

EXERCISE ANSWER SECTION CHAPTER 10
ONE-SAMPLE TESTS OF HYPOTHESES

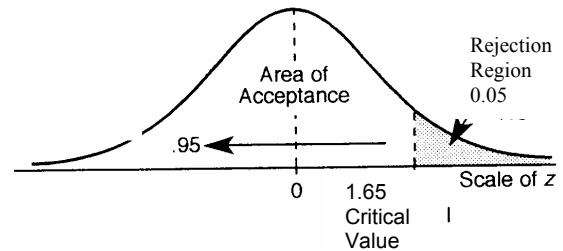
Exercise 10.1

$$H_0: \mu \leq \$30$$

$$H_1: \mu > \$30$$

H_0 is rejected if z is greater than 1.65.

$$z = \frac{\$33 - \$30}{\$12 / \sqrt{40}} = 1.58$$



H_0 is not rejected. No increase in the mean amount spent.

p -value = $P(z > 1.58) = 0.5000 - 0.4429 = 0.0571$ The p -value of $0.0571 \geq 0.05$, do not reject H_0 .

Exercise 10.2

Step 1: State the null and alternate hypotheses: The null hypothesis is that there is no change in the construction time. That is, the construction time is at least 3.5 days. The alternate hypothesis is that the construction time is less than 3.5 days. Symbolically, these statements are written as follows:

$$H_0: \mu \geq 3.5$$

$$H_1: \mu < 3.5$$

Step 2: Select the level of significance: It was given as 0.05.

Step 3: Select the test statistic: The test static is the t distribution. The distribution is said to be a normal distribution, however we do not know the value of the population standard deviation. Also, we have a small sample. We use text Formula [9-3]:

Thus:
$$t = \frac{\bar{X} - \mu}{s / \sqrt{n}} = \frac{3.4 - 3.5}{0.8 / \sqrt{15}} = \frac{-0.1}{0.20656} = -0.48$$

Step 4: Develop the decision rule: The critical values of t are given in Appendix F. The number of degrees of freedom is $(n - 1) = (15 - 1) = 14$. We have a one-tailed test, so we find the portion of the table labeled ‘one-tailed.’ Locate the column for the 0.05 significance level. Read down the column until it intersects the row with 14 degrees of freedom. The value is 1.761.

Since this is a one-tailed test and the rejection region is in the left tail, the critical value is negative. The decision rule is to reject H_0 if the value of t is less than -1.761 .

Step 5: Make a decision regarding the null hypothesis, and interpret the results: Because -0.48 lies to the right of the critical value -1.761 , the null hypothesis is not rejected at the 0.05

significance level. This indicates that the use of the “precut and assembled roof trusses” does not decrease the construction time to less than 3.5 days.

Exercise 10.3

Step 1: State the null and alternate hypotheses: The null hypothesis is that The University of Findlay students use the computer 2.55 hours a day. The alternate hypothesis is that The University of Findlay students do not use the computer 2.55 hours a day. Symbolically, these statements are written as follows:

$$H_0 : \mu = 2.55$$

$$H_1 : \mu \neq 2.55$$

Step 2: Select the level of significance: We decide on the 0.05 significance level.

Step 3: Select the test statistic: The test static in this situation is the *t* distribution.

We need to calculate the mean and standard deviation of the sample. The standard deviation of the sample can be determined using either Formula [3-2] or [3-10].

<i>X</i>	$X - \bar{X}$	$(X - \bar{X})^2$
3.15	0.46154	0.21302
3.25	0.56154	0.31533
2.00	-0.68846	0.47398
2.50	-0.18846	0.03552
2.65	-0.03846	0.00148
2.75	0.06154	0.00379
2.35	-0.33846	0.11456
2.85	0.16154	0.02610
2.95	0.26154	0.06840
2.45	-0.23846	0.05686
1.95	-0.73846	0.54532
2.35	-0.33846	0.11456
<u>3.75</u>	<u>1.06154</u>	<u>1.12687</u>
Σ 34.95	0.00000	3.09579

$$\bar{X} = \frac{\Sigma X}{n} = \frac{34.95}{13} = 2.68846$$

$$s = \sqrt{\frac{\Sigma(X - \bar{X})^2}{n - 1}} = \sqrt{\frac{3.09579}{13 - 1}}$$

$$= \sqrt{0.25798} = 0.5079 = 0.51$$

The value of *t* is computed using Formula [10-5]:

$$t = \frac{\bar{X} - \mu}{s / \sqrt{n}} = \frac{2.69 - 2.55}{0.51 / \sqrt{13}} = \frac{0.14}{0.1414} = 0.9901$$

Step 4: Develop the decision rule:

Remember that the significance level stated in the problem is 0.05. The critical values of *t* are given in Appendix F. The number of degrees of freedom is $(n - 1) = (13 - 1) = 12$. We have a two-tailed test, so we find the portion of the table labeled “two-tailed.” Locate the column for the 0.05 significance level. Read down the column until it intersects the row with 12 degrees of freedom. The value is 2.179.

The decision rule is: Reject the null hypothesis if the computed value of t is to the left of -2.179 , or to the right of 2.179

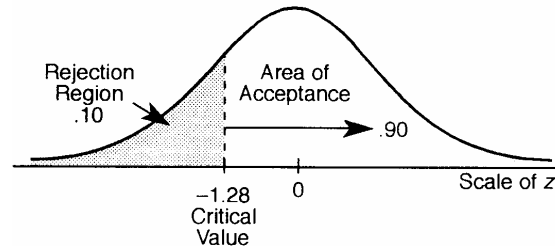
Step 5: Make a decision regarding the null hypothesis, and interpret the results:

The value of t lies between the two critical values: -2.179 and 2.179 . The null hypothesis is not rejected at the 0.05 significance level. We conclude the population mean hours of usage could be 2.55 hours per day. The evidence fails to show Findlay students to be different.

Exercise 10.4

$$H_0: \rho \geq 0.40 \quad H_1: \rho < 0.40$$

The 0.10 level of significance yields a decision rule of $(0.500 - 0.100) = 0.400$ or 1.28. Thus, H_0 is rejected if z is less than -1.28 .



$$z = \frac{\frac{60}{200} - 0.40}{\sqrt{\frac{(0.40)(1-0.40)}{200}}} = \frac{-0.10}{0.03464} = -2.886 = -2.89$$

Since -2.89 lies to the left of -1.28 H_0 is rejected. Less than 40% of the viewing audience watched the concert.

The p -value is the probability of a z value to the left of -2.89 . It is $(0.5000 - 0.4981) = 0.0019$, which is less than the level of significance of 0.10; thus we reject H_0 .