject H_0; test statistic $t = 3 > 2.353$
d. The *p*-value is between .05 to .10; Reject H_0

PTS: 1 TOP: Hypothesis Tests

25. A student believes that no more than 20% (i.e., $\leq 20\%$) of the students who finish a statistics course get an A. A random sample of 100 students was taken. Twenty-four percent of the students in the sample received A's.

a. State the null and alternative hypotheses.
b. Using the critical value approach, test the hypotheses at the 1% level of significance.

c. Using the *p*-value approach, test the hypotheses at the 1% level of significance.

ANS:

a. H_0: $P \leq 0.2$
   H_a: $P > 0.2$
b. Do not reject H_0; test statistic $Z = 1 < 2.33$
c. Do not reject H_0; *p*-value = $0.1587 > 0.01$

PTS: 1 TOP: Hypothesis Tests

26. An official of a large national union claims that the fraction of women in the union is not significantly different from one-half. Using the critical value approach and the sample information reported below, carry out a test of this statement. Let $\alpha = 0.05$.

sample size	400
women	168
men	232

ANS:
H_0: $P = 0.5$
H_a: $P \neq 0.5$ Reject H_0; test statistic $Z = -3.2 < -1.96$

PTS: 1 TOP: Hypothesis Tests

27. A law enforcement agent believes that at least 88% of the drivers stopped on Saturday nights for speeding are under the influence of alcohol. A sample of 66 drivers who were stopped for speeding on a Saturday night was taken. Eighty percent of the drivers in the sample were under the influence of alcohol.

a. State the null and alternative hypotheses.
b. Compute the test statistic.
c. Using the *p*-value approach, test the hypotheses at the .05 level of significance.

ANS:

a. H_0: $P \geq 0.88$
   H_a: $P < 0.88$
b. $Z = -2$
c. *p*-value = $0.0228 < 0.05$; reject H_0

PTS: 1 TOP: Hypothesis Tests

28. Two thousand numbers are selected randomly; 960 were even numbers.

a. State the hypotheses to determine whether the proportion of odd numbers is significantly different from 50%.
b. Compute the test statistic.
c. At 90% confidence using the *p*-value approach, test the hypotheses.

ANS:

a. H_0: $P = 0.5$

H_a: $P \neq 0.5$

b. $Z = 1.79$

c. p-value = .0734 < 0.10; reject H_0

PTS: 1 TOP: Hypothesis Tests

29. In the last presidential election, a national survey company claimed that no more than 50% (i.e., $\leq$ 50%) of all registered voters voted for the Republican candidate. In a random sample of 400 registered voters, 208 voted for the Republican candidate.

a. State the null and the alternative hypotheses.
b. Compute the test statistic.
c. At 95% confidence, compute the p-value and test the hypotheses.

ANS:

a. H_0: $P \leq 0.5$
H_a: $P > 0.5$

b. $Z = 0.8$

c. p-value = 0.2119 > 0.05; do not reject H_0.

PTS: 1 TOP: Hypothesis Tests

30. An automobile manufacturer stated that it will be willing to mass produce electric-powered cars if **more** than 30% of potential buyers indicate they will purchase the newly designed electric cars. In a sample of 500 potential buyers, 160 indicated that they would buy such a product.

a. State the hypotheses for this problem
b. Compute the standard error of $\bar{p}$.
c. Compute the test statistic.
d. At 95% confidence, what is your conclusion? Should the manufacturer produce the new electric powered car?

ANS:

a. H_0: $P \leq 0.3$
H_a: $P > 0.3$

b. 0.0205

c. $Z = 0.98$

d. p-value = 0.1635 <0.05; do not reject H_0; no, the manufacturer should not produce the cars.

PTS: 1 TOP: Hypothesis Tests

31. It is said that **more** males register to vote in a national election than females. A research organization selected a random sample of 300 registered voters and reported that 165 of the registered voters were male.

a. Formulate the hypotheses for this problem.
b. Compute the standard error of $\bar{p}$.
c. Compute the test statistic.
d. Using the p-value approach, can you conclude that more males registered to vote than females? Let $\alpha = .05$.

ANS:

a. H_0: $P \leq 0.5$
   H_a: $P > 0.5$
b. 0.0289
c. $Z = 1.73$
d. p-value = 0.0418 < .05; reject H_0; yes, more males than females registered to vote.

PTS: 1 TOP: Hypothesis Tests

32. Consider the following hypothesis test:

H_0: $\mu = 10$
H_a: $\mu \neq 10$

A sample of 81 provides a sample mean of 9.5 and a sample standard deviation of 1.8.

a. Determine the standard error of the mean.
b. Compute the value of the test statistic.
c. Determine the p-value; and at 95% confidence, test the above hypotheses.

ANS:

a. 0.2
b. $t = -2.5$
c. p-value is between .01 and .02 (two tail test); reject H_0

PTS: 1 TOP: Hypothesis Tests

33. Consider the following hypothesis test:

H_0: $\mu \geq 14$
H_a: $\mu < 14$

A sample of 64 provides a sample mean of 13 and a sample standard deviation of 4.

a. Determine the standard error of the mean.
b. Compute the value of the test statistic.
c. Determine the p-value; and at 95% confidence, test the above hypotheses.

ANS:

a. 0.5
b. $t = -2$
c. p-value is between .01 and .025; reject H_0

PTS: 1 TOP: Hypothesis Tests

34. Consider the following hypothesis test:

H_0: $\mu \geq 40$

H_a: $\mu < 40$

A sample of 49 provides a sample mean of 38 and a sample standard deviation of 7.

a. Determine the standard error of the mean.
b. Compute the value of the test statistic.
c. Determine the *p*-value; and at 95% confidence, test the above hypotheses.

ANS:

a. 1
b. t = -2
c. *p*-value is between .025 and .05; reject H_0

PTS: 1 TOP: Hypothesis Tests

35. Consider the following hypothesis test:

H_o: $\mu \leq 38$
H_a: $\mu > 38$

You are given the following information obtained from a random sample of six observations. Assume the population has a normal distribution.

X
38
40
42
32
46
42

a. Compute the mean of the sample
b. Determine the standard deviation of the sample.
c. Determine the standard error of the mean.
d. Compute the value of the test statistic.
e. At 95% confidence using the *p*-value approach, test the above hypotheses.

ANS:

a. 40
b. 4.73
c. 1.93
d. 1.036
e. *p*-value is between 0.1 and 0.2; do not reject H_0.

PTS: 1 TOP: Hypothesis Tests

36. Consider the following hypothesis test:

H_o: $P \leq 0.8$
H_a: $P > 0.8$

A sample of 400 provided a sample proportion of 0.853.

a. Determine the standard error of the proportion.
b. Compute the value of the test statistic.
c. Determine the *p*-value; and at 95% confidence, test the above hypotheses.

ANS:

a. 0.02
b. Z = 2.65
c. *p*-value = 0.004; reject H_0

PTS: 1 TOP: Hypothesis Tests

37. You are given the following information obtained from a random sample of 5 observations. Assume the population has a normal distribution.

20 18 17 22 18

You want to determine whether or not the mean of the population from which this sample was taken is significantly less than 21.

a. State the null and the alternative hypotheses.
b. Compute the standard error of the mean.
c. Determine the test statistic.
d. Determine the *p*-value and at 90% confidence, test whether or not the mean of the population is significantly less than 21.

ANS:

a. H_0: $\mu \geq 21$
   H_a: $\mu < 21$
b. 0.8944
c. t = -2.236
d. *p*-value is between .025 and .05; reject H_0, the mean is significantly less than 21.

PTS: 1 TOP: Hypothesis Tests

38. Consider the following hypothesis test:

H_0: $p = 0.5$
H_a: $p \neq 0.5$

A sample of 800 provided a sample proportion of 0.58.

a. Determine the standard error of the proportion.
b. Compute the value of the test statistic.
c. Determine the *p*-value, and at 95% confidence, test the hypotheses.

ANS:

a. 0.01768
b. Z = 4.53

c. *p*-value is almost zero; reject H_0

PTS: 1 TOP: Hypothesis Tests

39. You are given the following information obtained from a random sample of 4 observations.

25 47 32 56

You want to determine whether or not the mean of the population from which this sample was taken is significantly different from 48. (Assume the population is normally distributed.)

a. State the null and the alternative hypotheses.
b. Determine the test statistic.
c. Determine the *p*-value; and at 95% confidence test to determine whether or not the mean of the population is significantly different from 48.

ANS:

a. H_0: $\mu = 48$
   H_a: $\mu \neq 48$
b. $t = -1.137$
c. *p*-value is between 0.2 and 0.4 (two tailed); do not reject H_0

PTS: 1 TOP: Hypothesis Tests

40. Confirmed cases of West Nile virus in birds for a sample of six counties in the state of Georgia are shown below.

County	**Cases**
Catoosa	6
Chattooga	3
Dade	3
Gordon	5
Murray	3
Walker	4

We are interested in testing the following hypotheses regarding these data:
H_0: $\mu \leq 3$
H_a: $\mu > 3$

a. Compute the mean and the standard deviation of the sample.
b. Compute the standard error of the mean.
c. Determine the test statistic.
d. Determine the *p*-value and at 95% confidence, test the hypotheses.

ANS:

a. 4 and 1.265 (rounded)
b. 0.5164
c. $t = 1.94$ (rounded)
d. *p*-value is between 0.05 and 0.1; reject H_0 and conclude that the mean of the population is significantly more than 3.

PTS: 1 TOP: Hypothesis Tests

41. A sample of 64 account balances from a credit company showed an average daily balance of $1,040. The standard deviation of the ***population*** is known to be $200. We are interested in determining if the mean of all account balances (i.e., population mean) is significantly different from $1,000.

    a. Develop the appropriate hypotheses for this problem.
    b. Compute the test statistic.
    c. Compute the *p*-value.
    d. Using the *p*-value approach at 95% confidence, test the above hypotheses.
    e. Using the critical value approach at 95% confidence, test the hypotheses.

    ANS:
    a. H_o: $\mu = 1000$
       H_a: $\mu \neq 1000$
    b. 1.60
    c. 0.1096
    d. The *p*-value = 0.1096, which is larger than $\alpha = 0.05$ (95% confidence). Hence, the null hypothesis is not rejected; and we conclude that there is not sufficient evidence to indicate that the advertising campaigns have been effective.
    e. In Part b, the *Z* statistic was computed and its value was 1.60. Since 1.60 is between -1.96 and 1.96, the null hypothesis cannot be rejected; and we conclude that there is no evidence that the mean is significantly different from $1,000.

    PTS: 1 TOP: Hypothesis Tests

42. Consider the following hypotheses test.

    H_o: $\mu \geq 80$
    H_a: $\mu < 80$

    A sample of 121 provided a sample mean of 77.3. The ***population standard deviation*** is known to be 16.5.

    a. Compute the value of the test statistic.
    b. Determine the *p*-value; and at 93.7% confidence, test the above hypotheses.
    c. Using the critical value approach at 93.7% confidence, test the hypotheses.

    ANS:
    a. $Z = -1.8$
    b. *p*-value = 0.0359 < 0.063, reject H_o
    c. test statistic $Z = -1.8 < Z_{.063} = -1.53$, reject H_o

    PTS: 1 TOP: Hypothesis Tests

43. Automobiles manufactured by the Efficiency Company have been averaging 42 miles per gallon of gasoline in highway driving. It is believed that its new automobiles average **more** than 42 miles per gallon. An independent testing service road-tested 36 of the automobiles. The sample showed an average of 42.8 miles per gallon with a standard deviation of 1.2 miles per gallon.

    a. With a 0.05 level of significance using the critical value approach, test to determine whether or not the new automobiles actually do average ***more*** than 42 miles per gallon.

b. What is the *p*-value associated with the sample results? What is your conclusion based on the *p*-value?

ANS:

a. H_o: $\mu \leq 42$
   H_a: $\mu > 42$
   Since $t = 4.0 > 1.690$, reject H_o and conclude that the new cars average more than 42 miles per gallon.
b. *p*-value < 0.005, therefore reject H_o (area to the right of $t = 4.0$ is almost zero)

PTS: 1 TOP: Hypothesis Tests

44. The average starting salary of students who graduated from colleges of Business in 2009 was $48,400. A sample of 100 graduates of **2010** showed an average starting salary of $50,000. Assume the standard deviation of the population is known to be $8,000. We want to determine whether or not there has been a significant ***increase*** in the starting salaries.

a. State the null and alternative hypotheses to be tested.
b. Compute the test statistic.
c. The null hypothesis is to be tested at 95% confidence. Determine the critical value for this test.
d. What do you conclude?
e. Compute the p-value.

ANS:

a. H_o: $\mu \leq 48{,}400$
   H_a : $\mu > 48{,}400$
b. Test Statistic Z = 2.0
c. Critical Z = 1.64
d. Reject H_o and conclude that there has been a significant increase.
e. P-value = .0228

PTS: 1 TOP: Hypothesis Testing

45. The average price of homes sold in the U.S. in the ***past year*** was $220,000. A random sample of 81 homes sold ***this year*** showed an average price of $210,000. It is known that the standard deviation of the population is $36,000. At 95% confidence test to determine if there has been a significant decrease in the average price homes.

a. State the null and alternative hypotheses to be tested.
b. Compute the test statistic.
c. Determine the critical value for this test.
d. What do you conclude?
e. Compute the p-value.

ANS:

a. H_o: $\mu \geq 220{,}000$
   H_a : $\mu < 220{,}000$
b. Test statistic Z = -2.5
c. Critical Z = -1.64
d. Reject H_o and conclude that there has been a significant decrease.
e. P-value = 0.0062

PTS: 1 TOP: Hypothesis Testing