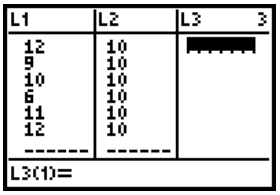
CHAPTER 10 CHI-SQUARE TESTS

Section 10.1 ▪ Testing a Probability Model: The Chi-Square Goodness-of-Fit Test

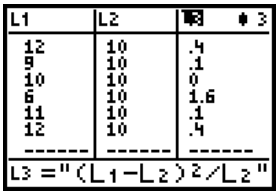
A Test Statistic

The TI-83 and TI-83 Plus's List Editor screen can help calculate the chi-square test statistic.

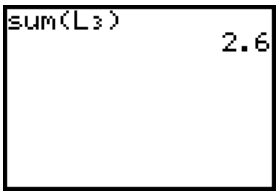
a. Enter the observed frequencies into list L1, and enter the expected frequencies into list L2.



b. Define list L3 as $(observed - expected)^2/expected$, or (L1−L2)²/L2.



c. The sum of list L3 gives the value of χ^2. Find the **sum(** command by pressing 2nd [LIST] MATH **5:sum(**.

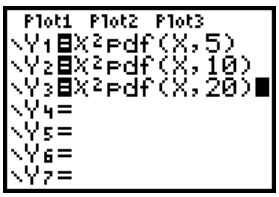


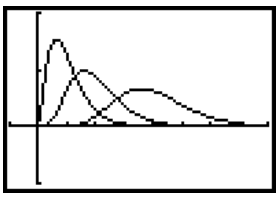
For Activity 10.1, "Generating the Chi-Square Distribution," you can first use the random integer generator **randInt(1,6,60)** to store 60 rolls of a die in list L1. Then use the program **FREQTABL** to create a list of observed frequencies in list L3. (See pages 12–13 of this Calculator Guide for information about **FREQTABL**.) Now you can enter the expected frequencies into list L4 and calculate χ^2 as described above.

The Distribution of Chi-Square 2nd [DISTR] DISTR 6:χ^2pdf(

The *Statistics in Action* student text leads you through an examination of chi-square distribution using simulations of dice with different numbers of sides. On your calculator, you can similarly graph and explore the chi-square probability density function for different degrees of freedom. You find the

function by pressing 2nd [DISTR] DISTR 6:χ^2pdf(. Enter the function in the form χ^2pdf(X, *degrees of freedom*).

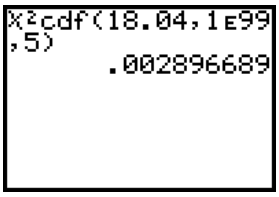




[−5, 40, 5, −0.1, 0.2, 0.1]

Exploring the probability density function illustrates that as the degrees of freedom increases, the chi-square distribution approaches a normal distribution. You'll come to recognize that the mean of a chi-square distribution equals the number of degrees of freedom of the distribution.

The Chi-Square Goodness-of-Fit Test



The TI-83 and TI-83 Plus do not perform a chi-square goodness-of-fit test. Nonetheless, you can use your calculator to precisely calculate the *P*-value associated with χ^2. You do this by entering an expression in the form χ^2cdf(χ^2, 1E99, *degrees of freedom*). You find the χ^2cdf(command by pressing 2nd [DISTR] DISTR 7:χ^2cdf(. For example, you calculate the *P*-value for the M&M's example on pages 585–586 of the *Statistics in Action* student text with χ^2cdf(18.04,1E99,5).

This is a more exact method than approximating the P-value from a chi-square table.

Section 10.2 ▪ The Chi-Square Test of Homogeneity

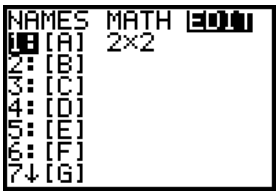
The TI-83 and TI-83 Plus can perform a chi-square test of homogeneity by using a chi-square test of independence for data stored in a two-way table—the calculations are identical for both tests. However, it is critical to understand that there are different conditions for the two tests and that the calculation of the expected values arises from very different situations. See the next section to learn how to perform a chi-square test of independence.

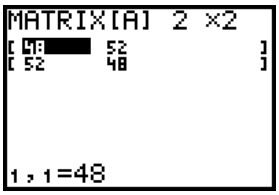
Section 10.3 ▪ The Chi-Square Test of Independence

Procedure for a Chi-Square Test of Independence
STAT TESTS C:χ^2-Test

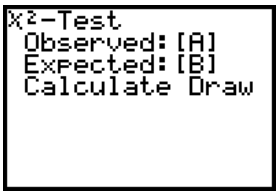
The TI-83 and TI-83 Plus conduct a chi-square test of independence with the χ^2-Test command. You find this command by pressing STAT TESTS C:χ^2-Test. The following example uses the responses from Sample 1 in Display 10.33 on page 619 of the *Statistics in Action* student text.

a. First enter the two-way table in a matrix. Press 2nd [MATRIX], arrow to the EDIT submenu, and select a matrix. Enter the dimensions of the matrix, in this case 2×2, and enter the observed values.

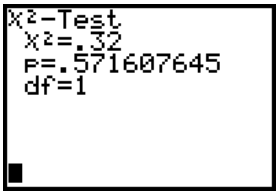


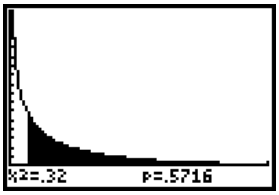


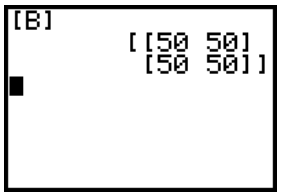
b. Start the χ^2-Test. Enter the name of the matrix with the observed frequencies, and name a second matrix into which the expected frequencies will be stored.



c. Selecting **Calculate** gives the value of the test statistic, χ^2, the *P*-value, **p**, and the degrees of freedom, **df**. Selecting **Draw** gives χ^2, **p**, and a shaded distribution, but not the degrees of freedom.







d. To check the expected frequencies, display matrix [B]. Press 2nd [MATRIX] NAMES 2:[B]. Scroll right and left to read the entire matrix. In some cases, it may be easier to inspect the matrix if you first round the values to one decimal place. To do this, enter **round**([B],1) on the Home screen. You find the **round**(command by pressing MATH NUM 2:**round**(.

As with all tests, you should use your calculator as an aid in the complete solution. A complete solution includes a check of the conditions, a statement of the hypotheses, a summary of the calculations, and a written conclusion.