

Chapter 14 / **Example 14****Goodness of fit to binomial distribution**

In a trial three coins are tossed.

- a** Find the probability of obtaining: 0 heads, exactly 1 head, exactly 2 heads, exactly 3 heads.

Hagar tosses three coins 200 times and makes a note of the number of heads each time. Her results are as follows.

Number of heads	Probability
0	28
1	67
2	83
3	22

She is interested to find out if her coins are fair and so performs a χ^2 goodness-of-fit test at the 5% significance level on her data.

- b** Use the probabilities for $B(3, 0.5)$ and the fact that Hagar tossed the coins 200 times, to find the expected values for the number of heads.
- c** Write down the null and alternative hypotheses and the degrees of freedom for the test.

The critical value is 7.815.

Press **MENU** 1 **Run-Mat** to display the Run-Matrix screen for arithmetical calculations.

Press **OPTN** **F5** **STAT** **F3** **DIST** **F5** **BINOMIAL** **F1** **Bpd**

Type 3 as the number of trials and 0.5 as the probability of success, separated by commas. Close the parentheses and press **EXE**.

The GDC displays a list of probabilities.

```
BinomialPD(3,0.5)
{0.125,0.375,0.375,0}
□
Bpd | Bcd | InvB
```

Type $\times 200$ and press **EXE** to find the expected values.

```
BinomialPD(3,0.5)
{0.125,0.375,0.375,0}
List Ans×200
{25,75,75,25}
□
Bpd | Bcd | InvB
```

Press **→**, **SHIFT** **1** **[List]**, type 1 and press **EXE** to store the expected values in List1.

```
BinomialPD(3,0.5)
{0.125,0.375,0.375,0}
List Ans×200
{25,75,75,25}
List Ans→List 1
{25,75,75,25}
□
Bpd | Bcd | InvB
```

Chapter 14 / Example 14

Goodness of fit to binomial distribution

Press **MENU** 2 **STAT** to display the List Editor screen.

Type the observed frequencies in the second column.

	List 1	List 2	List 3	List 4
SUB				
1	25	28		
2	75	67		
3	75	83		
4	25	22		
				22
GRAPH CALC TEST INTR DIST				

Press **F3** TEST **F3** CHI **F1** GOF

For this test you must enter the degrees of freedom yourself.

Observed: List2

Expected: List1

Enter df: 3

Navigate down to Execute using and press **F1** CALC.

```

χ² GOF Test
Observed: List2
Expected: List1
df: 3
CNTRB: List3
Save Res: None
GphColor: Blue
LIST
  
```

$\chi^2 = 2.43$ and the p-value = 0.489

Either: $2.43 < 7.815$,

or $0.489 > 0.05$

Hence not significant so no reason to reject the null hypothesis.

```

χ² GOF Test
χ² = 2.42666667
p = 0.48868993
df = 3
CNTRB: List3
  
```