

Chapter 8 / Example 6

 χ^2 goodness of fit to the binomial distribution

The GDC can work out the values of the chi squared statistic and the p -value.

Using what you learned in Chapter 7, find the probability when you toss three coins of obtaining: 0 heads, exactly 1 head, exactly 2 heads, 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	Frequency
0	28
1	67
2	83
3	22

She is interested in finding out if her results follow a binomial distribution and performs a χ^2 goodness of fit test at the 5% significance level.

- Using the terms of $B(3, 0.5)$ and the fact that Hagar tossed the coins 200 times, find the expected values for the number of heads.
- Comment on whether any of these values are less than 5.
- Write down the null and alternative hypotheses and the degrees of freedom. The critical value is 7.815.
- Find the χ^2 value and the p -value.
- Write down the conclusion for this test.

First you will enter the observed frequencies in a list.

Press $\boxed{\text{stat}}$ 1:Edit and press $\boxed{\text{enter}}$ [format]

Enter the frequencies in the first column.

Press $\boxed{\text{enter}}$ or $\boxed{\nabla}$ after each number to move to the next cell.

Note: If the list contains other numbers, you can clear it by pressing $\boxed{\text{stat}}$ 4:ClrList and press $\boxed{\text{enter}}$. The home screen displays ClrList. Press $\boxed{2\text{nd}}$ $\boxed{1}$ $\boxed{[L1]}$ and press $\boxed{\text{enter}}$. Press $\boxed{\text{stat}}$ 1:Edit and press $\boxed{\text{enter}}$ to return to the table.

L1	L2	L3	L4	L5	1
28	-----	-----	-----	-----	
67	-----	-----	-----	-----	
83	-----	-----	-----	-----	
22	-----	-----	-----	-----	
	-----	-----	-----	-----	
	-----	-----	-----	-----	
	-----	-----	-----	-----	
	-----	-----	-----	-----	
	-----	-----	-----	-----	
	-----	-----	-----	-----	

L1(5)=

To calculate the expected values, you will use the binomial pdf function.

Press $\boxed{2\text{nd}}$ $\boxed{\text{vars}}$ ($\boxed{[distr]}$) A:binompdf(.

The number of trials is 3, the probability of success is 0.5 and the first x-value is 0.

Navigate to Paste and press $\boxed{\text{enter}}$.

binompdf	
trials:3	
p:0.5	
x value:0	
Paste	

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Multiply the answer by 200 (type \times 200) and press enter .

```
binompdf(3,0.5,0)*200
..... 25
```

Press stat 1:Edit and press enter [format]
 Press \blacktriangleright to move to the first cell in the second column.
 Press 2nd $(-)$ ([ans]) and press enter [format]
 This will enter the expected score.

L1	L2	L3	L4	L5	2
28	25	-----	-----	-----	
67					
83					
22					

L2(2)=

Repeat the process to calculate the other expected frequencies and enter them all in the second column.

```
binompdf(3,0.5,0)*200 ..... 25
binompdf(3,0.5,1)*200 ..... 75
binompdf(3,0.5,2)*200 ..... 75
binompdf(3,0.5,3)*200 ..... 25
```

There are now 4 entries in each of the lists.
 None of the values are less than five.

L1	L2	L3	L4	L5	2
28	25	-----	-----	-----	
67	75				
83	75				
22	25				

L2(5)=

Press 2nd [quit] to enter the home screen.
 Press stat . Press \blacktriangleright \blacktriangleright to access the TESTS menu.
 Select D: χ^2 GOF-Test...
 Select L₁ as the observed list, L₂ as the expected list and enter 3 for df. Use \blacktriangledown to navigate down to Calculate. Press enter .

```

 $\chi^2$ GOF-Test
Observed:L1
Expected:L2
df:3
Color: BLUE
Calculate Draw
```

The χ^2 statistic is 2.43 and the p -value is 0.489.
 Since $0.489 > 0.05$ or $2.42 < 7.815$, the null hypothesis is accepted. The number of heads follows a binomial distribution.

```

 $\chi^2$ GOF-Test
 $\chi^2=2.426666667$ 
 $p=.4886899362$ 
df=3
CNTRB={.36 .8533333333 ...
```