Chapter 9 and 10 Practice

Provide an appropriate response.

1) The statement represents a claim. Write its complement and state which is $H_0$ and which is $H_A$. $\mu = 8.3$

2) The statement represents a claim. Write its complement and state which is $H_0$ and which is $H_A$. $p \leq 0.93$

3) The statement represents a claim. Write its complement and state which is $H_0$ and which is $H_A$. $\sigma < 8.2$

4) The mean age of bus drivers in Chicago is 48.6 years. Write the null and alternative hypotheses.

5) The mean IQ of statistics teachers is greater than 160. Write the null and alternative hypotheses.

6) The mean score for all NBA games during a particular season was less than 92 points per game. Write the null and alternative hypotheses.

7) A candidate for governor of a particular state claims to be favored by at least half of the voters. Write the null and alternative hypotheses.

8) The buyer of a local hiking club store recommends against buying the new digital altimeters because they vary more than the old altimeters, which had a standard deviation of one yard. Write the null and alternative hypotheses.

9) The dean of a major university claims that the mean time for students to earn a Master’s degree is at most 4.2 years. State this claim mathematically. Write the null and alternative hypotheses. Identify which hypothesis is the claim.

10) Given $H_0$: $p \geq 80\%$ and $H_A$: $p < 80\%$, determine whether the hypothesis test is left-tailed, right-tailed, or two-tailed.

11) Given $H_0$: $\mu \leq 25$ and $H_A$: $\mu > 25$, determine whether the hypothesis test is left-tailed, right-tailed, or two-tailed.

12) A researcher claims that 71% of voters favor gun control. Determine whether the hypothesis test for this claim is left-tailed, right-tailed, or two-tailed.

13) A brewery claims that the mean amount of beer in their bottles is at least 12 ounces. Determine whether the hypothesis test for this claim is left-tailed, right-tailed, or two-tailed.

14) A car maker claims that its new sub-compact car gets better than 49 miles per gallon on the highway. Determine whether the hypothesis test for this is left-tailed, right-tailed, or two-tailed.
15) The owner of a professional basketball team claims that the mean attendance at games is over 22,000 and therefore the team needs a new arena. Determine whether the hypothesis test for this claim is left-tailed, right-tailed, or two-tailed.

16) An elementary school claims that the standard deviation in reading scores of its fourth grade students is less than 3.75. Determine whether the hypothesis test for this claim is left-tailed, right-tailed, or two-tailed.

17) Given $H_0: \mu \leq 12$, for which confidence interval should you reject $H_0$?
   A) (13, 16)   B) (10, 13)   C) (11.5, 12.5)

18) Given $H_0: p \geq 0.45$, for which confidence interval should you reject $H_0$?
   A) (0.40, 0.50)   B) (0.42, 0.47)   C) (0.32, 0.40)

19) The P-value for a hypothesis test is $P = 0.034$. Do you reject or fail to reject $H_0$ when the level of significance is $\alpha = 0.01$?

20) The P-value for a hypothesis test is $P = 0.066$. Do you reject or fail to reject $H_0$ when the level of significance is $\alpha = 0.05$?

21) Find the P-value for the hypothesis test with the standardized test statistic $z$. Decide whether to reject $H_0$ for the level of significance $\alpha$.

   Right-tailed test
   $z = 1.43$
   $\alpha = 0.05$

22) The P-value for a hypothesis test is $P = 0.006$. Do you reject or fail to reject $H_0$ when the level of significance is $\alpha = 0.01$?

23) Find the P-value for the hypothesis test with the standardized test statistic $z$. Decide whether to reject $H_0$ for the level of significance $\alpha$.

   Left-tailed test
   $z = -2.05$
   $\alpha = 0.05$

   The test statistic in a left-tailed test is $z = -2.05$.

24) Find the critical value and rejection region for the type of $z$-test with level of significance $\alpha$.

   Right-tailed test, $\alpha = 0.01$

25) Find the critical value and rejection region for the type of $z$-test with level of significance $\alpha$.

   Two-tailed test, $\alpha = 0.01$
26) Find the critical value and rejection region for the type of $z$-test with level of significance $\alpha$.

Left-tailed test, $\alpha = 0.05$

27) Find the critical value and rejection region for the type of $z$-test with level of significance $\alpha$.

Left-tailed test, $\alpha = 0.025$

28) Test the claim about the population mean $\mu$ at the level of significance $\alpha$. Assume the population is normally distributed.

Claim: $\mu > 28; \alpha = 0.05; \sigma = 1.2$
Sample statistics: $\bar{x} = 33.3$, $n = 50$

29) Test the claim about the population mean $\mu$ at the level of significance $\alpha$. Assume the population is normally distributed.

Claim: $\mu \neq 35; \alpha = 0.05; \sigma = 2.7$
Sample statistics: $\bar{x} = 34.1$, $n = 35$

30) Test the claim about the population mean $\mu$ at the level of significance $\alpha$. Assume the population is normally distributed.

Claim: $\mu \leq 47; \alpha = 0.01; \sigma = 4.3$
Sample statistics: $\bar{x} = 48.8$, $n = 40$

31) Test the claim about the population mean $\mu$ at the level of significance $\alpha$. Assume the population is normally distributed.

Claim: $\mu = 1400; \alpha = 0.01; \sigma = 82$
Sample statistics: $\bar{x} = 1370$, $n = 35$

32) A fast food outlet claims that the mean waiting time in line is less than 3.8 minutes. A random sample of 60 customers has a mean of 3.7 minutes with a population standard deviation of 0.6 minute. If $\alpha = 0.05$, test the fast food outlet's claim.

33) You wish to test the claim that $\mu > 33$ at a level of significance of $\alpha = 0.05$ and are given sample statistics $n = 50$, $\bar{x} = 33.3$. Assume the population standard deviation is 1.2. Compute the value of the standardized test statistic. Round your answer to two decimal places.

34) You wish to test the claim that $\mu \neq 14$ at a level of significance of $\alpha = 0.05$ and are given sample statistics $n = 35$, $\bar{x} = 13.1$. Assume the population standard deviation is 2.7. Compute the value of the standardized test statistic. Round your answer to two decimal places.

35) You wish to test the claim that $\mu = 1430$ at a level of significance of $\alpha = 0.01$ and are given sample statistics $n = 35$, $\bar{x} = 1400$. Assume the population standard deviation is 82. Compute the value of the standardized test statistic. Round your answer to two decimal places.
36) Suppose you want to test the claim that $\mu = 3.5$. Given a sample size of $n = 40$ and a level of significance of $\alpha = 0.05$, when should you reject $H_0$?

37) Test the claim that $\mu > 18$, given that $\sigma = 1.2$, $\alpha = 0.05$ and the sample statistics are $n = 50$ and $\bar{x} = 18.3$.

38) Test the claim that $\mu \neq 13$, given that $\sigma = 2.7$, $\alpha = 0.05$ and the sample statistics are $n = 35$ and $\bar{x} = 12.1$.

39) Test the claim that $\mu \leq 40$, given that $\sigma = 4.3$, $\alpha = 0.01$ and the sample statistics are $n = 40$ and $\bar{x} = 41.8$.

40) Test the claim that $\mu = 740$, given that $\sigma = 82$, $\alpha = 0.01$ and the sample statistics are $n = 35$ and $\bar{x} = 710$.

41) A local brewery distributes beer in bottles labeled 32 ounces. A government agency thinks that the brewery is cheating its customers. The agency selects 50 of these bottles, measures their contents, and obtains a sample mean of 31.7 ounces with a population standard deviation of 0.70 ounce. Use a 0.01 significance level to test the agency’s claim that the brewery is cheating its customers.

42) A manufacturer claims that the mean lifetime of its fluorescent bulbs is 1500 hours. A homeowner selects 40 bulbs and finds the mean lifetime to be 1480 hours with a population standard deviation of 80 hours. Test the manufacturer’s claim. Use $\alpha = 0.05$.

43) A trucking firm suspects that the mean lifetime of a certain tire it uses is less than 36,000 miles. To check the claim, the firm randomly selects and tests 54 of these tires and gets a mean lifetime of 35,630 miles with a population standard deviation of 1200 miles. At $\alpha = 0.05$, test the trucking firm’s claim.

44) A local group claims that the police issue at least 60 speeding tickets a day in their area. To prove their point, they randomly select one month. Their research yields the number of tickets issued for each day. The data are listed below. Assume the population standard deviation is 12.2 tickets. At $\alpha = 0.01$, test the group’s claim.

<table>
<thead>
<tr>
<th>70</th>
<th>48</th>
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</table>

45) Find the critical value and rejection region for the type of t-test with level of significance $\alpha$ and sample size $n$.

   Left-tailed test, $\alpha = 0.1$, $n = 22$

46) Find the critical value and rejection region for the type of t-test with level of significance $\alpha$ and sample size $n$.

   Right-tailed test, $\alpha = 0.1$, $n = 35$

47) Find the critical value and rejection region for the type of t-test with level of significance $\alpha$ and sample size $n$.

   Two-tailed test, $\alpha = 0.05$, $n = 38$

48) Find the standardized test statistic $t$ for a sample with $n = 12$, $\bar{x} = 31.2$, $s = 2.2$, and $\alpha = 0.01$ if $H_0: \mu = 30$. Round your answer to three decimal places.
49) Find the standardized test statistic \( t \) for a sample with \( n = 15 \), \( \bar{x} = 7.2 \), \( s = 0.8 \), and \( \alpha = 0.05 \) if \( H_0: \mu \leq 6.9 \). Round your answer to three decimal places.

50) Find the standardized test statistic \( t \) for a sample with \( n = 25 \), \( \bar{x} = 28 \), \( s = 3 \), and \( \alpha = 0.005 \) if \( H_a: \mu > 27 \). Round your answer to three decimal places.

51) Test the claim about the population mean \( \mu \) at the level of significance \( \alpha \). Assume the population is normally distributed.

Claim \( \mu = 24; \alpha = 0.01 \). Sample statistics: \( \bar{x} = 25.2, s = 2.2, n = 12 \)

52) Test the claim about the population mean \( \mu \) at the level of significance \( \alpha \). Assume the population is normally distributed.

Claim \( \mu \leq 6.4; \alpha = 0.05 \). Sample statistics: \( \bar{x} = 6.7, s = 0.8, n = 15 \)

53) Test the claim about the population mean \( \mu \) at the level of significance \( \alpha \). Assume the population is normally distributed.

Claim \( \mu > 33; \alpha = 0.005 \). Sample statistics: \( \bar{x} = 34, s = 3, n = 25 \)

54) The Metropolitan Bus Company claims that the mean waiting time for a bus during rush hour is less than 5 minutes. A random sample of 20 waiting times has a mean of 3.7 minutes with a standard deviation of 2.1 minutes. At \( \alpha = 0.01 \), test the bus company’s claim. Assume the distribution is normally distributed.

55) A local group claims that the police issue more than 60 speeding tickets a day in their area. To prove their point, they randomly select two weeks. Their research yields the number of tickets issued for each day. The data are listed below. At \( \alpha = 0.01 \), test the group’s claim.

\[
\begin{array}{cccccccccc}
70 & 48 & 41 & 68 & 69 & 55 & 70 \\
57 & 60 & 83 & 32 & 60 & 72 & 58 \\
\end{array}
\]

56) A manufacturer claims that the mean lifetime of its fluorescent bulbs is 1400 hours. A homeowner selects 25 bulbs and finds the mean lifetime to be 1390 hours with a standard deviation of 80 hours. Test the manufacturer’s claim. Use \( \alpha = 0.05 \).

57) Determine whether the normal sampling distribution can be used. The claim is \( p > 0.015 \) and the sample size is \( n = 150 \).

58) Determine whether the normal sampling distribution can be used. The claim is \( p \geq 0.675 \) and the sample size is \( n = 42 \).

59) Determine the standardized test statistic, \( z \), to test the claim about the population proportion \( p \geq 0.132 \) given \( n = 48 \) and \( \hat{p} = 0.11 \). Use \( \alpha = 0.05 \).
60) Fifty-five percent of registered voters in a congressional district are registered Democrats. The Republican candidate takes a poll to assess his chances in a two-candidate race. He polls 1200 potential voters and finds that 621 plan to vote for the Republican candidate. Does the Republican candidate have a chance to win? Use \( \alpha = 0.05 \).

61) A recent study claimed that at least 15% of junior high students are overweight. In a sample of 160 students, 18 were found to be overweight. At \( \alpha = 0.05 \), test the claim.

62) A recent study claimed that at least 15% of junior high students are overweight. In a sample of 160 students, 18 were found to be overweight. If \( \alpha = 0.05 \), test the claim using confidence intervals.

63) A coin is tossed 1000 times and 570 heads appear. At \( \alpha = 0.05 \), test the claim that this is not a biased coin. Does this suggest the coin is fair?

64) A telephone company claims that 20% of its customers have at least two telephone lines. The company selects a random sample of 500 customers and finds that 88 have two or more telephone lines. If \( \alpha = 0.05 \), test the company’s claim using critical values and rejection regions.

65) A coin is tossed 1000 times and 530 heads appear. At \( \alpha = 0.05 \), test the claim that this is not a biased coin. Use a P-value. Does this suggest the coin is fair?

66) Find the critical value and rejection region for the type of chi-square test with sample size \( n \) and level of significance \( \alpha \).

   Two-tailed test,
   \( n = 12, \alpha = 0.05 \)

67) Find the critical value and rejection region for the type of chi-square test with sample size \( n \) and level of significance \( \alpha \).

   Right-tailed test,
   \( n = 20, \alpha = 0.01 \)

68) Find the critical value and rejection region for the type of chi-square test with sample size \( n \) and level of significance \( \alpha \).

   Left-tailed test,
   \( n = 28, \alpha = 0.10 \)

69) Compute the standardized test statistic, \( X^2 \), to test the claim \( \sigma^2 = 25.8 \) if \( n = 12, s^2 = 21.6 \), and \( \alpha = 0.05 \).

70) Compute the standardized test statistic, \( X^2 \), to test the claim \( \sigma^2 \leq 16 \) if \( n = 20, s^2 = 31 \), and \( \alpha = 0.01 \).

71) Test the claim that \( \sigma^2 = 34.4 \) if \( n = 12, s^2 = 28.8 \) and \( \alpha = 0.05 \). Assume that the population is normally distributed.

72) Test the claim that \( \sigma^2 > 9.5 \) if \( n = 18, s^2 = 13.5 \), and \( \alpha = 0.01 \). Assume that the population is normally distributed.
73) Test the claim that $\sigma \geq 6.7$ if $n = 15$, $s = 6.1$, and $\alpha = 0.05$. Assume that the population is normally distributed.

74) Listed below is the number of tickets issued by a local police department. Assuming that the data is normally distributed, test the claim that the standard deviation for the data is 15 tickets. Use $\alpha = 0.01$.

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<thead>
<tr>
<th>70</th>
<th>48</th>
<th>41</th>
<th>68</th>
<th>69</th>
<th>55</th>
<th>70</th>
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<td>83</td>
<td>32</td>
<td>60</td>
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75) The heights (in inches) of 20 randomly selected adult males are listed below. Test the claim that the variance is less than 6.25. Use $\alpha = 0.05$. Assume the population is normally distributed.

<table>
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<th>70</th>
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<td>72</td>
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</table>

76) A trucking firm suspects that the variance for a certain tire is greater than 1,000,000. To check the claim, the firm puts 101 of these tires on its trucks and gets a standard deviation of 1200 miles. At $\alpha = 0.05$, test the trucking firm's claim.

77) A local bank needs information concerning the standard deviation of the checking account balances of its customers. From previous information it was assumed to be $250$. A random sample of 61 accounts was checked. The standard deviation was $286.20$. At $\alpha = 0.01$, test the bank's assumption. Assume that the account balances are normally distributed.

78) Classify the two given samples as independent or dependent.

Sample 1: Pre-training weights of 18 people
Sample 2: Post-training weights of 18 people

79) Classify the two given samples as independent or dependent.

Sample 1: The scores of 22 students who took the ACT
Sample 2: The scores of 22 different students who took the SAT

80) As part of a marketing experiment, a department store regularly mailed discount coupons to 25 of its credit card holders. Their total credit card purchases over the next three months were compared to the credit card purchases over the next three months for 25 credit card holders who were not sent discount coupons. Determine whether the samples are dependent or independent.

81) Find the standardized test statistic to test the claim that $\mu_1 = \mu_2$. Assume the two samples are random and independent.

Population statistics: $\sigma_1 = 1.5$ and $\sigma_2 = 1.9$
Sample statistics: $\bar{x}_1 = 24$, $n_1 = 50$ and $\bar{x}_2 = 22$, $n_2 = 60$
82) Find the standardized test statistic to test the claim that \( \mu_1 > \mu_2 \). Assume the two samples are random and independent.

Population statistics: \( \sigma_1 = 45 \) and \( \sigma_2 = 25 \)
Sample statistics: \( \bar{x}_1 = 480, n_1 = 100 \) and \( \bar{x}_2 = 465, n_2 = 125 \)

83) Suppose you want to test the claim that \( \mu_1 \neq \mu_2 \). Assume the two samples are random and independent. At a level of significance of \( \alpha = 0.05 \), when should you reject \( H_0 \)?

Population statistics: \( \sigma_1 = 1.5 \) and \( \sigma_2 = 1.9 \)
Sample statistics: \( \bar{x}_1 = 19, n_1 = 50 \) and \( \bar{x}_2 = 17, n_2 = 60 \)

84) Test the claim that \( \mu_1 = \mu_2 \). Assume the two samples are random and independent. Use \( \alpha = 0.05 \).

Population statistics: \( \sigma_1 = 1.5 \) and \( \sigma_2 = 1.9 \)
Sample statistics: \( \bar{x}_1 = 17, n_1 = 50 \) and \( \bar{x}_2 = 15, n_2 = 60 \)

85) Suppose you want to test the claim that \( \mu_1 > \mu_2 \). Assume the two samples are random and independent. At a level of significance of \( \alpha = 0.01 \), when should you reject \( H_0 \)?

Population statistics: \( \sigma_1 = 45 \) and \( \sigma_2 = 25 \)
Sample statistics: \( \bar{x}_1 = 805, n_1 = 100 \) and \( \bar{x}_2 = 790, n_2 = 125 \)

86) A study was conducted to determine if the salaries of elementary school teachers from two neighboring states were equal. A sample of 100 teachers from each state was randomly selected. The mean from the first state was $29,100 with a population standard deviation of $2300. The mean from the second state was $30,500 with a population standard deviation of $2100. Test the claim that the salaries from both states are equal. Use \( \alpha = 0.05 \).

87) A medical researcher suspects that the pulse rate of smokers is higher than the pulse rate of non-smokers. Test the researcher's suspicion using \( \alpha = 0.05 \). Assume the two samples are random and independent.

<table>
<thead>
<tr>
<th>Smokers</th>
<th>Nonsmokers</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n_1 = 100 )</td>
<td>( n_2 = 100 )</td>
</tr>
<tr>
<td>( \bar{x}_1 = 87 )</td>
<td>( \bar{x}_2 = 84 )</td>
</tr>
<tr>
<td>( \sigma_1 = 4.8 )</td>
<td>( \sigma_2 = 5.3 )</td>
</tr>
</tbody>
</table>
88) A statistics teacher wanted to see whether there was a significant difference in ages between day students and night students. A sample of 35 students is selected from each group. The data are given below. Assume the two samples are random and independent. Test the claim that there is no difference in age between the two groups. Use $\alpha = 0.05$.

Day Students

22 24 24 23 19 19 23 22 18 21 21 18
18 25 29 24 23 22 22 21 20 20 20 27
17 19 18 21 20 23 26 30 25 21 25

Evening Students

18 23 25 23 21 21 23 24 27 31 24 20
20 23 19 25 24 27 23 20 20 21 25 24
23 28 20 19 23 24 20 27 21 29 30

89) A recent study of 100 elementary school teachers in a southern state found that their mean salary was $24,700 with a population standard deviation of $2100. A similar study of 100 elementary school teachers in a western state found that their mean salary was $35,100 with a population standard deviation of $3200. Test the claim that the salaries of elementary school teachers in the western state is more than $10,000 greater than that of elementary teachers in the southern state. Use $\alpha = 0.05$. Assume the two samples are random and independent.

90) Find the critical values, $t_0$, to test the claim that $\mu_1 = \mu_2$. Two samples are random, independent, and come from populations that are normal. The sample statistics are given below. Assume that $\sigma_1^2 = \sigma_2^2$. Use $\alpha = 0.05$.

$n_1 = 25$  $n_2 = 30$
$x_1 = 17$  $x_2 = 15$
$s_1 = 1.5$  $s_2 = 1.9$

91) Find the critical value, $t_0$, to test the claim that $\mu_1 > \mu_2$. Two samples are random, independent, and come from populations that are normal. The sample statistics are given below. Assume that $\sigma_1^2 = \sigma_2^2$. Use $\alpha = 0.01$.

$n_1 = 18$  $n_2 = 13$
$x_1 = 600$  $x_2 = 585$
$s_1 = 40$  $s_2 = 25$

92) Find the critical value, $t_0$, to test the claim that $\mu_1 \neq \mu_2$. Two samples are random, independent, and come from populations that are normal. The sample statistics are given below. Assume that $\sigma_1^2 \neq \sigma_2^2$. Use $\alpha = 0.02$.

$n_1 = 11$  $n_2 = 18$
$x_1 = 3.9$  $x_2 = 4.3$
$s_1 = 0.76$  $s_2 = 0.51$
93) Find the standardized test statistic, $t$, to test the claim that $\mu_1 = \mu_2$. Two samples are random, independent, and come from populations that are normally distributed. The sample statistics are given below. Assume that $\sigma_1^2 \neq \sigma_2^2$.

$n_1 = 25 \quad n_2 = 30$
$x_1 = 33 \quad x_2 = 31$
$s_1 = 1.5 \quad s_2 = 1.9$

94) Find the standardized test statistic, $t$, to test the claim that $\mu_1 > \mu_2$. Two samples are random, independent, and come from populations that are normally distributed. The sample statistics are given below. Assume that $\sigma_1^2 \neq \sigma_2^2$.

$n_1 = 18 \quad n_2 = 13$
$x_1 = 515 \quad x_2 = 500$
$s_1 = 40 \quad s_2 = 25$

95) Suppose you want to test the claim that $\mu_1 = \mu_2$. Two samples are random, independent, and come from populations that are normally distributed. The sample statistics are given below. Assume that $\sigma_1^2 \neq \sigma_2^2$. At a level of significance of $\alpha = 0.01$, when should you reject $H_0$?

$n_1 = 25 \quad n_2 = 30$
$x_1 = 23 \quad x_2 = 21$
$s_1 = 1.5 \quad s_2 = 1.9$

96) Suppose you want to test the claim that $\mu_1 > \mu_2$. Two samples are random, independent, and come from populations that are normally distributed. The sample statistics are given below. Assume that $\sigma_1^2 \neq \sigma_2^2$. At a level of significance of $\alpha = 0.01$, when should you reject $H_0$?

$n_1 = 18 \quad n_2 = 13$
$x_1 = 595 \quad x_2 = 580$
$s_1 = 40 \quad s_2 = 25$
97) A local bank claims that the waiting time for its customers to be served is the lowest in the area. A competitor's bank checks the waiting times at both banks. Assume the samples are random and independent, and the populations are normally distributed. Test the local bank’s claim: (a) assuming that \( \sigma_1^2 = \sigma_2^2 \), and (b) assuming that \( \sigma_1^2 \neq \sigma_2^2 \). Use \( \alpha = 0.05 \).

Local Bank Competitor Bank
\[ n_1 = 15 \quad n_2 = 16 \]
\[ \bar{x}_1 = 5.3 \text{ minutes} \quad \bar{x}_2 = 5.6 \text{ minutes} \]
\[ s_1 = 1.1 \text{ minutes} \quad s_2 = 1.0 \text{ minutes} \]

98) A sports analyst claims that the mean batting average for teams in the American League is not equal to the mean batting average for teams in the National League because a pitcher does not bat in the American League. The data listed below are random, independent, and come from populations that are normally distributed. At \( \alpha = 0.05 \), test the sports analyst’s claim. Assume the population variances are equal.

<table>
<thead>
<tr>
<th>American League</th>
<th>National League</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.279 0.274 0.271 0.268</td>
<td>0.284 0.267 0.266 0.263</td>
</tr>
<tr>
<td>0.265 0.254 0.240</td>
<td>0.261 0.259 0.256</td>
</tr>
</tbody>
</table>

99) Find \( \bar{d} \). Assume the samples are random and dependent, and the populations are normally distributed.

<table>
<thead>
<tr>
<th>A</th>
<th>13 11 30 26 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>11 7 8 18 5</td>
</tr>
</tbody>
</table>

100) Find \( s_d \). Assume the samples are random and dependent, and the populations are normally distributed.

<table>
<thead>
<tr>
<th>A</th>
<th>27 25 44 40 28</th>
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</thead>
<tbody>
<tr>
<td>B</td>
<td>25 21 22 32 19</td>
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</tbody>
</table>

101) Test the claim that the paired sample data is from a population with a mean difference of 0. Assume the samples are random and dependent, and the populations are normally distributed. Use \( \alpha = 0.01 \).

<table>
<thead>
<tr>
<th>A</th>
<th>5.6 6.6 8.5 5.5 5.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>8.0 6.9 6.8 6.7 8.1</td>
</tr>
</tbody>
</table>

102) Test the claim that \( \mu_d = 0 \) using the sample statistics below. Assume the samples are random and dependent, and the populations are normally distributed. Use \( \alpha = 0.05 \).

Sample statistics: \( n = 12, \bar{d} = 6.0, s_d = 1.3 \)

103) Test the claim that \( \mu_d < 0 \) using the sample statistics below. Assume the samples are random and dependent, and the populations are normally distributed. Use \( \alpha = 0.10 \).

Sample statistics: \( n = 18, \bar{d} = -1.5, s_d = 0.2 \)
104) Nine students took the SAT. Their scores are listed below. Later on, they took a test preparation course and retook the SAT. Their new scores are listed below. Test the claim that the test preparation had no effect on their scores. Assume the samples are random and dependent, and the populations are normally distributed. Use \( \alpha = 0.05 \).

<table>
<thead>
<tr>
<th>Student</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores before course</td>
<td>720</td>
<td>860</td>
<td>850</td>
<td>880</td>
<td>860</td>
<td>710</td>
<td>850</td>
<td>1200</td>
<td>950</td>
</tr>
<tr>
<td>Scores after course</td>
<td>740</td>
<td>860</td>
<td>840</td>
<td>920</td>
<td>890</td>
<td>720</td>
<td>840</td>
<td>1240</td>
<td>970</td>
</tr>
</tbody>
</table>

105) In a study of effectiveness of physical exercise on weight loss, 20 people were randomly selected to participate in a program for 30 days. Test the claim that exercise had no bearing on weight loss. Assume the samples are random and dependent, and the populations are normally distributed. Use \( \alpha = 0.02 \).

| Weight before Program (in pounds) | 178 | 210 | 156 | 188 | 193 | 225 | 190 | 165 | 168 | 200 |
| Weight after program (in pounds) | 182 | 205 | 156 | 190 | 183 | 220 | 195 | 155 | 165 | 200 |

| Weight before Program (in pounds) | 186 | 172 | 166 | 184 | 225 | 145 | 208 | 214 | 148 | 174 |
| Weight after program (in pounds) | 180 | 173 | 165 | 186 | 240 | 138 | 203 | 203 | 142 | 174 |

106) A physician claims that a person’s diastolic blood pressure can be lowered if, instead of taking a drug, the person listens to a relaxation tape each evening. Ten subjects are randomly selected and pretested. Their blood pressures, measured in millimeters of mercury, are listed below. The 10 patients are given the tapes and told to listen to them each evening for one month. At the end of the month, their blood pressures are taken again. The data are listed below. Test the physician’s claim. Assume the samples are random and dependent, and the populations are normally distributed. Use \( \alpha = 0.01 \).

<table>
<thead>
<tr>
<th>Patient</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>85</td>
<td>96</td>
<td>92</td>
<td>83</td>
<td>80</td>
<td>91</td>
<td>79</td>
<td>98</td>
<td>93</td>
<td>96</td>
</tr>
<tr>
<td>After</td>
<td>82</td>
<td>90</td>
<td>92</td>
<td>75</td>
<td>74</td>
<td>80</td>
<td>82</td>
<td>88</td>
<td>89</td>
<td>80</td>
</tr>
</tbody>
</table>

107) Find the weighted estimate, \( \bar{p} \), to test the claim that \( p_1 = p_2 \). Use \( \alpha = 0.05 \). Assume the samples are random and independent.

Sample statistics: \( n_1 = 50, x_1 = 35 \), and \( n_2 = 60, x_2 = 40 \)

108) Find the weighted estimate, \( \bar{p} \), to test the claim that \( p_1 < p_2 \). Use \( \alpha = 0.10 \). Assume the samples are random and independent.

Sample statistics: \( n_1 = 550, x_1 = 121 \), and \( n_2 = 690, x_2 = 195 \)

109) Find the standardized test statistic, \( z \), to test the claim that \( p_1 = p_2 \). Assume the samples are random and independent.

Sample statistics: \( n_1 = 50, x_1 = 35 \), and \( n_2 = 60, x_2 = 40 \)

12
110) Find the standardized test statistic, $z$, to test the claim that $p_1 \neq p_2$. Assume the samples are random and independent.

Sample statistics: $n_1 = 1000$, $x_1 = 250$, and $n_2 = 1200$, $x_2 = 195$

111) In a recent survey of gun control laws, a random sample of 1000 women showed that 65% were in favor of stricter gun control laws. In a random sample of 1000 men, 60% favored stricter gun control laws. Test the claim that the percentage of men and women favoring stricter gun control laws is the same. Use $\alpha = 0.05$.

112) In a random survey of 500 doctors that practice specialized medicine, 20% felt that the government should control health care. In a random sample of 800 doctors that were general practitioners, 30% felt that the government should control health care. Test the claim that there is a difference in the proportions. Use $\alpha = 0.10$.

113) A random sample of 100 students at a high school was asked whether they would ask their father or mother for help with a homework assignment in science. A second sample of 100 different students was asked the same question for an assignment in history. If 43 students in the first sample and 47 students in the second sample replied that they turned to their mother rather than their father for help, test the claim whether the difference between the proportions is due to chance. Use $\alpha = 0.02$.

114) A well-known study of 22,000 randomly selected male physicians was conducted to determine if taking aspirin daily reduces the chances of a heart attack. Half of the physicians were given a regular dose of aspirin while the other half was given placebos. Six years later, among those who took aspirin, 104 suffered heart attacks while among those who took placebos, 189 suffered heart attacks. Does it appear that the aspirin can reduce the number of heart attacks among the sample group that took aspirin? Use $\alpha = 0.01$.

115) In the initial test of the Salk vaccine for polio, 400,000 children were randomly selected and divided into two groups of 200,000. One group was vaccinated with the Salk vaccine while the second group was vaccinated with a placebo. Of those vaccinated with the Salk vaccine, 33 later developed polio. Of those receiving the placebo, 115 later developed polio. Test the claim that the Salk vaccine is effective in lowering the polio rate. Use $\alpha = 0.01$. 

13
1) H₀: μ = 8.3 (claim); Hₐ: μ ≠ 8.3
2) H₀: p ≤ 0.93 (claim); Hₐ: p > 0.93
3) H₀: σ ≥ 8.2; Hₐ: σ < 8.2 (claim)
4) H₀: μ = 48.6, Hₐ: μ ≠ 48.6
5) H₀: μ ≤ 160, Hₐ: μ > 160
6) H₀: μ ≥ 92, Hₐ: μ < 92
7) H₀: p ≥ 0.5, Hₐ: p < 0.5
8) H₀: σ ≤ 1, Hₐ: σ > 1
9) claim: μ ≤ 4.2; H₀: μ ≤ 4.2, Hₐ: μ > 4.2; claim is H₀
10) left-tailed
11) right-tailed
12) two-tailed
13) left-tailed
14) right-tailed
15) right-tailed
16) left-tailed
17) A
18) C
19) fail to reject H₀
20) fail to reject H₀
21) 0.0764; Fail to reject H₀
22) reject H₀
23) 0.0202; reject H₀
24) z₀ = 2.33; z > 2.33
25) - z₀ = -2.575, z₀ = 2.575; z < -2.575, z > 2.575
26) z₀ = -1.645; z < -1.645
27) z₀ = -1.96; z < -1.96
28) Reject H₀. There is enough evidence at the 5% level of significance to support the claim.
29) Reject H₀. There is enough evidence at the 5% level of significance to support the claim.
30) Reject H₀. There is enough evidence at the 1% level of significance to reject the claim.
31) Fail to reject H₀. There is not enough evidence at the 1% level of significance to support the claim.
32) Fail to reject H₀; There is not enough evidence to support the fast food outlet's claim that the mean waiting time is less than 3.8 minutes.
33) 1.77
34) -1.97
35) -2.16
36) Reject H₀ if the standardized test statistic is greater than 1.96 or less than -1.96.
37) standardized test statistic = 1.77; critical value = 1.645; reject H₀; There is enough evidence to support the claim.
38) standardized test statistic = -1.97; critical value = ±1.96; reject H₀; There is enough evidence to support the claim.
39) standardized test statistic = 2.65; critical value = ±2.33; reject H₀; There is enough evidence to reject the claim.
40) standardized test statistic = -2.16, critical value = ±2.575, fail to reject H₀; There is not enough evidence to reject the claim.
41) standardized test statistic = -3.03; critical value z₀ = -2.33; reject H₀; The data support the agency's claim.
42) standardized test statistic \( \approx -1.58 \); critical value \( z_0 = \pm 0.96 \); fail to reject \( H_0 \); There is not sufficient evidence to reject the manufacturer’s claim.

43) standardized test statistic \( \approx -2.27 \); critical value \( z_0 = -1.645 \); reject \( H_0 \); There is sufficient evidence to support the trucking firm’s claim.

44) \( \bar{x} = 60.4 \), standardized test statistic \( \approx 0.18 \); critical value \( z_0 = 2.33 \); fail to reject \( H_0 \); There is not sufficient evidence to reject the claim.

45) \( t_0 = -1.323 \); \( t > -1.323 \)

46) \( t_0 = 1.307 \); \( t > 1.307 \)

47) \( t_0 = -2.026 \); \( t_0 = 2.026 \); \( t < -2.026 \), \( t > 2.026 \)

48) 1.890

49) 1.452

50) 1.667

51) \( t_0 = \pm 3.106 \); standardized test statistic \( \approx 1.890 \), fail to reject \( H_0 \); There is not sufficient evidence to reject the claim.

52) \( t_0 = 1.761 \), standardized test statistic \( \approx 1.452 \), fail to reject \( H_0 \); There is not sufficient evidence to reject the claim.

53) \( t_0 = 2.797 \), standardized test statistic \( \approx 1.667 \), fail to reject \( H_0 \); There is not sufficient evidence to support the claim.

54) critical value \( t_0 = -2.539 \); standardized test statistic \( \approx -2.768 \); reject \( H_0 \); There is sufficient evidence to support the Metropolitan Bus Company’s claim.

55) \( \bar{x} = 60.21 \), \( s = 13.43 \); critical value \( t_0 = 2.650 \); standardized test statistic \( \approx 0.060 \); fail to reject \( H_0 \); There is not sufficient evidence to support the claim.

56) critical value \( t_0 = \pm 2.064 \); standardized test statistic \( \approx -0.625 \); fail to reject \( H_0 \); There is not sufficient evidence to reject the manufacturer’s claim.

57) Do not use the normal distribution.

58) Use the normal distribution.

59) -0.45

60) critical value \( z_0 = 1.645 \); standardized test statistic \( \approx 1.21 \); fail to reject \( H_0 \); There is not sufficient evidence to support the claim \( p > 0.5 \). The Republican candidate has no chance.

61) critical value \( z_0 = -1.645 \); standardized test statistic \( \approx -1.33 \); fail to reject \( H_0 \); There is not sufficient evidence to reject the claim.

62) Confidence interval \( (0.071, 0.154) \); 15% lies in the interval, fail to reject \( H_0 \); There is not sufficient evidence to reject the study’s claim.

63) critical value \( z_0 = \pm 0.96 \); standardized test statistic \( \approx 4.43 \); reject \( H_0 \); There is enough evidence to reject the claim that this is not a biased coin. The coin is not fair.

64) Standardized test statistic \( \approx -1.34 \); critical value \( z_0 = \pm 0.96 \); fail to reject \( H_0 \); There is not sufficient evidence to reject the company’s claim.

65) \( \alpha = 0.05 \); \( P - value = 0.0574 \); \( P > \alpha \); fail to reject \( H_0 \); There is not enough evidence to reject the claim that this is not a biased coin. The coin is fair.

66) \( \chi^2_L = 3.816 \), \( \chi^2_R = 21.920 \); \( \chi^2 < 3.816 \), \( \chi^2 > 21.920 \)

67) \( \chi^2 = 36.191 \); \( \chi^2 > 36.191 \)

68) \( \chi^2 = 18.114 \); \( \chi^2 < 18.114 \)

69) 9.209

70) 36.813

71) critical values \( \chi^2_L = 3.816 \) and \( \chi^2_R = 21.920 \); standardized test statistic \( \chi^2 = 9.209 \); fail to reject \( H_0 \); There is not sufficient evidence to reject the claim.
72) critical value $X_0^2 = 33.409$; standardized test statistic $X^2 = 24.158$; fail to reject $H_0$; There is not sufficient evidence to reject the claim.

73) critical value $X_0^2 = 6.571$; standardized test statistic $X^2 = 11.605$; fail to reject $H_0$; There is not sufficient evidence to reject the claim.

74) critical values $X_L^2 = 3.565$ and $X_R^2 = 29.819$; standardized test statistic $X^2 = 10.42$; fail to reject $H_0$; There is not sufficient evidence to reject the claim.

75) critical value $X_0^2 = 10.117$; standardized test statistic $X^2 = 9.048$; reject $H_0$; There is sufficient evidence to support the claim.

76) critical value $X_0^2 = 124.342$; standardized test statistic $X^2 = 144$; reject $H_0$; There is sufficient evidence to support the claim.

77) critical values $X_L^2 = 35.534$ and $X_R^2 = 91.952$; standardized test statistic $X^2 = 78.634$; fail to reject $H_0$; There is not sufficient evidence to reject the claim.

78) dependent
79) independent
80) independent
81) 6.2
82) 2.99
83) Reject $H_0$ if the standardized test statistic is less than -1.96 or greater than 1.96.
84) critical value $z_0 = \pm 1.96$; standardized test statistic $z = 6.17$; reject $H_0$; There is sufficient evidence to reject the claim.
85) Reject $H_0$ if the standardized test statistic is greater than 2.33.
86) critical values $z_0 = \pm 1.96$; standardized test statistic $z = -4.50$; reject $H_0$; There is sufficient evidence to reject the claim.
87) critical value $z_0 = 1.645$; standardized test statistic $z = 4.20$; reject $H_0$; There is sufficient evidence to support the claim.
88) day students $\bar{x}_1 = 22$, $\sigma_1 = 3.134$; evening students $\bar{x}_2 = 23.29$, $\sigma_2 = 3.268$; critical values $z_0 = \pm 1.96$; standardized test statistic $z = -1.69$; fail to reject $H_0$; There is not sufficient evidence to reject the claim.
89) critical value $z_0 = 1.645$; standardized test statistic $z \approx 1.05$; fail to reject $H_0$; There is not sufficient evidence to support the claim.
90) ±2.064
91) 2.681
92) ±2.764
93) 4.361
94) 1.282
95) Reject $H_0$ if the standardized test statistic is less than -2.797 or greater than 2.797.
96) Reject $H_0$ if the standardized test statistic is greater than 2.681.
97) (a) critical value $t_0 = -1.699$; standardized test statistic $z \approx -0.795$; fail to reject $H_0$; There is not sufficient evidence to support the claim.
(b) critical value $t_0 = -1.761$; standardized test statistic $z \approx -0.793$; fail to reject $H_0$; There is not sufficient evidence to support the claim.
Answer Key
Testname: CH9AND10

98) Standardized test statistic \( z = -0.167 \); critical value \( z_0 = \pm 2.179 \); fail to reject \( H_0 \); There is not sufficient evidence to support the claim.
99) 9.0
100) 7.8
101) critical values \( t_0 = \pm 4.064 \); standardized test statistic \( t = -1.213 \); fail to reject \( H_0 \); There is not sufficient evidence to reject the claim.
102) critical values \( t_0 = \pm 2.201 \); standardized test statistic \( t = 15.988 \); reject \( H_0 \); There is sufficient evidence to reject the claim.
103) critical value \( t_0 = -1.333 \); standardized test statistic \( t = -31.82 \); reject \( H_0 \); There is sufficient evidence to support the claim.
104) claim: \( \mu_d = 0 \); critical values \( t_0 = \pm 2.306 \); standardized test statistic \( t = -2.401 \); reject \( H_0 \); There is sufficient evidence to reject the claim.
105) claim: \( \mu_d = 0 \); critical values \( t_0 = \pm 2.539 \); standardized test statistic \( t = 1.451 \); fail to reject \( H_0 \); There is not sufficient evidence to reject the claim.
106) claim: \( \mu_d > 0 \); critical value \( t_0 = 2.821 \); standardized test statistic \( t = 3.490 \); reject \( H_0 \); There is sufficient evidence to support the claim.
107) 0.682
108) 0.255
109) 0.374
110) 5.09
111) claim: \( p_1 = p_2 \); critical value \( z_0 = 1.96 \); standardized test statistic \( t = 2.309 \); reject the null hypothesis; There is sufficient evidence to reject the claim.
112) claim: \( p_1 \neq p_2 \); critical values \( z_0 = \pm 1.645 \); standardized test statistic \( z = -3.991 \); reject \( H_0 \); There is sufficient evidence to support the claim.
113) claim: \( p_1 = p_2 \); critical values \( z_0 = \pm 2.33 \); standardized test statistic \( t = -0.569 \); fail to reject \( H_0 \); There is not sufficient evidence to reject the claim.
114) claim: \( p_1 < p_2 \); critical value \( z_0 = -2.33 \); standardized test statistic \( t \approx -4.999 \); reject \( H_0 \); There is sufficient evidence to support the claim.
115) claim: \( p_1 < p_2 \); critical value \( z_0 = -2.33 \); standardized test statistic \( t \approx -6.742 \); reject \( H_0 \); There is sufficient evidence to support the claim.