As displayed in Figure 11.4.2, the value of the test statistic does not fall in the rejection region because $-1.645 < -0.48 < 1.645$. Thus, the difference between the observed value and the hypothesized value is likely due to ordinary sampling variation. We fail to reject the null hypothesis at $\alpha = 0.10$.

Using the P-value approach, we want to find $2P(Z < -0.48) = 2(0.3156) = 0.6312$. You may recall that the decision rule when using the P-value approach is that we reject the null hypothesis if the P-value is less than α. Thus, since the P-value is 0.6312 which is greater than 0.10, we fail to reject the null hypothesis.

Conclusion and Interpretation: There is insufficient evidence at $\alpha = 0.10$ for the cell phone executive to conclude that the proportion of defective phones produced differs between the two plants.

11.4 Exercises

Basic Concepts

1. Why is comparing two population proportions particularly useful?

2. Give two examples of situations in which someone would be interested in comparing population proportions.

3. What assumptions are necessary to perform a hypothesis test for the difference between two population proportions?

4. Which sampling distribution is used in a two-sample test of hypothesis about population proportions? What are the characteristics of this sampling distribution?

5. What is the test statistic that is used when comparing two population proportions?

6. True or false: in order to use the specified test statistic, the hypothesized difference in the null hypothesis between the two population proportions must be zero.

Exercises

7. Determine the critical value(s) of the test statistic for each of the following large sample tests for the comparison of two population proportions.

- **a.** Left-tailed test, $\alpha = 0.01$
- **b.** Right-tailed test, $\alpha = 0.05$
- **c.** Two-tailed test, $\alpha = 0.10$

8. Determine the critical value(s) of the test statistic for each of the following large sample tests for the comparison of two population proportions.

- **a.** Left-tailed test, $\alpha = 0.025$
- **b.** Right-tailed test, $\alpha = 0.02$
- **c.** Two-tailed test, $\alpha = 0.04$

9. A fund-raiser believes that women are more likely to say "Yes" when asked to donate to a worthy cause than men. To test this theory, she randomly selects 100 men and 95 women and asks for donations to the same cause. The results of the survey are as follows.

Fund-Raiser Survey

	Number Surveyed	# of "Yes" Responses
Men	100	6
Women	95	9

a. Are the sample sizes large enough such that a hypothesis test for the difference between two population proportions may be performed? If so, do the data substantiate the fund-raiser's theory at $\alpha = 0.10$?

b. Calculate the P-value for the test and interpret its meaning.

c. Calculate a 95% confidence interval for the difference in the proportion of men and women who would most likely donate to a worthy cause. Interpret the interval.

10. A poll is conducted to determine if U.S. citizens think that there should be a national health care system in the U.S. 69% of the 300 women surveyed and 63% of the 250 men surveyed think that there should be a national health care system in the U.S. Are the sample sizes large enough such that a hypothesis test for the difference between two population proportions may be performed? If so, is there sufficient evidence to conclude at $\alpha = 0.05$ that men and women feel differently about this issue?

11. Major television networks have never seemed to have issues showing commercials for beer and other alcoholic beverages. Even though adult viewers tend to enjoy the commercials, most adults seem to think that the commercials target teenagers and young adults (those under 21 years old). To study this belief, the networks conducted a joint poll of viewers and asked them if they felt that beer and other alcoholic beverage commercials targeted teenagers and young adults. The results of the survey are as follows.

Network Advertising Survey		
Age Group	**Number Surveyed**	**Number of "Yes" Responses**
30 or Younger	1000	450
Older than 30	1000	655

a. Are the sample sizes large enough such that inferences about the difference between two population proportions can be made? If so, calculate a 99% confidence interval for the difference in the proportions of those older than 30 and those 30 or younger that believe alcoholic beverage commercials targeted teenagers and young adults. Interpret the interval.

b. Based on the data, can the networks conclude that the percentage of viewers who believe beer and alcoholic beverage commercials target teenagers and young adults is significantly higher in the over 30 age group than in the 30 or younger age group at $\alpha = 0.01$?

12. A manufacturer is comparing shipments of machine parts from two suppliers. The parts from Supplier A are less expensive; however, the manufacturer is concerned that the parts may be of a lower quality than those from Supplier B. The manufacturer has decided that he will purchase his supplies from Supplier A unless he can show that the proportion of defective parts is significantly higher for Supplier A than for Supplier B. He randomly selects parts from each supplier and inspects them for defects. The results are as follows. Determine whether the sample sizes are large enough such that inferences about the difference between the population proportions can be made. If so, which supplier will the manufacturer choose at $\alpha = 0.05$? Explain.

Number of Defective Parts		
	Number Surveyed	**Number of Defective Parts**
Supplier A	400	8
Supplier B	300	5