Chapter 14 / **Example 16**
Estimating parameters for the binomial distribution

In this example, instructions for performing the χ^2 goodness-of-fit test are not provided.

An archer fires five arrows at a target, aiming for the "bullseye" in the centre. She feels that she has an equal chance of hitting the bullseye with each shot, that each shot is independent of the ones that have gone before and so the binomial distribution is a good model to use.
To test this belief she looks back over her records and notes the number of times she has hit the bullseye in the last 150 sets of five arrows fired. These results are recorded in the table below.

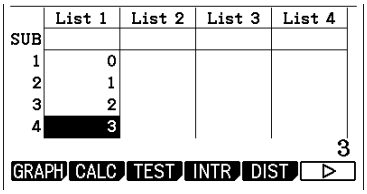
Number of bullseyes	0	1	2	3	4	5
Frequency	5	22	28	45	40	10

Perform a χ^2 goodness-of-fit test to test the following hypotheses.
H0: The number of bullseyes follows a binomial distribution.
H1: The number of bullseyes does not follow a binomial distribution.

Press [MENU] 2 [STAT] to display the List Editor screen.

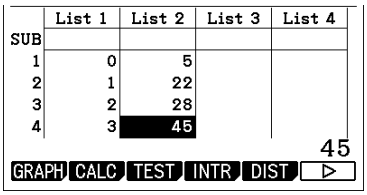
Type the number of bullseyes in the first column.

Press [EXE] after each number to move to the next cell.



Press [▶] to move to the next column.

Enter the frequencies in the second column.



To calculate an estimate of the mean

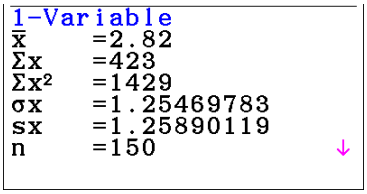
Press [F2] CALC and [F6] SET.

Set 1Var XList to List1 and 1Var Freq to List2 (press [F2] LIST type 2 and press [EXE]).

Press [EXIT] and [F1] 1-VAR.

The GDC displays a list of statistics for the data.

The results show that the mean ($\bar{x}$) is 2.82.



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Press MENU 1 RUN·MAT to display the Run-Matrix screen for arithmetical calculations.

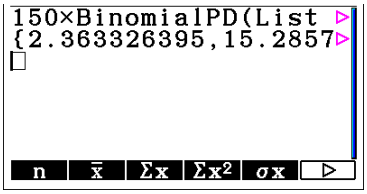
Type 150 ×

Press OPTN F5 STAT F3 DIST F5 BINOMIAL F1 Bpd

Press OPTN F1 LIST F1 List and type 1 , 5 ,

Press VARS F3 STAT F1 X F2 $\bar{x}$, type ÷ 5, close the parentheses and press EXE.

You can scroll through the result to read the expected values.



Since 2.36 < 5, the first two rows are combined.

Number of bullseyes	0, 1	2	3	4	5
Observed	27	28	45	40	10
Expected	17.649	39.547	51.157	33.088	8.560

Using these values calculate the *p*-value using a a χ^2 goodness-of-fit test with df = 3.

p-value = 0.0131 < 0.05

The result is significant at the 5% significance level so we reject the null hypothesis that the data follows a binomial distribution.