

# Categorical Data Analysis: Chi-Squared Tests

## 13.3

### The Chi-Square Test Statistic

- 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. Find the  $X^2$  test statistic for a one-way Chi-square goodness-of-fit test.

One Dog	Two Dogs	Three or More Dogs
31	13	6

- 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. The results are given below. Find the  $X^2$  test statistic for a one-way Chi-square goodness-of-fit test of the U.S. Department of Health's claim.

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

- 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 to find the  $X^2$  test statistic for a one-way Chi-square goodness-of-fit test of the claim that among college graduates, equal numbers of workers are completely satisfied, somewhat satisfied, and dissatisfied with their current job.

Completely Satisfied	Somewhat Satisfied	Dissatisfied
455	566	210

Answers:

1. The test stat is as follows:

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

2. The test stat is as follows:

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

3. The test stat is as follows:

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