Chapter 14 / **Example 13**

Goodness of fit to Poisson distribution

Flaws in a length of material are thought to be modelled by a Poisson distribution with a mean of two flaws per metre.
Fifty 1 m lengths of material are inspected and the number of flaws in each are recorded in the table below.

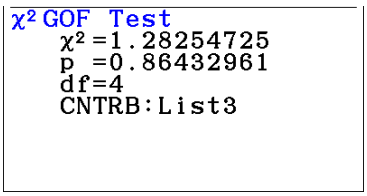
Number of flaws	0	1	2	3	≥4
Frequency	5	10	18	11	6

a If $X \sim \text{Po}(2)$ find $\text{P}(X = 0)$, $\text{P}(X = 1)$, $\text{P}(X = 2)$, $\text{P}(X = 3)$ and $\text{P}(X \geq 4)$.
b Hence find the expected values if the number of flaws follows a Poisson distribution with a mean of two flaws per metre.
c Write down the null and alternative hypotheses and the degrees of freedom for the test.
d Find the *p*-value.
e State the conclusion for this test.

Press MENU 2 STAT to display the List Editor screen.

Type the numbers 0, 1, 2, 3 in the first column.

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



Press F5 DIST F6 ▷ F1 POISSON F1 Ppd

Choose Data: List

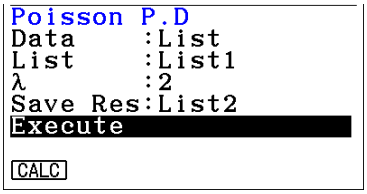
List: List1

λ: 2

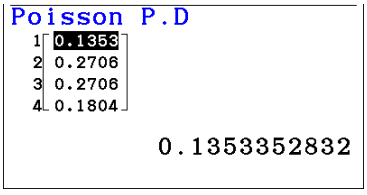
Save Res: List2

press EXE.

To enter List 2 press F2 LIST and type 2.



The GDC displays the first four probabilities.



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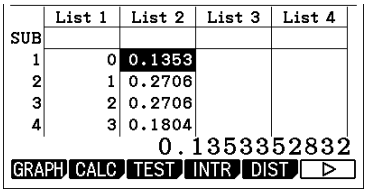
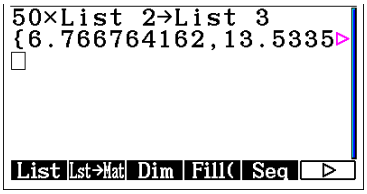
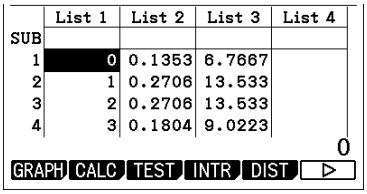
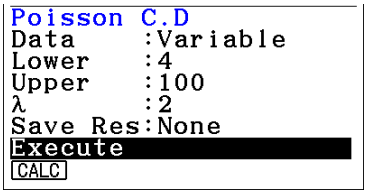
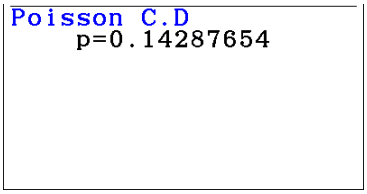
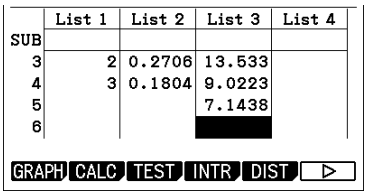
Press EXIT twice to return to the List Editor screen. The probabilities calculated are in List2.	
Press MENU 1 RUN·MAT to display the Run-Matrix screen for arithmetical calculations. Type 50 × Press OPTN F1 LIST F1 List Type 2, press → F1 List, type 3 and press EXE.	
Press MENU 2 STAT to display the List Editor screen. The GDC now displays expected frequencies in the third column.	
Press F5 DIST F6 ▷ F1 POISSON F2 Pcd Choose Data: F2 Var Lower: 4 Upper: 100 λ: 2 Save Res: F1 None Press EXE.	
The GDC shows P $X \geq 4$	
Press EXIT twice to return to the List Editor screen. Move to the cell below the last entry in List 3 Type 50 × Press SHIFT (−) [Ans] Press EXE.	

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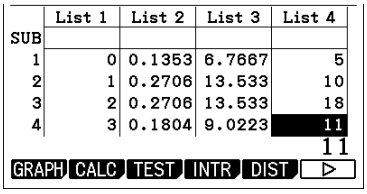
Press ▶ to move to the next column.

Enter the observed frequencies in the second column.



Press F3 TEST F3 CHI F1 GOF

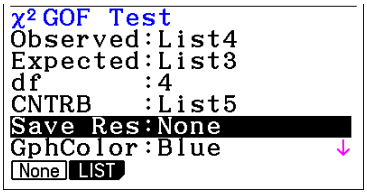
Observed: List4

Expected: List3

df: 4

CNTRB: List5

Navigate down to Execute using ▼ and press F1 CALC.



p-value = 0.482

0.482 > 0.05

This result is not significant so no reason to reject H_0 that the number of flaws follows a Poisson distribution.

Note that the p-value found is more accurate than the value in the example as the expected values have not been rounded.