

Categorical Data Analysis: Chi-Squared Tests

13.4 Testing Categorical Probabilities: One-Way Table

1. The Humane Society of the United States claims that among dog owners: 60% own one dog, 28% own two dogs, and 12% own three dogs or more dogs. Students at FIU conduct a random sample of 50 households to test the claim from the Humane Society. The results are shown below. Test the Humane Society's claim using a 5% significance level (note: the test statistic is $\chi^2 = 0.1048$).

One Dog	Two Dogs	Three or More Dogs
31	13	6

2. The U.S. Department of Health and Human Services claimed in 2007 that among people who are 18 - 25 years old: 42.6% have never used Illicit Drugs, 24.2% have used them in their lifetime, but have not used in the past year, and 33.2% have used in the past year. Twenty-five people in this age group are randomly selected and are surveyed. Use the results below and a 1% significance level to test the U.S. Department of Health's claim (note: the test statistic is $\chi^2 = 1.0543$).

Never Used	Used in Their Lifetime	Used in the Past Year
11	4	10

3. The Pew Research Center reported on the results of a survey of American workers in February 2012. The results of one question about worker satisfaction are given below. A total of 1,231 employed adults responded to the question. Use the results and a 10% significance level to test the claim that among college graduates equal numbers of workers are completely satisfied, somewhat satisfied, and dissatisfied with their current job (note: the test statistic is $\chi^2 = 161.7239$).

Completely Satisfied	Somewhat Satisfied	Dissatisfied
455	566	210

Answers:

1. The Humane Society's claim cannot be rejected using this data.

$$H_0 : \rho_1 = 0.60, \rho_2 = 0.28, \rho_3 = 0.12$$

H_A : At least one proportion differs significantly.

$$\text{Test Stat: } \chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(31-30)^2}{30} + \frac{(13-14)^2}{14} + \frac{(6-6)^2}{6} = 0.1048$$

Critical Value: 5.991

Do not reject the null, do not support the alternative.

2. The U.S. Dept. of Health's claim cannot be rejected using this data.

$$H_0 : \rho_1 = 0.426, \rho_2 = 0.242, \rho_3 = 0.332$$

H_A : At least one proportion differs significantly.

$$\text{Test Stat: } \chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(11-10.65)^2}{10.65} + \frac{(4-6.05)^2}{6.05} + \frac{(10-8.3)^2}{8.3} = 1.0543$$

Critical Value: 9.210

Do not reject the null, do not support the alternative.

3. The sample data allows us to reject the claim that the proportions are all equal.

$$H_0 : \rho_1 = \rho_2 = \rho_3$$

H_A : At least one proportion differs significantly.

Test Stat:

$$\chi^2 = \sum \frac{(O-E)^2}{E} = \frac{(455-410.333)^2}{410.333} + \frac{(566-410.333)^2}{410.333} + \frac{(210-410.333)^2}{410.333} = 161.7239$$

Critical Value: 4.605

Reject the null, support the alternative.