

7.S: Hypothesis Testing (Solutions- Practice + Homework)

38. a right-tailed test

40. a left-tailed test

42. This is a left-tailed test.

44. This is a two-tailed test.

45.

- a. $H_0: \mu = 34; H_a: \mu \neq 34$
- b. $H_0: p \leq 0.60; H_a: p > 0.60$
- c. $H_0: \mu \geq 100,000; H_a: \mu < 100,000$
- d. $H_0: p = 0.29; H_a: p \neq 0.29$
- e. $H_0: p = 0.05; H_a: p < 0.05$
- f. $H_0: \mu \leq 10; H_a: \mu > 10$
- g. $H_0: p = 0.50; H_a: p \neq 0.50$
- h. $H_0: \mu = 6; H_a: \mu \neq 6$
- i. $H_0: p \geq 0.11; H_a: p < 0.11$
- j. $H_0: \mu \leq 20,000; H_a: \mu > 20,000$

47.c

49.

- 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 than 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

51. b

55. d

56.

- a. $H_0: \mu \geq 50,000$
- b. $H_a: \mu < 50,000$
- c. Let \overline{X} = the average lifespan of a brand of tires.
- d. normal distribution
- e. $z = -2.315$
- f. $p\text{-value} = 0.0103$
- g. Check student's solution.
- h.
 - i. alpha: 0.05
 - ii. Decision: Reject the null hypothesis.
 - iii. Reason for decision: The $p\text{-value}$ 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)

58.

- a. $H_0: \mu = \$1.00$
- b. $H_a: \mu \neq \$1.00$
- c. Let \overline{X} = the average cost of a daily newspaper.
- d. normal distribution
- e. $z = -0.866$
- f. $p\text{-value} = 0.3865$
- g. Check student's solution.
- h.
 - i. Alpha: 0.01
 - ii. Decision: Do not reject the null hypothesis.
 - iii. Reason for decision: The $p\text{-value}$ 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,

60.

- a. $H_0: \mu = 10$
- b. $H_a: \mu \neq 10$
- c. Let \overline{X} = the mean number of sick days an employee takes per year.
- d. Student's t -distribution
- e. $t = -1.12$
- f. $p\text{-value} = 0.300$
- g. Check student's solution.
- h.
 - i. Alpha: 0.05
 - ii. Decision: Do not reject the null hypothesis.
 - iii. Reason for decision: The $p\text{-value}$ 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)

62.

- a. $H_0: p \geq 0.6$
- b. $H_a: p < 0.6$
- 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. $p\text{-value} = 0.1308$
- 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)

64.

- a. $H_0: \mu = 4$
- b. $H_a: \mu \neq 4$
- c. Let \bar{X} 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)

66.

- a. $H_0: p \geq 0.13$
- b. $H_a: p < 0.13$
- 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)

69.

- a. $H_0: p = 0.14$
- b. $H_a: p < 0.14$
- 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).

71.

- a. $H_0: \mu = 69,110$
- b. $H_a: \mu > 69,110$
- c. Let \overline{X} = 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)

73. c

75. c

77.

- a. $H_0: p = 0.488$ $H_a: p \neq 0.488$
- 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.

79.

- a. $H_0: p = 0.517$ $H_a: p \neq 0.517$
- 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.

81.

- a. $H_0: \mu \geq 11.52$ $H_a: \mu < 11.52$
- 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 α was 1% because the p -value is almost 0.

83.

- a. $H_0: \mu \leq 5.8$ $H_a: \mu > 5.8$
- 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.

85.

1. $H_0 : \mu \geq 150$ $H_a : \mu < 150$
2. p -value = 0.0622
3. $\alpha = 0.01$
4. Do not reject the null hypothesis.
5. 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.
6. The student academic group's claim appears to be correct.

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