

8.9: Chapter 8 Homework

8.2 Comparing Two Independent Population Means

Use the following information to answer the next 15 exercises: Indicate if the hypothesis test is for

- independent group means
 - matched or paired samples
 - single mean
 - two proportions
 - single proportion
1. It is believed that 70% of males pass their drivers test in the first attempt, while 65% of females pass the test in the first attempt. Of interest is whether the proportions are in fact equal.
 2. A new laundry detergent is tested on consumers. Of interest is the proportion of consumers who prefer the new brand over the leading competitor. A study is done to test this.
 3. A new windshield treatment claims to repel water more effectively. Ten windshields are tested by simulating rain without the new treatment. The same windshields are then treated, and the experiment is run again. A hypothesis test is conducted.
 4. Company A and Company B are in the financial industry. Suppose samples are taken of mid-level professionals from Company A and from Company B. The sample mean salary for mid-level professionals in Company A is \$80,000. The sample mean salary for mid-level professionals in Company B is \$96,000. Company A and Company B management want to know if their mid-level professionals are paid differently, on average.
 5. The average worker in Germany gets eight weeks of paid vacation.
 6. According to a television commercial, 80% of dentists agree that Ultrafresh toothpaste is the best on the market.
 7. It is believed that the average grade on an English essay in a particular school system for females is higher than for males. A random sample of 31 females had a mean score of 82 with a standard deviation of three, and a random sample of 25 males had a mean score of 76 with a standard deviation of four.
 8. The league mean batting average is 0.280 with a known standard deviation of 0.06. The Rattlers and the Vikings belong to the league. The mean batting average for a sample of eight Rattlers is 0.210, and the mean batting average for a sample of eight Vikings is 0.260. There are 24 players on the Rattlers and 19 players on the Vikings. Are the batting averages of the Rattlers and Vikings statistically different?
 9. In a random sample of 100 forests in the United States, 56 were coniferous or contained conifers. In a random sample of 80 forests in Mexico, 40 were coniferous or contained conifers. Is the proportion of conifers in the United States statistically more than the proportion of conifers in Mexico?
 10. A new medicine is said to help improve sleep. Eight subjects are picked at random and given the medicine. The means hours slept for each person were recorded before starting the medication and after.
 11. It is thought that teenagers sleep more than adults on average. A study is done to verify this. A sample of 16 teenagers has a mean of 8.9 hours slept and a standard deviation of 1.2. A sample of 12 adults has a mean of 6.9 hours slept and a standard deviation of 0.6.
 12. Varsity athletes practice five times a week, on average.
 13. A sample of 12 in-state graduate school programs at school A has a mean tuition of \$64,000 with a standard deviation of \$8,000. At school B, a sample of 16 in-state graduate programs has a mean of \$80,000 with a standard deviation of \$6,000. On average, are the mean tuitions different?
 14. A new WiFi range booster is being offered to consumers. A researcher tests the native range of 12 different routers under the same conditions. The ranges are recorded. Then the researcher uses the new WiFi range booster and records the new ranges. Does the new WiFi range booster do a better job?
 15. A high school principal claims that 30% of student athletes drive themselves to school, while 4% of non-athletes drive themselves to school. In a sample of 20 student athletes, 45% drive themselves to school. In a sample of 35 non-athlete students,

6% drive themselves to school. Is the percent of student athletes who drive themselves to school more than the percent of non-athletes?

Use the following information to answer the next three exercises: A study is done to determine which of two soft drinks has more sugar. There are 13 cans of Beverage A in a sample and six cans of Beverage B. The mean amount of sugar in Beverage A is 36 grams with a standard deviation of 0.6 grams. The mean amount of sugar in Beverage B is 38 grams with a standard deviation of 0.8 grams. The researchers believe that Beverage B has more sugar than Beverage A, on average. Both populations have normal distributions.

16. Are standard deviations known or unknown?

17. What is the random variable?

18. Is this a one-tailed or two-tailed test?

Use the following information to answer the next 12 exercises: The U.S. Center for Disease Control reports that the mean life expectancy was 47.6 years for whites born in 1900 and 33.0 years for nonwhites. Suppose that you randomly survey death records for people born in 1900 in a certain county. Of the 124 whites, the mean life span was 45.3 years with a standard deviation of 12.7 years. Of the 82 nonwhites, the mean life span was 34.1 years with a standard deviation of 15.6 years. Conduct a hypothesis test to see if the mean life spans in the county were the same for whites and nonwhites.

19. Is this a test of means or proportions?

20. State the null and alternative hypotheses.

1. H_0 : _____

2. H_a : _____

21. Is this a right-tailed, left-tailed, or two-tailed test?

22. In symbols, what is the random variable of interest for this test?

23. In words, define the random variable of interest for this test.

24. Which distribution (normal or Student's t) would you use for this hypothesis test?

25. Explain why you chose the distribution you did for the previous question.

26. Calculate the test statistic.

27. Sketch a graph of the situation. Label the horizontal axis. Mark the hypothesized difference and the sample difference. Shade the area corresponding to the p -value.

28. At $\alpha = 0.05$, what is your:

1. Decision:

2. Reason for the decision:

3. Conclusion (write out in a complete sentence):

29. Does it appear that the means are the same? Why or why not?

8.4 Comparing Two Independent Population Proportions

Use the following information for the next five exercises. Two types of phone operating system are being tested to determine if there is a difference in the proportions of system failures (crashes). Fifteen out of a random sample of 150 phones with OS₁ had system failures within the first eight hours of operation. Nine out of another random sample of 150 phones with OS₂ had system failures within the first eight hours of operation. OS₂ is believed to be more stable (have fewer crashes) than OS₁.

30. Is this a test of means or proportions?

31. What is the random variable?

32. State the null and alternative hypotheses.

33. Conduct a hypothesis test using the confidence interval approach and 95% confidence. What can you conclude about the two operating systems?

Use the following information to answer the next twelve exercises. In the recent Census, three percent of the U.S. population reported being of two or more races. However, the percent varies tremendously from state to state. Suppose that two random surveys are conducted. In the first random survey, out of 1,000 North Dakotans, only nine people reported being of two or more races. In the second random survey, out of 500 Nevadans, 17 people reported being of two or more races. Conduct a hypothesis test to determine if the population percents are the same for the two states or if the percent for Nevada is statistically higher than for North Dakota.

34. Is this a test of means or proportions?
35. State the null and alternative hypotheses.
 1. H_0 : _____
 2. H_a : _____
36. Is this a right-tailed, left-tailed, or two-tailed test? How do you know?
37. What is the random variable of interest for this test?
38. In words, define the random variable for this test.
39. Which distribution (normal or Student's t) would you use for this hypothesis test?
40. Explain why you chose the distribution you did for the previous question.
41. Calculate the confidence interval. Use 95% confidence.
42. At $\alpha = 0.05$, what is your:
 1. Decision:
 2. Reason for the decision:
 3. Conclusion (write out in a complete sentence):
43. Does it appear that the proportion of Nevadans who are two or more races is higher than the proportion of North Dakotans? Why or why not?

8.5 Matched or Paired Samples

Use the following information to answer the next five exercises. A study was conducted to test the effectiveness of a software patch in reducing system failures over a six-month period. Results for randomly selected installations are shown in the table below. The “before” value is matched to an “after” value, and the differences are calculated. The differences have a normal distribution. Test at the 1% significance level.

Installation	A	B	C	D	E	F	G	H
Before	3	6	4	2	5	8	2	6
After	1	5	2	0	1	0	2	1

Table 8.9.1

44. What is the random variable?
45. State the null and alternative hypotheses.
46. What conclusion can you draw about the software patch?
 - a. Test the above hypotheses using confidence intervals. Interpret the CI.
 - b. Test the above hypotheses using test statistics.
 - c. Test the above hypotheses using p -values. Interpret the p -value.

Use the following information to answer next five exercises. A study was conducted to test the effectiveness of a juggling class. Before the class started, six subjects juggled as many balls as they could at once. After the class, the same six subjects juggled as many balls as they could. The differences in the number of balls are calculated. The differences have a normal distribution. Test at the 1% significance level.

Subject	A	B	C	D	E	F
Before	3	4	3	2	4	5
After	4	5	6	4	5	7

Table 8.9.2

47. State the null and alternative hypotheses.

48. What is the sample mean difference?

49. What conclusion can you draw about the juggling class?

- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.

Use the following information to answer the next five exercises. A doctor wants to know if a blood pressure medication is effective. Six subjects have their blood pressures recorded. After twelve weeks on the medication, the same six subjects have their blood pressure recorded again. For this test, only systolic pressure is of concern. Test at the 1% significance level.

Patient	A	B	C	D	E	F
Before	161	162	165	162	166	171
After	160	159	166	160	167	169

Table 8.9.3

50. State the null and alternative hypotheses.

51. What is the sample mean difference?

52. What is the conclusion?

- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.

8.2 Comparing Two Independent Population Means

53. The mean number of English courses taken in a two-year time period by male and female college students is believed to be about the same. A survey is conducted and data are collected from 29 males and 16 females. The males took an average of three English courses with a standard deviation of 0.8. The females took an average of four English courses with a standard deviation of 1.0. Are the means statistically the same? Use the 1% significance level.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.
- Calculate and interpret Cohen's d .

54. A student at a four-year college claims that mean enrollment at four-year colleges is higher than at two-year colleges in the United States. Two surveys are conducted. Of the 35 two-year colleges surveyed, the mean enrollment was 5,068 with a standard deviation of 4,777. Of the 35 four-year colleges surveyed, the mean enrollment was 5,466 with a standard deviation of 8,191. Use 95% confidence.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.

e. Calculate and interpret Cohen's d .

55. At Rachel's 11th birthday party, eight girls were timed to see how long (in seconds) they could hold their breath in a relaxed position. After a two-minute rest, they timed themselves while jumping. The girls thought that the mean difference between their jumping and relaxed times would be zero. Test their hypothesis using 90% confidence.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.
- Calculate and interpret Cohen's d .

Relaxed time (seconds)	Jumping time (seconds)
26	21
47	40
30	28
22	21
23	25
45	43
37	35
29	32

Table 8.9.4

56. Mean entry-level salaries for college graduates with mechanical engineering degrees and electrical engineering degrees are believed to be approximately the same. A recruiting office thinks that the mean mechanical engineering salary is actually lower than the mean electrical engineering salary. The recruiting office randomly surveys 50 entry level mechanical engineers and 60 entry level electrical engineers. Their mean salaries were \$46,100 and \$46,700, respectively. Their standard deviations were \$3,450 and \$4,210, respectively. Conduct a hypothesis test to determine if you agree that the mean entry-level mechanical engineering salary is lower than the mean entry-level electrical engineering salary. Use the 5% significance level.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.
- Calculate and interpret Cohen's d .

57. Marketing companies have collected data implying that teenage girls use more ring tones on their cellular phones than teenage boys do. In one particular study of 40 randomly chosen teenage girls and boys (20 of each) with cellular phones, the mean number of ring tones for the girls was 3.2 with a standard deviation of 1.5. The mean for the boys was 1.7 with a standard deviation of 0.8. Conduct a hypothesis test to determine if the means are approximately the same or if the girls' mean is higher than the boys' mean. Use 99% confidence.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.
- Calculate and interpret Cohen's d .

Use the following information to answer the next two exercises. The Eastern and Western Major League Soccer conferences have a new Reserve Division that allows new players to develop their skills. Data for a randomly picked date showed the following annual goals.

Western	Eastern
Los Angeles 9	D.C. United 9
FC Dallas 3	Chicago 8
Chivas USA 4	Columbus 7
Real Salt Lake 3	New England 6
Colorado 4	MetroStars 5
San Jose 4	Kansas City 3

Table 8.9.5

Conduct a hypothesis test to answer the next two exercises.

58. The distribution for the hypothesis test is:

- the normal distribution
- the Student's t -distribution
- the uniform distribution
- the exponential distribution

59. If the level of significance is 0.05, the conclusion is:

- There is sufficient evidence to conclude that the W Division teams score fewer goals, on average, than the E teams
- There is insufficient evidence to conclude that the W Division teams score more goals, on average, than the E teams.
- There is insufficient evidence to conclude that the W teams score fewer goals, on average, than the E teams score.
- Unable to determine

60. Suppose a statistics instructor believes that there is no significant difference between the mean class scores of statistics day students on Exam 2 and statistics night students on Exam 2. She takes random samples from each of the populations. The mean and standard deviation for 35 statistics day students were 75.86 and 16.91. The mean and standard deviation for 37 statistics night students were 75.41 and 19.73. The “day” subscript refers to the statistics day students. The “night” subscript refers to the statistics night students. A concluding statement is:

- There is sufficient evidence to conclude that statistics night students' mean on Exam 2 is better than the statistics day students' mean on Exam 2.
- There is insufficient evidence to conclude that the statistics day students' mean on Exam 2 is better than the statistics night students' mean on Exam 2.
- There is insufficient evidence to conclude that there is a significant difference between the means of the statistics day students and night students on Exam 2.
- There is sufficient evidence to conclude that there is a significant difference between the means of the statistics day students and night students on Exam 2.

61. Researchers interviewed street prostitutes in Canada and the United States. The mean age of the 100 Canadian prostitutes upon entering prostitution was 18 with a standard deviation of six. The mean age of the 130 United States prostitutes upon entering prostitution was 20 with a standard deviation of eight. Is the mean age of entering prostitution in Canada lower than the mean age in the United States? Test at a 1% significance level.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.
- Calculate and interpret Cohen's d .

62. A powder diet is tested on 49 people, and a liquid diet is tested on 36 different people. Of interest is whether the liquid diet yields a higher mean weight loss than the powder diet. The powder diet group had a mean weight loss of 42 pounds with a standard

deviation of 12 pounds. The liquid diet group had a mean weight loss of 45 pounds with a standard deviation of 14 pounds. Use 90% confidence.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.
- Calculate and interpret Cohen's d .

63. Suppose a statistics instructor believes that there is no significant difference between the mean class scores of statistics day students on Exam 2 and statistics night students on Exam 2. She takes random samples from each of the populations. The mean and standard deviation for 35 statistics day students were 75.86 and 16.91, respectively. The mean and standard deviation for 37 statistics night students were 75.41 and 19.73. The “day” subscript refers to the statistics day students. The “night” subscript refers to the statistics night students. An appropriate alternative hypothesis for the hypothesis test is:

- $\mu_{\text{day}} > \mu_{\text{night}}$
- $\mu_{\text{day}} < \mu_{\text{night}}$
- $\mu_{\text{day}} = \mu_{\text{night}}$
- $\mu_{\text{day}} \neq \mu_{\text{night}}$

8.4 Comparing Two Independent Population Proportions

64. A recent drug survey showed an increase in the use of drugs and alcohol among local high school seniors as compared to the national percent. Suppose that a survey of 100 local seniors and 100 national seniors is conducted to see if the proportion of drug and alcohol use is higher locally than nationally. Locally, 65 seniors reported using drugs or alcohol within the past month, while 60 national seniors reported using them. Use the 1% significance level to test this difference.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.

65. We are interested in whether the proportions of female suicide victims for ages 15 to 24 are the same for White and Black women in the United States. We randomly pick one year, 1992, to compare the races. The number of suicides estimated in the United States in 1992 for White females is 4,930. Five hundred eighty were aged 15 to 24. The estimate for Black females is 330. Forty were aged 15 to 24. Use the 5% significance level to test this difference.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.

66. Elizabeth Mjelde, an art history professor, was interested in whether the value from the Golden Ratio formula, (larger dimension/smaller dimension) = (larger dimension + smaller dimension)/(larger dimension), was the same in the Whitney Exhibit for works from 1900 to 1919 as for works from 1920 to 1942. Thirty-seven early works were sampled, averaging 1.74 with a standard deviation of 0.11. Sixty-five of the later works were sampled, averaging 1.746 with a standard deviation of 0.1064. Using 95% confidence, is there a significant difference in the Golden Ratio calculation?

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.

67. A recent year was randomly picked from 1985 to the present. In that year, there were 2,051 Hispanic students at Cabrillo College out of a total of 12,328 students. At Lake Tahoe College, there were 321 Hispanic students out of a total of 2,441 students. In general, do you think that the percentage of Hispanic students at the two colleges is basically the same or different? Use 95% confidence.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.

Use the following information to answer the next three exercises. Neuroinvasive West Nile virus is a severe disease that affects a person's nervous system. It is spread by the Culex species of mosquito. In the United States in 2010 there were 629 reported cases of neuroinvasive West Nile virus out of a total of 1,021 reported cases and there were 486 neuroinvasive reported cases out of a total of 712 cases reported in 2011. Is the 2011 proportion of neuroinvasive West Nile virus cases more than the 2010 proportion of neuroinvasive West Nile virus cases? Using a 1% level of significance, conduct an appropriate hypothesis test.

68. This is:

- a. a test of two proportions
- b. a test of two independent means
- c. a test of a single mean
- d. a test of matched pairs.

69. An appropriate null hypothesis is:

- a. $P_{2011} \leq P_{2010}$
- b. $P_{2011} \geq P_{2010}$
- c. $\mu_{2011} \leq \mu_{2010}$
- d. $P_{2011} > P_{2010}$

70. Researchers conducted a study to find out if there is a difference in the use of eReaders by different age groups. Randomly selected participants were divided into two age groups. In the 16- to 29-year-old group, 7% of the 628 surveyed use eReaders, while 11% of the 2,309 participants 30 years old and older use eReaders. Test this research question using the 10% significance level.

- a. Write a pair of hypotheses to test this research question.
- b. Test the above hypotheses using confidence intervals. Interpret the CI.

71. Adults aged 18 years old and older were randomly selected for a survey on obesity. Adults are considered obese if their body mass index (BMI) is at least 30. The researchers wanted to determine if the proportion of women who are obese in the south is less than the proportion of southern men who are obese. The results are shown in the table below.. Test at the 1% level of significance.

- a. Write a pair of hypotheses to test this research question.
- b. Test the above hypotheses using confidence intervals. Interpret the CI.

	Number who are obese	Sample size
Men	42,769	155,525
Women	67,169	248,775

Table 8.9.6

72. Two computer users were discussing tablet computers. A higher proportion of people ages 16 to 29 use tablets than the proportion of people age 30 and older. Test this assertion at the 1% level of significance. The table below details the number of tablet owners for each age group.

- a. Write a pair of hypotheses to test this research question.
- b. Test the above hypotheses using confidence intervals. Interpret the CI.

	16–29 year olds	30 years old and older
Own a tablet	69	231
Sample size	628	2,309

Table 8.9.7

73. A group of friends debated whether more men use smartphones than women. They consulted a research study of smartphone use among adults. The results of the survey indicate that of the 973 men randomly sampled, 379 use smartphones. For women, 404 of the 1,304 who were randomly sampled use smartphones. Test at the 5% level of significance.

- a. Write a pair of hypotheses to test this research question.
- b. Test the above hypotheses using confidence intervals. Interpret the CI.

74. While her husband spent 2½ hours picking out new speakers, a statistician decided to determine whether the percent of men who enjoy shopping for electronic equipment is higher than the percent of women who enjoy shopping for electronic equipment.

The population was Saturday afternoon shoppers. Out of 67 men, 24 said they enjoyed the activity. Nine of the 34 women surveyed claimed to enjoy the activity. Test this hypothesis using 95% confidence, and interpret the results of the survey.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.

75. We are interested in whether children's educational computer software costs less, on average, than children's entertainment software. Thirty-six educational software titles were randomly picked from a catalog. The mean cost was \$31.14 with a standard deviation of \$4.69. Thirty-five entertainment software titles were randomly picked from the same catalog. The mean cost was \$33.86 with a standard deviation of \$10.87. Decide whether children's educational software costs less, on average, than children's entertainment software. Use 95% confidence to test this question.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.
- Calculate and interpret Cohen's d .

76. Joan Nguyen recently claimed that the proportion of college-age males with at least one pierced ear is lower than the proportion of college-age females with a pierced ear. She conducted a survey in her classes. Out of 107 males, 20 had at least one pierced ear. Out of 92 females, 47 had at least one pierced ear. Use 95% confidence here.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.

8.5 Matched or Paired Samples

77. Ten individuals went on a low-fat diet for 12 weeks to lower their cholesterol. The data are recorded in the table below. Were their cholesterol levels were significantly lowered? Test this question using 95% confidence.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.

Starting cholesterol level	Ending cholesterol level
140	140
220	230
110	120
240	220
200	190
180	150
190	200
360	300
280	300
260	230

Table 8.9.8

Use the following information to answer the next two exercises. An experiment is conducted to show that blood pressure can be consciously reduced in people trained in a "biofeedback exercise program." Six subjects were randomly selected and blood pressure measurements were recorded before and after the training. The difference between blood pressures was calculated (after -

before) producing the following results: $\bar{x}_d = -10.2$ $s_d = 8.4$. Using the data, test the hypothesis that the blood pressure has decreased after the training.

78. The distribution for the test is:

- t_5
- t_6
- $N(-10.2, 8.4)$
- $N\left(-10.2, \frac{8.4}{\sqrt{6}}\right)$

79. A golf instructor is interested in determining if her new technique for improving players' golf scores is effective. She takes four new students. She records their 18-hole scores before learning the technique and then after having taken her class. She conducts a hypothesis test using 90% confidence. The data are as follows.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.

	Player 1	Player 2	Player 3	Player 4
Mean score before class	83	78	93	87
Mean score after class	80	80	86	86

Table 8.9.9

80. A local cancer support group believes that the estimate for new female breast cancer cases in the south is higher in 2013 than in 2012. The group compared the estimates of new female breast cancer cases by southern state in 2012 and in 2013. The results are in the table below. Test their question using 95% confidence.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.

Southern states	2012	2013
Alabama	3,450	3,720
Arkansas	2,150	2,280
Florida	15,540	15,710
Georgia	6,970	7,310
Kentucky	3,160	3,300
Louisiana	3,320	3,630
Mississippi	1,990	2,080
North Carolina	7,090	7,430
Oklahoma	2,630	2,690
South Carolina	3,570	3,580
Tennessee	4,680	5,070
Texas	15,050	14,980
Virginia	6,190	6,280

Table 8.9.10

81. A traveler wanted to know if the prices of hotels are different in the ten cities that he visits the most often. The list of the cities with the corresponding hotel prices for his two favorite hotel chains is in the table below. Test at the 1% level of significance.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.

Cities	Hyatt Regency prices in dollars	Hilton prices in dollars
Atlanta	107	169
Boston	358	289
Chicago	209	299
Dallas	209	198
Denver	167	169
Indianapolis	179	214
Los Angeles	179	169
New York City	625	459
Philadelphia	179	159
Washington, DC	245	239

Table 8.9.11

82. A politician asked his staff to determine whether the underemployment rate in the northeast decreased from 2011 to 2012. The results are in the table below. Test with the 5% level of significance.

- Write a pair of hypotheses to test this research question.
- Test the above hypotheses using confidence intervals. Interpret the CI.
- Test the above hypotheses using test statistics.
- Test the above hypotheses using p -values. Interpret the p -value.

Northeastern states	2011	2012
Connecticut	17.3	16.4
Delaware	17.4	13.7
Maine	19.3	16.1
Maryland	16.0	15.5
Massachusetts	17.6	18.2
New Hampshire	15.4	13.5
New Jersey	19.2	18.7
New York	18.5	18.7
Ohio	18.2	18.8
Pennsylvania	16.5	16.9
Rhode Island	20.7	22.4
Vermont	14.7	12.3

Northeastern states	2011	2012
West Virginia	15.5	17.3

Table 8.9.12

Use the following information to answer the next ten exercises. indicate which of the following choices best identifies the hypothesis test.

- independent group means
 - matched or paired samples
 - single mean
 - two proportions
 - single proportion
- 83.** A powder diet is tested on 49 people, and a liquid diet is tested on 36 different people. The population standard deviations are two pounds and three pounds, respectively. Of interest is whether the liquid diet yields a higher mean weight loss than the powder diet.
- 84.** A new chocolate bar is taste-tested on consumers. Of interest is whether the proportion of children who like the new chocolate bar is greater than the proportion of adults who like it.
- 85.** The mean number of English courses taken in a two-year time period by male and female college students is believed to be about the same. An experiment is conducted and data are collected from nine males and 16 females.
- 86.** A football league reported that the mean number of touchdowns per game was five. A study is done to determine if the mean number of touchdowns has decreased.
- 87.** A study is done to determine if students in the California state university system take longer to graduate than students enrolled in private universities. One hundred students from both the California state university system and private universities are surveyed. From years of research, it is known that the population standard deviations are 1.5811 years and one year, respectively.
- 88.** According to a YWCA Rape Crisis Center newsletter, 75% of rape victims know their attackers. A study is done to verify this.
- 89.** According to a recent study, U.S. companies have a mean maternity-leave of six weeks.
- 90.** A recent drug survey showed an increase in use of drugs and alcohol among local high school students as compared to the national percent. Suppose that a survey of 100 local youths and 100 national youths is conducted to see if the proportion of drug and alcohol use is higher locally than nationally.
- 91.** A new SAT study course is tested on 12 individuals. Pre-course and post-course scores are recorded. Of interest is the mean increase in SAT scores. The following data are collected:

Pre-course score	Post-course score
1	300
960	920
1010	1100
840	880
1100	1070
1250	1320
860	860
1330	1370
790	770
990	1040

Pre-course score	Post-course score
1110	1200
740	850

Table 8.9.13

92. University of Michigan researchers reported in the *Journal of the National Cancer Institute* that quitting smoking is especially beneficial for those under age 49. In this American Cancer Society study, the risk (probability) of dying of lung cancer was about the same as for those who had never smoked.

93. Lesley E. Tan investigated the relationship between left-handedness vs. right-handedness and motor competence in preschool children. Random samples of 41 left-handed preschool children and 41 right-handed preschool children were given several tests of motor skills to determine if there is evidence of a difference between the children based on this experiment. The experiment produced the means and standard deviations shown below. Determine the appropriate test and best distribution to use for that test.

	Left-handed	Right-handed
Sample size	41	41
Sample mean	97.5	98.1
Sample standard deviation	17.5	19.2

Table 8.9.14

- Two independent means, normal distribution
- Two independent means, Student's t -distribution
- Matched or paired samples, Student's t -distribution
- Two population proportions, normal distribution

94. A golf instructor is interested in determining if her new technique for improving players' golf scores is effective. She takes four (4) new students. She records their 18-hole scores before learning the technique and then after having taken her class. She conducts a hypothesis test. The data are as shown below.

	Player 1	Player 2	Player 3	Player 4
Mean score before class	83	78	93	87
Mean score after class	80	80	86	86

Table 8.9.15

This is:

- a test of two independent means.
- a test of two proportions.
- a test of a single mean.
- a test of a single proportion.

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