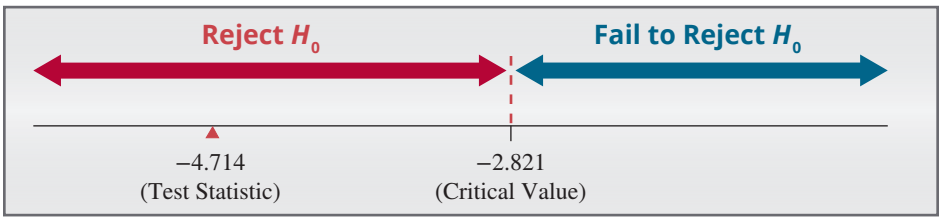


Since the P-value of 0.00055 is much smaller than $\alpha = 0.01$, the null hypothesis is rejected.

Step 6: State the conclusion in terms of the original problem.

There is sufficient evidence for the researcher to conclude at $\alpha = 0.01$ that the average response time is significantly higher for those participants who have drunk one ounce of 100-proof alcohol than those who have not.

12.3 Exercises

Basic Concepts

1. Describe the differences between an independent experimental design and a paired design.
2. What are the assumptions for a paired difference experimental design?
3. What is the appropriate statistical measure to use when performing a hypothesis test about a paired difference experiment?
4. How does the hypothesis testing procedure for a paired difference experiment differ from that of a two-sample t-test?
5. What is the test statistic used in a paired difference hypothesis test?

Exercises

6. Determine the critical value(s) of the test statistic for each of the following paired difference tests (assume the differences have an approximately normal distribution).
   - **a.** Left-tailed test, $\alpha = 0.01$, $n = 15$
   - **b.** Right-tailed test, $\alpha = 0.10$, $n = 20$
   - **c.** Two-tailed test, $\alpha = 0.05$, $n = 8$

7. Determine the critical value(s) of the test statistic for each of the following paired difference tests (assume the differences have an approximately normal distribution).
   - **a.** Left-tailed test, $\alpha = 0.005$, $n = 12$
   - **b.** Right-tailed test, $\alpha = 0.025$, $n = 5$
   - **c.** Two-tailed test, $\alpha = 0.10$, $n = 25$

8. Given that most textbooks can now be purchased online, one wonders if students can save money by comparison shopping for textbooks at online retailers and at their local bookstores. To investigate, students at a university randomly sampled 25 textbooks on the shelves of their local bookstores. The students then found the "best" available price for the same textbooks via online retailers. The prices for the textbooks are listed in the following table. Let the difference d = bookstore price - online retailer price.

a. Is a paired design appropriate for the above study? Explain.

b. What assumption must be made in order to perform the test of hypothesis?

c. Does the data appear to satisfy the assumption described in part **b.**? Why or why not?

d. Based on the data, is it less expensive for the students to purchase textbooks from the online retailers than from local bookstores? Use $\alpha = 0.01$.

e. Calculate a 99% confidence interval for the mean difference in cost between the bookstores and the online retailers. Interpret the interval.

Data

stat.hawkeslearning.com
Discovering Statistics and Data, Fourth Edition > Data Sets > Textbook Prices

Textbook Prices

	Price ($)	
Textbook	**Bookstore**	**Online Retailer**
1	70	60
2	38	36
3	88	89
4	165	149
5	80	136
6	103	95
7	42	50
8	98	111
9	89	65
10	97	86
11	140	130
12	40	30
13	175	150
14	85	75
15	100	85
16	68	62
17	67	69
18	140	142
19	49	40
20	149	127
21	126	130
22	92	93
23	144	129
24	98	84
25	40	52

9. The management for a large grocery store chain would like to determine if a new scanner will enable cashiers to process a larger number of items on average than the scanner they are currently using. Seven cashiers are randomly selected, and the number of grocery items they can process in three minutes is measured for both the old scanner and the new scanner. The results of the test are as follows. Let the difference d = number of items processed by the old scanner - number of items processed by the new scanner.

Number of Grocery Items Processed in Three Minutes

Cashier	1	2	3	4	5	6	7
Old Scanner	60	70	55	75	62	52	58
New Scanner	65	71	55	75	65	57	57

a. Is a paired design appropriate for the above experiment? Explain.

b. What assumption must be made in order to perform the test of hypothesis?

c. Does the data appear to satisfy the assumption described in part **b.**? Why or why not?

d. Calculate a 95% confidence interval for the mean difference between the number of items processed using the old scanner and the new scanner. Interpret this interval.

e. Can the management conclude that the new scanner will allow cashiers to process a significantly larger number of items on average than the old scanner at $\alpha = 0.05$?

10. An auto dealer is marketing two different models of a high-end sedan. Since customers are particularly interested in the safety features of the sedans, the dealer would like to determine if there is a difference in the braking distance (the number of feet required to go from 60 mph to 0 mph) of the two sedans. Six drivers are randomly selected and asked to participate in a test to measure the braking distance for both models. Each driver is asked to drive both models and brake once they have reached exactly 60 mph. The distance required to come to a complete halt is then measured in feet. The results of the test are as follows. Let the difference d = braking distance for Model A - braking distance for Model B.

Braking Distance of High-End Sedans (Feet)						
Driver	1	2	3	4	5	6
Model A	150	145	160	155	152	153
Model B	152	146	160	157	154	155

a. Is a paired design appropriate for the above experiment? Explain.

b. What assumption must be made in order to perform the test of hypothesis?

c. Does the data appear to satisfy the assumption described in part **b.**? Why or why not?

d. Calculate a 90% confidence interval for the average difference between braking distances for Model A and Model B. Interpret the interval.

e. Can the auto dealer conclude that there is a significant difference in the braking distances of the two models of high-end sedans? Use $\alpha = 0.10$.

11. A sleep disorder specialist wants to test the effectiveness of a new drug that is reported to increase the number of hours of sleep patients get during the night. To do so, the specialist randomly selects eight patients and records the number of hours of sleep each gets with and without the new drug. The results of the two-night study are listed in the table below.

Patient	1	2	3	4	5	6	7	8
Hours of sleep without the drug	5.7	6.2	5.1	5.6	4.8	6.8	5.4	5.9
Hours of sleep with the drug	6.0	5.8	5.4	6.1	5.3	6.5	5.7	6.2

Let d = (hours of sleep with the new drug) – (hours of sleep without the new drug). Assume that the hours of sleep are normally distributed for the population of patients both before and after taking the new drug. Using this data, determine the 95% confidence interval for the true difference in hours of sleep between the patients when using and when not using the new drug.

12. A psychology graduate student wants to test the claim that there is a significant IQ difference between husbands and wives. To test this claim, she measures the IQs of 8 married couples using a standard IQ test. The results of the IQ tests are listed in the following table.

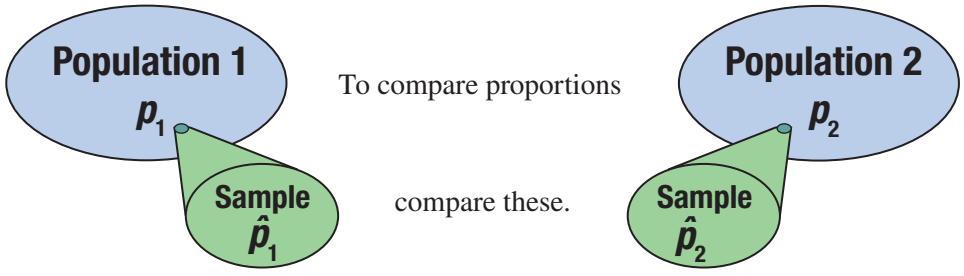
IQs of Married Couples								
Husband	109	112	102	130	119	106	121	116
Wife	105	110	109	124	123	111	115	120

Using a 0.10 level of significance, test the claim that there is a significant difference between the IQs of husbands and wives. Assume that the population distribution of the paired differences is approximately normal. Let the group "Husband" be Population 1 and let the group "Wife" be Population 2.

12.4 Inference about Two Population Proportions

Techniques are developed in this section for comparing two population proportions. A methodology for comparing two population proportions is particularly useful because proportions are among the few measures that can be used for summarizing categorical data. For a more extensive treatment of comparisons for categorical data, see Chapter 16.

There are many situations where comparing two population proportions may be of interest. For example, a sociologist may be interested in comparing the proportion of females who believe that it is okay to cry in public to the proportion of males who think it is okay to cry in public. A marketing manager may be interested in comparing the proportion of customers who favor Product A to the proportion of customers who favor Product B.



In order to perform a comparison of two population proportions, the assumptions outlined below must be met.