

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 **[STAT]** 1:Edit and press **[ENTER]**

Type the number of bullseyes in the first column.

Press **ENTER** or **▼** after each number to move to the next cell.

[illegible]

Press  to move to the next column.

Enter the frequencies in the second column.

[illegible]

To find the summary statistics

Press **[STAT]** and **~** to access the CALC menu.

Select 1:1-Var Stats and press **ENTER**.

Enter L_2 as the FreqList by pressing $\boxed{2\text{nd}} \boxed{2} \boxed{[L_2]}$.

Navigate to Calculate and press **ENTER**.

1-Var Stats
List:L1
FreqList:L2
Calculate

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The GDC displays a list of statistics for the data.

From the sample

$$\bar{x} = 2.82$$

1-Var Stats
 $\bar{x}=2.82$
 $\Sigma x=423$
 $\Sigma x^2=1429$
 $Sx=1.258901193$
 $\sigma x=1.254697839$
 $n=150$
 $\min X=0$
 $\downarrow Q_1=2$

Press **STAT** 1:Edit and press **ENTER**



Move to the cell labelled L_3

Type 150 x

Press Press **2nd** **VARS** (**[DISTR]**) A:binompdf(

Enter 5 as the value of trials

To enter the value of p press **[VARS]** 5:Statistics... select 2: \bar{x}
type $\div 5$ and press **[ENTER]**.

Use  to navigate down to Calculate. Press .

```
binompdf
trials:5
p: $\bar{x}/5$ 
x value:
Paste
```

Press **ENTER**.

The GDC displays the expected values.

[illegible]

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 χ^2 goodness-of-fit test with $df = 3$.

$$p\text{-value} = 0.0131 < 0.05$$

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

χ^2 GOF-Test
 $\chi^2=10.75313706$
 $P=.0131384707$
 $df=3$
 $CNTRB=\{4.9544564 \ 3.37151...$