

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

There is evidence at the 0.10 level to conclude that support for raising the national minimum wage and political affiliation are dependent. The difference in support is too great to believe it to be attributed to ordinary sampling variation alone.

## 16.3 Exercises

### Basic Concepts

1. Explain the difference between the chi-square test for goodness of fit and the chi-square test for association.
2. What is a contingency table?
3. Describe the information that each cell in a contingency table provides.
4. What properties must the two categories of the contingency table possess?
5. What level(s) of measurement may the categories of a contingency table have?
6. Consider the variable income. Describe how this variable could be transformed to be included in a contingency table. Is information lost during the transformation?
7. Explain why a test for association is not valid if single data points are allowed to belong to more than one category.
8. Restate the multiplication rule for independent events. Explain how this rule pertains to the chi-square test for association.
9. State the null and alternative hypotheses for a chi-square test for association between two qualitative variables.

### Exercises

10. A political analyst is interested in studying the relationship between age and political affiliation. The analyst randomly selects 200 people and determines their age and political affiliation. The number of responses in each of the categories is as follows.

Age and Political Affiliation			
Age	Political Affiliation		
	Democrat	Republican	Independent
18–34	50	10	15
35–51	15	25	15
52–68	25	35	10

- a. Can the analyst conclude that age and political affiliation are dependent at  $\alpha = 0.05$ ?
- b. What assumptions were made in the test for part a.?

11. A sociologist is interested in studying the relationship between education and crime. She randomly selects 450 people and asks their education level and whether or not they have ever been convicted of a felony. The following table displays the number of respondents in each category.

Education and Crime		
Have you ever been convicted of a felony?		
Education Level	Response	
	Yes	No
Less Than 9 Years	6	105
9 Years to 12 Years	12	93
12 Years to 16 Years	3	93
16+ Years	12	126

- a. Can the sociologist conclude that education level and crime are dependent at  $\alpha = 0.10$ ?
- b. What assumptions were made in the test for part a.?
12. A psychologist is preparing a thesis on child abuse. He thinks that there may be a relationship between various types of child abuse and the marital status of the parents of the child. To study this, he randomly selects the records of 197 abused children and determines the marital status of the parents and the documented type of child abuse. The results of the study are as follows.

Child Abuse		
Type of Abuse	Marital Status	
	Married	Not Married
Neglect	50	50
Physical	20	30
Sexual	10	19
Emotional	10	8

- a. Can the psychologist conclude that the type of child abuse and marital status of the child's parents are dependent at  $\alpha = 0.05$ ?
- b. What assumptions were made in the test for part a.?
13. The National Fire Protection Association is interested in studying the relationship between the causes of fires and the region of the country in which the fires occur. They randomly select 500 fires and determine the region of the country in which the fire occurred and cause of the fire with the following results.

Fires				
Cause of Fire	Region			
	North	South	East	West
Smoking	37	38	45	35
Heating Equipment	25	20	12	19
Arson	17	15	23	15
Electrical	12	13	25	13
Children at Play	10	11	8	11
Other	27	28	14	27

- a. Can the association conclude that the cause of the fire and the region of the fire are dependent at  $\alpha = 0.01$ ?
- b. What assumptions were made in the test for part a.?

14. A market researcher believes that brand perception of one of the company's products may vary between different age groups. After interviewing 291 persons, the following data was compiled.

Market Research				
Age	Brand Perception			Total
	Favorable	Unfavorable	Neutral	
18–29	64	20	23	107
30–45	49	14	18	81
Over 45	61	20	22	103
<b>Total</b>	174	54	63	291

- a. Calculate the expected number of people from the 18-29 age group who respond favorably to the brand.
  - b. Calculate the expected number of people from the 30-45 age group who respond unfavorably to the brand.
  - c. Calculate the test statistic.
  - d. Can we conclude that brand perception is dependent on age at a significance level of 0.05?
15. An educational researcher wishes to know if there is a difference in academic performance for college freshmen that live on campus and those that commute. Data was collected from 232 students.

Educational Research				
Location	Academic Performance			Total
	Average	Below Average	Above Average	
On campus	89	39	42	170
Off campus	31	16	15	62
<b>Total</b>	120	55	57	232

- a. Calculate the expected number of college freshmen who live on campus and perform above average.
- b. Calculate the expected number of college freshmen who live off campus and perform above average.
- c. Calculate the test statistic.
- d. Can we conclude that freshman housing location and academic performance are related at a significance level of 0.01?