

Chapter 9: HYPOTHESIS TESTING With One Sample

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| Exercise 1. | *You are testing that the mean speed of your cable Internet connection is more than three Megabits per second. What is the random variable? Describe in words.* |
| Solution | The random variable is the mean Internet speed in Megabits per second. |
| Exercise 2. | *You are testing that the mean speed of your cable Internet connection is more than three Megabits per second. State the null and alternative hypotheses.* |
| Solution | *H0*: *μ* ≤ 3  *Ha*: *μ* > 3 |
| Exercise 3. | *The American family has an average of two children. What is the random variable? Describe in words.* |
| Solution | The random variable is the mean number of children an American family has. |
| Exercise 4. | *The mean entry level salary of an employee at a company is $58,000. You believe it is higher for IT professionals in the company. State the null and alternative hypotheses.* |
| Solution | *H0*: *μ* = 58,000  *Ha*: *μ* > 58,000 |
| Exercise 5. | *A sociologist claims the probability that a person picked at random in Times Square in New York City is visiting the area is 0.83. You want to test to see if the proportion is actually less. What is the random variable? Describe in words.* |
| Solution | The random variable is the proportion of people picked at random in Times Square visiting the city. |
| Exercise 6. | *A sociologist claims the probability that a person picked at random in Times Square in New York City is visiting the area is 0.83. You want to test to see if the claim is correct. State the null and alternative hypotheses.* |
| Solution | *H0*: *p* = 0.83  *Ha*: *p* ≠ 0.83 |
| Exercise 7. | *In a population of fish, approximately 42% are female. A test is conducted to see if, in fact, the proportion is less. State the null and alternative hypotheses.* |
| Solution | *H0*: *p* = 0.42  *Ha*: *p* < 0.42 |
| Exercise 8. | *Suppose that a recent article stated that the mean time spent in jail by a first–time convicted burglar is 2.5 years. A study was then done to see if the mean time has increased in the new century. A random sample of 26 first-time convicted burglars in a recent year was picked. The mean length of time in jail from the survey was 3 years with a standard deviation of 1.8 years. Suppose that it is somehow known that the population standard deviation is 1.5. If you were conducting a hypothesis test to determine if the mean length of jail time has increased, what would the null and alternative hypotheses be? The distribution of the population is normal.*  *State the null and alternative hypotheses.*  *a. H0: \_\_\_\_\_\_\_\_\_\_*  *b.**Ha: \_\_\_\_\_\_\_\_\_\_* |
| Solution | a. *H0*: *μ* = 2.5 (or, *H0*: *μ* ≤ 2.5)  b. *Ha* : *μ* > 2.5 |
| Exercise 9. | *A random survey of 75 death row inmates revealed that the mean length of time on death row is 17.4 years with a standard deviation of 6.3 years. If you were conducting a hypothesis test to determine if the population mean time on death row could likely be 15 years, what would the null and alternative hypotheses be?*  *a. H0: \_\_\_\_\_\_\_\_\_\_*  *b. Ha: \_\_\_\_\_\_\_\_\_\_* |
| Solution | a. *H0*: *μ* = 15  b. *Ha*: *μ* ≠ 15 |
| Exercise 10. | *The National Institute of Mental Health published an article stating that in any one-year period, approximately 9.5 percent of American adults suffer from depression or a depressive illness. Suppose that in a survey of 100 people in a certain town, seven of them suffered from depression or a depressive illness. If you were conducting a hypothesis test to determine if the true proportion of people in that town suffering from depression or a depressive illness is lower than the percent in the general adult American population, what would the null and alternative hypotheses be?*  *a. H0: \_\_\_\_\_\_\_\_\_\_*  *b. Ha: \_\_\_\_\_\_\_\_\_\_* |
| Solution | a. *H0*: *p* = 0.095  b. *Ha*: *p* < 0.095 |
| Exercise 11. | *The mean price of mid-sized cars in a region is $32,000. A test is conducted to see if the claim is true. State the Type I and Type II errors in complete sentences.* |
| Solution | Type I: The mean price of mid-sized cars is $32,000, but we conclude that it is not $32,000. Type II: The mean price of mid-sized cars is not $32,000, but we conclude that it is $32,000. |
| Exercise 12. | *A sleeping bag is tested to withstand temperatures of -15 °F. You think the bag cannot stand temperatures that low. State the Type I and Type II errors in complete sentences.* |
| Solution | Type I: The bag can withstand -15 °F, but you conclude that it cannot stand temperatures that low. Type II: The bag cannot withstand -15 °F, but you conclude that it can. |
| Exercise 13. | *For Exercise 9.12, what are α and β in words?* |
| Solution | *α* = the probability that you think the bag cannot withstand -15 degrees F, when in fact it can *β* = the probability that you think the bag can withstand -15 degrees F, when in fact it cannot |
| Exercise 14. | *In words, describe 1 – β for Exercise 9.12.* |
| Solution | 1 – *β* is 1 – the probability of a Type II error. It represents the power of the test. A valid test will have a high power; therefore, a low probability of a Type II error. |
| Exercise 15. | *A group of doctors is deciding whether or not to perform an operation. Suppose the null hypothesis, H0, is: the surgical procedure will go well. State the Type I and Type II errors in complete sentences.* |
| Solution | Type I: The procedure will go well, but the doctors think it will not. Type II: The procedure will not go well, but the doctors think it will. |
| Exercise 16. | *A group of doctors is deciding whether or not to perform an operation. Suppose the null hypothesis, H0, is: the surgical procedure will go well. Which is the error with the greater consequence?* |
| Solution | The Type II error has the greater consequence because the doctors will move forward with the procedure when it will not go well. |
| Exercise 17. | *The power of a test is 0.981. What is the probability of a Type II error?* |
| Solution | 0.019 |
| Exercise 18. | *A group of divers is exploring an old sunken ship. Suppose the null hypothesis, H0, is: the sunken ship does not contain buried treasure. State the Type I and Type II errors in complete sentences.* |
| Solution | Type I: The ship does not contain buried treasure, but the divers think it does. Type II: The ship does contain buried treasure, but the divers think it does not. |
| Exercise 19. | *A microbiologist is testing a water sample for E-coli. Suppose the null hypothesis, H0, is: the sample does not contain E-coli. The probability that the sample does not contain E-coli, but the microbiologist thinks it does is 0.012. The probability that the sample does contain E-coli, but the microbiologist thinks it does not is 0.002. What is the power of this test?* |
| Solution | 0.998 |
| Exercise 20. | *A microbiologist is testing a water sample for E-coli. Suppose the null hypothesis, H0, is: the sample contains E-coli. Which is the error with the greater consequence?* |
| Solution | A Type I error has the greater consequence. Thinking there are no E-coli when there are can cause more exposure to the bacteria. |
| Exercise 21. | *Which two distributions can you use for hypothesis testing for this chapter?* |
| Solution | A normal distribution or a Student’s *t*-distribution |
| Exercise 22. | *Which distribution do you use when you are testing a population mean and the population standard deviation is known? Assume a normal distribution, with n ≥ 30.* |
| Solution | Use a normal distribution. |
| Exercise 23. | *Which distribution do you use when the standard deviation is not known and you are testing one population mean? Assume sample size is large.* |
| Solution | Use a Student’s *t*-distribution. |
| Exercise 24. | *A population mean is 13. The sample mean is 12.8, and the sample standard deviation is two. The sample size is 20. What distribution should you use to perform a hypothesis test? Assume the underlying population is normal.* |
| Solution | a Student’s *t*-distribution |
| Exercise 25. | *A population has a mean is 25 and a standard deviation of five. The sample mean is 24, and the sample size is 108. What distribution should you use to perform a hypothesis test?* |
| Solution | a normal distribution for a single population mean |
| Exercise 26. | *It is thought that 42% of respondents in a taste test would prefer Brand A. In a particular test of 100 people, 39% preferred Brand A. What distribution should you use to perform a hypothesis test?* |
| Solution | a normal distribution for a single population proportion |
| Exercise 27. | *You are performing a hypothesis test of a single population mean using a Student’s t- distribution. What must you assume about the distribution of the data?* |
| Solution | It must be approximately normally distributed. |
| Exercise 28. | *You are performing a hypothesis test of a single population mean using a Student’s t-distribution. The data are not from a simple random sample. Can you accurately perform the hypothesis test?* |
| Solution | No, for a hypothesis test, the data are assumed to be from a simple random sample. |
| Exercise 29. | *You are performing a hypothesis test of a single population proportion. What must be true about the quantities of np and nq?* |
| Solution | They must both be greater than five. |
| Exercise 30. | *You are performing a hypothesis test of a single population proportion. You find out that np is less than five. What must you do to be able to perform a valid hypothesis test?* |
| Solution | Increase the sample size so that *np* is greater than five. |
| Exercise 31. | *You are performing a hypothesis test of a single population proportion. The data come from which distribution?* |
| Solution | binomial distribution |
| Exercise 32 | *Assume H0: μ = 9 and Ha: μ < 9. Is this a left-tailed, right-tailed, or two-tailed test?* |
| Solution | This is a left-tailed test. |
| Exercise 33 | *Assume H0: μ ≤ 6 and Ha: μ > 6. Is this a left-tailed, right-tailed, or two-tailed test?* |
| Solution | This is a right-tailed test. |
| Exercise 34 | *Assume H0: p = 0.25 and Ha: p ≠ 0.25. Is this a left-tailed, right-tailed, or two-tailed test?* |
| Solution | This is a two-tailed test. |
| Exercise 35 | *Draw the general graph of a left-tailed test.* |
| Solution | fig-ch09_09_01 |
| Exercise 36 | *Draw the graph of a two-tailed test.* |
| Solution | CNX_Stats_C09_M09_item002anno  Figure 9.25 |
| Exercise 37 | *A bottle of water is labeled as containing 16 fluid ounces of water. You believe it is less than that. What type of test would you use?* |
| Solution | a left-tailed test |
| Exercise 38 | *Your friend claims that his mean golf score is 63. You want to show that it is higher than that. What type of test would you use?* |
| Solution | a right-tailed test |
| Exercise 39 | *A bathroom scale claims to be able to identify correctly any weight within a pound. You think that it cannot be that accurate. What type of test would you use?* |
| Solution | A two-tailed test |
| Exercise 40 | *You flip a coin and record whether it shows heads or tails. You know the probability of getting heads is 50%, but you think it is less for this particular coin. What type of test would you use?* |
| Solution | a left-tailed test |
| Exercise 41 | *If the alternative hypothesis has a not equals ( ≠ ) symbol, you know to use which type of test?* |
| Solution | a two-tailed test |
| Exercise 42 | *Assume the null hypothesis states that the mean is at least 18. Is this a left-tailed, right-tailed, or two-tailed test?* |
| Solution | This is a left-tailed test. |
| Exercise 43 | *Assume the null hypothesis states that the mean is at most 12. Is this a left-tailed, right-tailed, or two-tailed test?* |
| Solution | This is a right-tailed test. |
| Exercise 44 | *Assume the null hypothesis states that the mean is equal to 88. The alternative hypothesis states that the mean is not equal to 88. Is this a left-tailed, right-tailed, or two-tailed test?* |
| Solution | This is a two-tailed test |
| Exercise 45 | *Some of the following statements refer to the null hypothesis, some to the alternate hypothesis. State the null hypothesis, H0, and the alternative hypothesis. Ha, in terms of the appropriate parameter (μ or p).*  *a. The mean number of years Americans work before retiring is 34.*  *b. At most 60% of Americans vote in presidential elections.*  *c. The mean starting salary for San Jose State University graduates is at least $100,000 per year.*  *d. Twenty-nine percent of high school seniors get drunk each month.*  *e. Fewer than 5% of adults ride the bus to work in Los Angeles.*  *f. The mean number of cars a person owns in her lifetime is not more than ten.*  *g. About half of Americans prefer to live away from cities, given the choice.*  *h. Europeans have a mean paid vacation each year of six weeks.*  *i. The chance of developing breast cancer is under 11% for women.*  *j. Private universities' mean tuition cost is more than $20,000 per year.* |
| Solution | a. *H0*: *μ* = 34; *Ha*: *μ* ≠ 34  b. *H0*: *p* ≤ 0.60; *Ha*: *p* > 0.60  c. *H0*: *μ* ≥ 100,000; *Ha*: *μ* < 100,000  d. *H0*: *p* = 0.29; *Ha*: *p* ≠ 0.29  e. *H0*: *p* = 0.05; *Ha*: *p* < 0.05  f. *H0*: *μ* ≤ 10; *Ha*: *μ* > 10  g. *H0*: *p* = 0.50; *Ha*: *p* ≠ 0.50  h. *H0*: *μ* = 6; *Ha*: *μ* ≠ 6  i. *H0*: *p* ≥ 0.11; *Ha*: *p* < 0.11  j. *H0*: *μ* ≤ 20,000; *Ha*: *μ* > 20,000 |
| Exercise 46 | *Over the past few decades, public health officials have examined the link between weight concerns and teen girls' smoking. Researchers surveyed a group of 273 randomly selected teen girls living in Massachusetts (between 12 and 15 years old). After four years the girls were surveyed again. Sixty-three said they smoked to stay thin. Is there good evidence that more than thirty percent of the teen girls smoke to stay thin? The alternative hypothesis is:*  *a. p < 0.30*  *b. p ≤ 0.30*  *c. p ≥ 0.30*  *d. p > 0.30* |
| Solution | d |
| Exercise 47 | *A statistics instructor believes that fewer than 20% of Evergreen Valley College (EVC) students attended the opening night midnight showing of the latest Harry Potter movie. She surveys 84 of her students and finds that 11 attended the midnight showing.*  *An appropriate alternative hypothesis is:*  *a. p = 0.20*  *b. p > 0.20*  *c. p < 0.20*  d. *p* ≤ 0.20 |
| Solution | c |
| Exercise 48 | *Previously, an organization reported that teenagers spent 4.5 hours per week, on average, on the phone. The organization thinks that, currently, the mean is higher. Fifteen randomly chosen teenagers were asked how many hours per week they spend on the phone. The sample mean was 4.75 hours with a sample standard deviation of 2.0. Conduct a hypothesis test.*  *The null and alternative hypotheses are:*  *a. Ho:  = 4.5, Ha :  > 4.5*  *b. Ho : μ ≥ 4.5, Ha : μ < 4.5*  *c. Ho : μ = 4.75, Ha : μ > 4.75*  *d. Ho : μ = 4.5 Ha : μ > 4.5* |
| Solution | d |
| Exercise 49 | *State the Type I and Type II errors in complete sentences given the following statements.*  *a. The mean number of years Americans work before retiring is 34.*  *b. At most 60% of Americans vote in presidential elections.*  *c. The mean starting salary for San Jose State University graduates is at least $100,000 per year.*  *d. Twenty-nine percent of high school seniors get drunk each month.*  *e. Fewer than 5% of adults ride the bus to work in Los Angeles.*  *f. The mean number of cars a person owns in his or her lifetime is not more than ten.*  *g. About half of Americans prefer to live away from cities, given the choice.*  *h. Europeans have a mean paid vacation each year of six weeks.*  *i. The chance of developing breast cancer is under 11% for women.*  *j. Private universities mean tuition cost is more than $20,000 per year.* |
| Solution | a. Type I error: We conclude that the mean is not 34 years, when it really is 34 years. Type II error: We conclude that the mean is 34 years, when in fact it really is not 34 years.  b. Type I error: We conclude that more than 60% of Americans vote in presidential elections, when the actual percentage is at most 60%.Type II error: We conclude that at most 60% of Americans vote in presidential elections when, in fact, more than 60% do.  c. Type I error: We conclude that the mean starting salary is less than $100,000, when it really is at least $100,000. Type II error: We conclude that the mean starting salary is at least $100,000 when, in fact, it is less than $100,000.  d. Type I error: We conclude that the proportion of high school seniors who get drunk each month is not 29%, when it really is 29%. Type II error: We conclude that the proportion of high school seniors who get drunk each month is 29% when, in fact, it is not 29%.  e. Type I error: We conclude that fewer than 5% of adults ride the bus to work in Los Angeles, when the percentage that do is really 5% or more. Type II error: We conclude that 5% or more adults ride the bus to work in Los Angeles when, in fact, fewer that 5% do.  f. Type I error: We conclude that the mean number of cars a person owns in his or her lifetime is more than 10, when in reality it is not more than 10. Type II error: We conclude that the mean number of cars a person owns in his or her lifetime is not more than 10 when, in fact, it is more than 10.  g. Type I error: We conclude that the proportion of Americans who prefer to live away from cities is not about half, though the actual proportion is about half. Type II error: We conclude that the proportion of Americans who prefer to live away from cities is half when, in fact, it is not half.  h. Type I error: We conclude that the duration of paid vacations each year for Europeans is not six weeks, when in fact it is six weeks. Type II error: We conclude that the duration of paid vacations each year for Europeans is six weeks when, in fact, it is not.  i. Type I error: We conclude that the proportion is less than 11%, when it is really at least 11%. Type II error: We conclude that the proportion of women who develop breast cancer is at least 11%, when in fact it is less than 11%.  j. Type I error: We conclude that the average tuition cost at private universities is more than $20,000, though in reality it is at most $20,000. Type II error: We conclude that the average tuition cost at private universities is at most $20,000 when, in fact, it is more than $20,000. |
| Exercise 50 | *For statements a-j in Exercise 9.109, answer the following in complete sentences.*  *a. State a consequence of committing a Type I error.*  *b. State a consequence of committing a Type II error.* |
| Solution | a. Type I: Pension funds make investments that have maturity greater than 34 years. As a consequence, they do not have sufficient funds available for retirees' payout.  Type II: Pension funds act conservatively, and make investments that have maturity of at most 34 years (possibly losing out on higher interest earnings).  b. Type I: Too many voting booths are set up, costing tax payers more than required.  Type II: We do not have adequate voting booths, which result in longer waiting times at some booths.  c. Type I: San Jose' State University understates the value of its graduate degrees in its promotional materials.  Type II: San Jose' State University overstates the earning potential of its graduates.  d. Type I: We place less importance on educating high school seniors about the harmful effects of drinking (if 29% is considered to be too low).  Type II: (If 29% is considered too high,) more resources than needed are spent to raise public awareness about the dangers of teenage drinking.  e. Type I: Less public transportation is available than the demand necessitates.  Type II: Resources that could have been spent on education, for instance, get diverted towards providing public transportation in Los Angeles.  f. Type I: Car dealerships end up spending more on advertising new makes and models of cars to induce customers into buying newer cars.  Type II: Car dealerships choose not to advertise new makes and models as much as they probably should.  g. Type I: Housing supply falls short of demand in the suburbs beyond city limits where Americans prefer to live.  Type II: Too much housing is available beyond city limits, and not enough within the city limits.  h. Type I: European travel destinations spend less on advertisements to entice tourists than they probably should (if they think paid vacation time is less than six weeks).  Type II: We (Americans) start feeling resentful about not having six weeks' paid vacation like the Europeans!  i. Type I: Less resources are devoted towards research and development of new drugs for breast cancer treatment than warranted.  Type II: Doctors prescribe preventive mammograms more often than evidence would suggest necessary.  j. Type I: Estimates of student debt based on these numbers are overstated.  Type II: Estimates of student debt based on these numbers are understated, and consequently the magnitude of student debt becomes staggering. |
| Exercise 51 | *When a new drug is created, the pharmaceutical company must subject it to testing before receiving the necessary permission from the Food and Drug Administration (FDA) to market the drug. Suppose the null hypothesis is “the drug is unsafe.” What is the Type II Error?*  *a. To conclude the drug is safe when in, fact, it is unsafe.*  *b. Not to conclude the drug is safe when, in fact, it is safe.*  *c. To conclude the drug is safe when, in fact, it is safe.*  *d. Not to conclude the drug is unsafe when, in fact, it is unsafe.* |
| Solution | b |
| Exercise 52 | *A statistics instructor believes that fewer than 20% of Evergreen Valley College (EVC) students attended the opening midnight showing of the latest Harry Potter movie. She surveys 84 of her students and finds that 11 of them attended the midnight showing. The Type I error is to conclude that the percent of EVC students who attended is \_\_\_\_\_\_\_\_.*  *a. at least 20%, when in fact, it is less than 20%.*  *b. 20%, when in fact, it is 20%.*  *c. less than 20%, when in fact, it is at least 20%.*  *d. less than 20%, when in fact, it is less than 20%.* |
| Solution | a |
| Exercise 53 | *It is believed that Lake Tahoe Community College (LTCC) Intermediate Algebra students get less than seven hours of sleep per night, on average. A survey of 22 LTCC Intermediate Algebra students generated a mean of 7.24 hours with a standard deviation of 1.93 hours. At a level of significance of 5%, do LTCC Intermediate Algebra students get less than seven hours of sleep per night, on average?*  *The Type II error is not to reject that the mean number of hours of sleep LTCC students get per night is at least seven when, in fact, the mean number of hours*  *a. is more than seven hours.*  *b. is at most seven hours.*  *c. is at least seven hours.*  *d. is less than seven hours.* |
| Solution | d |
| Exercise 54 | *Previously, an organization reported that teenagers spent 4.5 hours per week, on average, on the phone. The organization thinks that, currently, the mean is higher. Fifteen randomly chosen teenagers were asked how many hours per week they spend on the phone. The sample mean was 4.75 hours with a sample standard deviation of 2.0. Conduct a hypothesis tes, the Type I error is:*  *a. to conclude that the current mean hours per week is higher than 4.5, when in fact, it is higher*  *b. to conclude that the current mean hours per week is higher than 4.5, when in fact, it is the same*  *c. to conclude that the mean hours per week currently is 4.5, when in fact, it is higher*  *d. to conclude that the mean hours per week currently is no higher than 4.5, when in fact, it is not higher* |
| Solution | b |
| Exercise 55 | *It is believed that Lake Tahoe Community College (LTCC) Intermediate Algebra students get less than seven hours of sleep per night, on average. A survey of 22 LTCC Intermediate Algebra students generated a mean of 7.24 hours with a standard deviation of 1.93 hours. At a level of significance of 5%, do LTCC Intermediate Algebra students get less than seven hours of sleep per night, on average?*  *The distribution to be used for this test is \_\_\_*  *a.*  *d. N(7.24,1.93)*  *c. t22*  *d. t21* |
| Solution | d |
| Exercise 56 | *A particular brand of tires claims that its deluxe tire averages at least 50,000 miles before it needs to be replaced. From past studies of this tire, the standard deviation is known to be 8,000. A survey of owners of that tire design is conducted. From the 28 tires surveyed, the mean lifespan was 46,500 miles with a standard deviation of 9,800 miles. Using alpha = 0.05, is the data highly inconsistent with the claim?* |
| Solution | a. *H0*: *μ* ≥ 50,000  b. *Ha*: *μ* < 50,000  c. Let  = the average lifespan of a brand of tires.  d. normal distribution  e. z = –2.315  f. *p*-value = 0.0103  g. Check student’s solution.  h. i. alpha: 0.05  ii. Decision: Reject the null hypothesis.  iii. Reason for decision: The *p*-value is less than 0.05.  iv. Conclusion: There is sufficient evidence to conclude that the mean lifespan of the tires is less than 50,000 miles.  i. (43,537, 49,463) |
| Exercise 57 | *From generation to generation, the mean age when smokers first start to smoke varies. However, the standard deviation of that age remains constant of around 2.1 years. A survey of 40 smokers of this generation was done to see if the mean starting age is at least 19. The sample mean was 18.1 with a sample standard deviation of 1.3. Do the data support the claim at the 5% level?* |
| Solution | a. *H0* : *μ* ≥ 19  b. *Ha* : *μ* < 19  c. Let  = the mean age at which a smoker first starts to smoke.  d. normal distribution  e. *z* = –2.71  f. *p*-value = 0.0034  g. Check student’s solution.  h. i. Alpha: 0.05  ii. Decision: Reject the null hypothesis.  iii. Reason for decision: The *p*-value is less than 0.05.  iv. Conclusion: There is sufficient evidence to conclude that the mean starting age of smokers is less than 19.  i. (17.449,18.757) |
| Exercise 58 | *The cost of a daily newspaper varies from city to city. However, the variation among prices remains steady with a standard deviation of 20￠. A study was done to test the claim that the mean cost of a daily newspaper is $1.00. Twelve costs yield a mean cost of 95￠ with a standard deviation of 18￠. Do the data support the claim at the 1% level?* |
| Solution | a. *H0* : *μ* = $1.00  b. *Ha*: *μ* ≠ $1.00  c. Let  = the average cost of a daily newspaper.  d. normal distribution  e. z = –0.866  f. *p*-value = 0.3865  g. Check student’s solution.  h. i. Alpha: 0.01  ii. Decision: Do not reject the null hypothesis.  iii. Reason for decision: The *p*-value is greater than 0.01.  iv. Conclusion: There is sufficient evidence to support the claim that the mean cost of daily papers is $1. The mean cost could be $1.  i. ($0.84, $1.06) |
| Exercise 59 | *An article in the San Jose Mercury News**stated that students in the California state university system take 4.5 years, on average, to finish their undergraduate degrees. Suppose you believe that the mean time is longer. You conduct a survey of 49 students and obtain a sample mean of 5.1 with a sample standard deviation of 1.2. Do the data support your claim at the 1% level?* |
| Solution | a. *H0* : *μ* ≤ 4.5  b. *Ha* : *μ* > 4.5  c. Let  = the average time to finish an undergraduate degree.  d. Student’s-t distribution  e. z = 3.5  f. *p*-value = 0.0005  g. Check student’s solution.  h. i. Alpha: 0.01  ii. Decision: Reject the null hypothesis  iii. Reason for decision: The *p*-value is less than the 0.01.  iv. Conclusion: There is sufficient evidence to conclude that the mean time is greater than 4.5 years.  i. (4.7553,5.4447) |
| Exercise 60 | *The mean number of sick days an employee takes per year is believed to be about ten. Members of a personnel department do not believe this figure. They randomly survey eight employees. The number of sick days they took for the past year are as follows: 12; 4; 15; 3; 11; 8; 6; 8. Let x = the number of sick days they took for the past year. Should the personnel team believe that the mean number is ten?* |
| Solution | a. *H0*: *μ* = 10  b. *Ha*: *μ* ≠ 10  c. Let  = the mean number of sick days an employee takes per year.  d. Student’s *t*-distribution  e. *t* = –1.12  f. *p*-value = 0.300  g. Check student’s solution.  h. i. Alpha: 0.05  ii. Decision: Do not reject the null hypothesis.  iii. Reason for decision: The *p*-value is greater than 0.05.  iv. Conclusion: At the 5% significance level, there is insufficient evidence to conclude that the mean number of sick days is not ten.  i. (4.9443, 11.806) |
| Exercise 61 | *In 1955, Life Magazine**reported that the 25 year-old mother of three worked, on average, an 80 hour week. Recently, many groups have been studying whether or not the women's movement has, in fact, resulted in an increase in the average work week for women (combining employment and at-home work). Suppose a study was done to determine if the mean work week has increased. 81 women were surveyed with the following results. The sample mean was 83; the sample standard deviation was ten. Does it appear that the mean work week has increased for women at the 5% level?* |
| Solution | a. *H0* : *μ* ≤ 80  b. *Ha* : *μ* > 80  c. Let  = the average work week for women.  d. Student’s-t distribution  e. 2.7  f. *p*-value = 0.0042  g. Check student’s solution.  h. i. Alpha: 0.05  ii. Decision: Reject the null hypothesis.  iii. Reason for decision: The *p*-value is less than 0.05.  iv. Conclusion: There is sufficient evidence to conclude that the mean work week for women is more than 80 hours.  i. (80.789,85.211) |
| Exercise 62 | *Your statistics instructor claims that 60 percent of the students who take her Elementary Statistics class go through life feeling more enriched. For some reason that she can't quite figure out, most people don't believe her. You decide to check this out on your own. You randomly survey 64 of her past Elementary Statistics students and find that 34 feel more enriched as a result of her class. Now, what do you think?* |
| Solution | a. *H0*: *p* ≥ 0.6  b. *Ha*: *p* < 0.6  c. Let *P′* = the proportion of students who feel more enriched as a result of taking Elementary Statistics.  d. normal for a single proportion  e. 1.12  f. *p*-value = 0.1308  g. Check student’s solution.  h. i. Alpha: 0.05  ii. Decision: Do not reject the null hypothesis.  iii. Reason for decision: The *p*-value is greater than 0.05.  iv. Conclusion: There is insufficient evidence to conclude that less than 60 percent of her students feel more enriched.  i. Confidence Interval: (0.409, 0.654)  The “plus-4s” confidence interval is (0.411, 0.648) |
| Exercise 63 | *A Nissan Motor Corporation advertisement read, “The average man’s I.Q. is 107. The average brown trout’s I.Q. is 4. So why can’t man catch brown trout?” Suppose you believe that the brown trout’s mean I.Q. is greater than four. You catch 12 brown trout. A fish psychologist determines the I.Q.s as follows: 5; 4; 7; 3; 6; 4; 5; 3; 6; 3; 8; 5. Conduct a hypothesis test of your belief.* |
| Solution | a. *H0*: *μ* ≤ 4  b. *Ha*: *μ* > 4  c. Let = the average I.Q. of a set of brown trout.  d. *t*11  e. *t* = 1.96  f. *p*-value = 0.0380  g. Check student’s solution.  h. i. Alpha: 0.05  ii. Decision: Reject the null hypothesis when *α* = 0.05, but do not reject null when  *α* = 0.01.  iii. Reason for decision: The *p*-value is less than 0.05 but greater than 0.01.  iv. Conclusion: When *α* = 0.05, there is sufficient evidence to conclude that the mean IQ for brown trout is greater than four. When *α* = 0.01, there is insufficient evidence to conclude that the mean IQ for brown trout is greater than four.  i. (3.8865,5.9468) |
| Exercise 64 | *Refer to Exercise 9.119. Conduct a hypothesis test to see if your decision and conclusion would change if your belief were that the brown trout’s mean I.Q. is* ***not*** *four.* |
| Solution | a. *H0*: *μ* = 4  b. *Ha*: *μ* ≠ 4  c. Let  the average I.Q. of a set of brown trout.  d. two-tailed Student’s *t*-test  e. *t* = 1.95  f. *p*-value = 0.076  g. Check student’s solution.  h. i. Alpha: 0.05  ii. Decision: Reject the null hypothesis.  iii. Reason for decision: The *p*-value is greater than 0.05  iv. Conclusion: There is insufficient evidence to conclude that the average IQ of brown trout is not four.  i. (3.8865,5.9468) |
| Exercise 65 | *According to an article in Newsweek, the natural ratio of girls to boys is 100:105. In China, the birth ratio is 100: 114 (46.7% girls). Suppose you don’t believe the reported figures of the percent of girls born in China. You conduct a study. In this study, you count the number of girls and boys born in 150 randomly chosen recent births. There are 60 girls and 90 boys born of the 150. Based on your study, do you believe that the percent of girls born in China is 46.7?* |
| Solution | a. *H0*: *p* = 0.467  b. *Ha*: *p* ≠ 0.467  c. Let *P′* = the proportion of births in China that are girls.  d. normal for a single proportion  e. –1.64  f. *p*-value = 0.1000  g. Check student’s solution.  h. i. alpha: 0.05  ii. Decision: Do not reject the null hypothesis.  iii. Reason for decision: The *p*-value is greater than 0.05.  iv. Conclusion: There is insufficient evidence to conclude that the proportion of girls born in China is not 0.467.  i. Confidence Interval: (0.3216, 0.4784)  The“plus-4s” confidence interval is (0.3251, 0.4801). |
| Exercise 66 | *A poll done for Newsweek found that 13% of Americans have seen or sensed the presence of an angel. A contingent doubts that the percent is really that high. It conducts its own survey. Out of 76 Americans surveyed, only two had seen or sensed the presence of an angel. As a result of the contingent’s survey, would you agree with the Newsweek poll? In complete sentences, also give three reasons why the two polls might give different results.* |
| Solution | a. *H0*: *p* ≥ 0.13  b. *Ha*: *p* < 0.13  c. Let *P′* = the proportion of Americans who have seen or sensed angels  d. normal for a single proportion  e. –2.688  f. *p*-value = 0.0036  g. Check student’s solution.  h. i. alpha: 0.05  ii. Decision: Reject the null hypothesis.  iii. Reason for decision: The *p*-value is less than 0.05.  iv. Conclusion: There is sufficient evidence to conclude that the percentage of Americans who have seen or sensed an angel is less than 13%.  i. (0, 0.0623).  The“plus-4s” confidence interval is (0.0022, 0.0978) |
| Exercise 67 | *The mean work week for engineers in a start-up company is believed to be about 60 hours. A newly hired engineer hopes that it’s shorter. She asks ten engineering friends in start-ups for the lengths of their mean work weeks. Based on the results that follow, should she count on the mean work week to be shorter than 60 hours?*  *Data (length of mean work week): 70; 45; 55; 60; 65; 55; 55; 60; 50; 55.* |
| Solution | a. *H0*: *μ* ≥ 60  b. *Ha*: *μ* < 60  c. Let the mean length of work weeks for engineers at the company.  d. *t*9  e. –1.33  f. *p*-value = 0.1086  g. Check student’s solution.  h. i. Alpha: 0.05  ii. Decision: Do not reject the null hypothesis.  iii. Reason for decision: The *p*-value is greater than 0.05  iv. Conclusion: There is insufficient evidence that the mean work week for company engineers is shorter than 60 hours.  i. (51.886, 62.114) |
| Exercise 68 | *Sixty-eight percent of online courses taught at community colleges nationwide were taught by full-time faculty. To test if 68% also represents California’s percent for full-time faculty teaching the online classes, Long Beach City College (LBCC) in California, was randomly selected for comparison. In the same year, 34 of the 44 online courses LBCC offered were taught by full-time faculty. Conduct a hypothesis test to determine if 68% represents California. NOTE: For more accurate results, use more California community colleges and this past year's data.* |
| Solution | a. *H0*: *p* = 0.68  b. *Ha*: *p* ≠ 0.68  c. Let *P′* = the proportion of online courses at LBCC that are taught by full-time faculty.  d. normal for a single proportion.  e. 1.32  f. 0.1873  g. Check student’s solution.  h. i. aApha: 0.05  ii. Decision: Do not reject the null hypothesis.  iii. Reason for decision: The *p*-value is greater than 0.05  iv. At the 5% level, the data do not provide statistically significant evidence that the true proportion of online courses taught by full-time faculty is not 68%.  i. Confidence Interval: (0.65, 0.90): The “plus-4s” confidence interval is (0.6275, 0.8725). |
| Exercise 69 | *According to an article in Bloomberg Businessweek, New York City's most recent adult smoking rate is 14%. Suppose that a survey is conducted to determine this year’s rate. Nine out of 70 randomly chosen N.Y. City residents reply that they smoke. Conduct a hypothesis test to determine if the rate is still 14% or if it has decreased.* |
| Solution | a. *H0*: *p* = 0.14  b. *Ha*: *p* < 0.14  c. Let *P′* = the proportion of NYC residents that smoke.  d. normal for a single proportion  e. –0.2756  f. *p*-value = 0.3914  g. Check student’s solution.  h. i. alpha: 0.05  ii. Decision: Do not reject the null hypothesis.  iii. Reason for decision: The *p*-value is greater than 0.05.  iv. At the 5% significance level, there is insufficient evidence to conclude that the proportion of NYC residents who smoke is less than 0.14.  i. Confidence Interval: (0.0502, 0.2070): The “plus-4s” confidence interval (see chapter 8) is (0.0676, 0.2297). |
| Exercise 70 | *The mean age of De Anza College students in a previous term was 26.6 years old. An instructor thinks the mean age for online students is older than 26.6. She randomly surveys 56 online students and finds that the sample mean is 29.4 with a standard deviation of 2.1. Conduct a hypothesis test.* |
| Solution | a. *H0*: *μ* = 26.6  b. *Ha*: *μ* > 26.6  c. Let  = the mean age for online students at De Anza College.  d. Student’s *t*-distribution  e. 9.98  f. *p*-value = 0.0000  g. Check student’s solution.  h. i. Alpha: 0.01  ii. Decision: Reject the null hypothesis.  iii. Reason for decision: The *p*-value is less than 0.01.  iv. There is sufficient evidence to conclude that the mean age of online students at De Anza College is greater than 26.6 years.  i. (28.8, 30.0) |
| Exercise 71 | *Registered nurses earned an average annual salary of $69,110. For that same year, a survey was conducted of 41 California registered nurses to determine if the annual salary is higher than $69,110 for California nurses. The sample average was $71,121 with a sample standard deviation of $7,489. Conduct a hypothesis test.* |
| Solution | a. *H0*: *μ* = 69,110  b. *Ha*: *μ* > 69,110  c. Let  = the mean salary in dollars for California registered nurses.  d. Student’s *t*-distribution  e. *t* = 1.719  f. *p*-value: 0.0466  g. Check student’s solution.  h. i. Alpha: 0.05  ii. Decision: Reject the null hypothesis.  iii. Reason for decision: The *p*-value is less than 0.05.  iv. Conclusion: At the 5% significance level, there is sufficient evidence to conclude that the mean salary of California registered nurses exceeds $69,110.  i. ($68,757, $73,485) |
| Exercise 72 | *La Leche League International reports that the mean age of weaning a child from breastfeeding is age four to five worldwide. In America, most nursing mothers wean their children much earlier. Suppose a random survey is conducted of 21 U.S. mothers who recently weaned their children. The mean weaning age was nine months (3/4 year) with a standard deviation of 4 months. Conduct a hypothesis test to determine if the mean weaning age in the U.S. is less than four years old.* |
| Solution | a. *H0*: *μ* = 4  b. *Ha*: *μ* < 4  c. Let *μ* represent the mean age at which American mothers wean their children  d. Student’s *t*-distribution  e. –44.7  f. *p*-value = 0.0000  g. Check student’s solution.  h. i. alpha: 0.01  ii. Decision: Reject the null hypothesis.  iii. Reason for decision: *p*-value is less than 0.01.  iv. There is sufficient evidence to conclude that the mean age at which American mothers wean their children is less than four years old.  i. (0.60 years, 0.90 years) or approximately (7.2 months, 10.8 months), when the sample standard deviation is rounded to 0.33. |
| Exercise 73 | *Over the past few decades, public health officials have examined the link between weight concerns and teen girls' smoking. Researchers surveyed a group of 273 randomly selected teen girls living in Massachusetts (between 12 and 15 years old). After four years the girls were surveyed again. Sixty-three said they smoked to stay thin. Is there good evidence that more than thirty percent of the teen girls smoke to stay thin? After conducting the test, your decision and conclusion are*  *a. Reject H0 : There is sufficient evidence to conclude that more than 30% of teen girls smoke to stay thin.*  *b. Do not reject H0 : There is not sufficient evidence to conclude that less than 30% of teen girls smoke to stay thin.*  *c. Do not reject H0 : There is not sufficient evidence to conclude that more than 30% of teen girls smoke to stay thin.*  *d. Reject H0 : There is sufficient evidence to conclude that less than 30% of teen girls smoke to stay thin.* |
| Solution | c |
| Exercise 74 | *A statistics instructor believes that fewer than 20% of Evergreen Valley College (EVC) students attended the opening night midnight showing of the latest Harry Potter movie. She surveys 84 of her students and finds that 11 of them attended the midnight showing.*  *At a 1% level of significance, an appropriate conclusion is:*  *a. There is insufficient evidence to conclude that the percent of EVC students who attended the midnight showing of Harry Potter is less than 20%.*  *b. There is sufficient evidence to conclude that the percent of EVC students who attended the midnight showing of Harry Potter is more than 20%.*  *c. There is sufficient evidence to conclude that the percent of EVC students who attended the midnight showing of Harry Potter is less than 20%.*  *d. There is insufficient evidence to conclude that the percent of EVC students who attended the midnight showing of Harry Potter is at least 20%.* |
| Solution | a |
| Exercise 75 | *Previously, an organization reported that teenagers spent 4.5 hours per week, on average, on the phone. The organization thinks that, currently, the mean is higher. Fifteen randomly chosen teenagers were asked how many hours per week they spend on the phone. The sample mean was 4.75 hours with a sample standard deviation of 2.0. Conduct a hypothesis test.*  *At a significance level of a = 0.05, what is the correct conclusion?*  *a. There is enough evidence to conclude that the mean number of hours is more than 4.75*  *b. There is enough evidence to conclude that the mean number of hours is more than 4.5*  *c. There is not enough evidence to conclude that the mean number of hours is more than 4.5*  *d. There is not enough evidence to conclude that the mean number of hours is more than 4.75* |
| Solution | c |
| Exercise 76 | *According to the Center for Disease Control website, in 2011 at least 18% of high school students have smoked a cigarette. An Introduction to Statistics class in Davies County, KY conducted a hypothesis test at the local high school (a medium sized–approximately 1,200 students–small city demographic) to determine if the local high school’s percentage was lower. One hundred fifty students were chosen at random and surveyed. Of the 150 students surveyed, 82 have smoked. Use a significance level of 0.05 and using appropriate statistical evidence, conduct a hypothesis test and state the conclusions.*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0*: *p* ≥ 0.18; *Ha*: *p* < 0.18  b. *p*-value = 1  c. alpha = 0.05  d. Do not reject the null hypothesis.  e. At the 5% level of significance, there is not enough evidence to conclude that the local high school’s proportion of students who smoke is less than 0.18. |
| Exercise 77 | *A recent survey in the N.Y. Times Almanac indicated that 48.8% of families own stock. A broker wanted to determine if this survey could be valid. He surveyed a random sample of 250 families and found that 142 owned some type of stock. At the 0.05 significance level, can the survey be considered to be accurate?*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0*: *p* = 0.488; *Ha*: *p* ≠ 0.488  b. *p*-value = 0.0114  c. Alpha = 0.05  d. Reject the null hypothesis.  e. At the 5% level of significance, there is enough evidence to conclude that 48.8% of families own stocks.  f. The survey does not appear to be accurate. |
| Exercise 78 | *Driver error can be listed as the cause of approximately 54% of all fatal auto accidents, according to the American Automobile Association. Thirty randomly selected fatal accidents are examined, and it is determined that 14 were caused by driver error. Using α = 0.05, is the AAA proportion accurate?*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0*: *p* = 0.54; *Ha*: *p* ≠ 0.54  b. *p*-value = 0.4203  c. Alpha = 0.05  d. Do not reject the null hypothesis.  e. At the 5% significance level, there is not enough evidence to conclude that the proportion of fatal accidents that are the driver’s fault is not 0.54.  f. It appears that the American Automobile Association’s claim is accurate. |
| Exercise 79 | *The US Department of Energy reported that 51.7% of homes were heated by natural gas. A random sample of 221 homes in Kentucky found that 115 were heated by natural gas. Does the evidence support the claim for Kentucky at the α = 0.05 level in Kentucky? Are the results applicable across the country? Why?*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0*: *p* = 0.517; *Ha*: *p* ≠ 0.517  b. *p*-value = 0.9203.  c. Alpha = 0.05.  d. Do not reject the null hypothesis.  e. At the 5% significance level, there is not enough evidence to conclude that the proportion of homes in Kentucky that are heated by natural gas is 0.517.  f. However, we cannot generalize this result to the entire nation. First, the sample’s population is only the state of Kentucky. Second, it is reasonable to assume that homes in the extreme north and south will have extreme high usage and low usage, respectively. We would need to expand our sample base to include these possibilities if we wanted to generalize this claim to the entire nation. |
| Exercise 80 | *For Americans using library services, the American Library Association claims that at most 67% of patrons borrow books. The library director in Owensboro, Kentucky feels this is not true, so she asked a local college statistic class to conduct a survey. The class randomly selected 100 patrons and found that 82 borrowed books. Did the class demonstrate that the percentage was higher in Owensboro, KY? Use α = 0.01 level of significance. What is the possible proportion of patrons that do borrow books from the Owensboro Library?*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0*: *p* ≤ 0.67 *Ha*: *p* > 0.67  b. *p*-value = 0.0007  c. Alpha = 0.01.  d. Reject the null hypothesis.  e. At the 1% significance level, there is enough evidence to conclude that the proportion of patrons in Owensboro, KY who borrow books is more than 0.67. The class demonstrated that the percentage was higher than 67%.  f. To determine the possible proportion of patrons who do borrow books, construct a 95% confidence interval. It is (0.7447, 0.8953). We are 95% confident that the true population proportion of patrons in Owensboro, KY who borrow books is between 0.7447 and 0.8953 (between 74.47% and 89.53%). |
| Exercise 81 | *The Weather Underground reported that the mean amount of summer rainfall for the northeastern US is at least 11.52 inches. Ten cities in the northeast are randomly selected and the mean rainfall amount is calculated to be 7.42 inches with a standard deviation of 1.3 inches. At the α = 0.05 level, can it be concluded that the mean rainfall was below the reported average? What if α = 0.01? Assume the amount of summer rainfall follows a normal distribution.*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0*: *μ* ≥ 11.52; *Ha*: *μ* < 11.52  b. *p*-value = 0.000002 which is almost 0.  c. Alpha = 0.05.  d. Reject the null hypothesis.  e. At the 5% significance level, there is enough evidence to conclude that the mean amount of summer rain in the northeaster US is less than 11.52 inches, on average.  f. We would make the same conclusion if alpha was 1% because the *p*-value is almost 0. |
| Exercise 82 | *A survey in the N.Y. Times Almanac finds the mean commute time (one way) is 25.4 minutes for the 15 largest US cities. The Austin, TX chamber of commerce feels that Austin’s commute time is less and wants to publicize this fact. The mean for 25 randomly selected commuters is 22.1 minutes with a standard deviation of 5.3 minutes. At the α = 0.10 level, is the Austin, TX commute significantly less than the mean commute time for the 15 largest US cities?*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0*: *μ* = 25.4 *Ha*: *μ* < 25.4  b. *p*-value = 0.0024  c. Alpha = 0.10.  d. Reject the null hypothesis.  e. At the 10% level of significance, there is enough evidence to conclude that the one-way mean commute in Austin, TX is less than 25.4 miles, which is the mean commute for the 15 largest US cities. |
| Exercise 83 | *A report by the Gallup Poll found that a woman visits her doctor, on average, at most 5.8 times each year. A random sample of 20 women results in these yearly visit totals*  *3; 2; 1; 3; 7; 2; 9; 4; 6; 6; 8; 0; 5; 6; 4; 2; 1; 3; 4; 1*  *At the α = 0.05 level can it be concluded that the sample mean is higher than 5.8 visits per year?*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0*: *μ* ≤ 5.8 *Ha*: *μ* > 5.8  b. *p*-value = 0.9987  c. Alpha = 0.05  d. Do not reject the null hypothesis.  e. At the 5% level of significance, there is not enough evidence to conclude that a woman visits her doctor, on average, more than 5.8 times a year. |
| Exercise 84 | *According to the N.Y. Times Almanac the mean family size in the U.S. is 3.18. A sample of a college math class resulted in the following family sizes:*  *5; 4; 5; 4; 4; 3; 6; 4; 3; 3; 5; 5; 6; 3; 3; 2; 7; 4; 5; 2; 2; 2; 3; 2*  *At α = 0.05 level, is the class’ mean family size greater than the national average? Does the Almanac result remain valid? Why?*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0 μ* = 3.18 *Ha*: *μ* > 3.18  b. *p*-value = 0.0179  c. alpha = 0.05.  d. Reject the null hypothesis.  e. At the 5% level of significance, there is enough evidence to conclude that the class’ mean family size is greater than  the national average of 3.18.  f. However, the almanac claim can still be considered valid. This sample does not meet the requirements for inference. It is not a randomly generated sample, and the size is too small to assume normalcy. |
| Exercise 85 | *The student academic group on a college campus claims that freshman students study at least 2.5 hours per day, on average. One Introduction to Statistics class was skeptical. The class took a random sample of 30 freshman students and found a mean study time of 137 minutes with a standard deviation of 45 minutes. At α = 0.01 level, is the student academic group’s claim correct?*  *a. State the null and alternate hypothesis.*  *b. State the p-value.*  *c. State alpha.*  *d. What is your decision?*  *e. Write a conclusion.*  *f. Answer any other questions asked in the problem.* |
| Solution | a. *H0*: *μ* ≥ 150 *Ha*: *μ* < 150  b. *p*-value = 0.0622  c. alpha = 0.01  d. Do not reject the null hypothesis.  e. At the 1% significance level, there is not enough evidence to conclude that freshmen students study less than 2.5 hours per day, on average.  f. The student academic group’s claim appears to be correct. |
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