Chapter 14 / **Example 15**

Estimating parameters

The lengths of fish caught in a lake are thought to be normally distributed. To test this belief 200 fish were caught and measured and the results are shown in the table below.

Length (*x* cm)	$0 < x < 10$	$10 < x < 15$	$15 < x < 20$	$20 < x < 25$	$25 < x < 30$	$30 < x < 40$
Number of fish	45	55	38	27	25	10

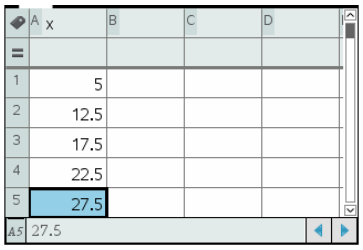
Using estimates of the mean and standard deviation of the population taken from the sample data, test the hypothesis at the 5% level that the lengths of the fish are normally distributed.

Open a new document and add a Lists & Spreadsheet page.

Type 'x' in the first cell.

Type the mid-interval values: 5, 12.5, 17.5, 22.5, 27.5, 35 in the first column.

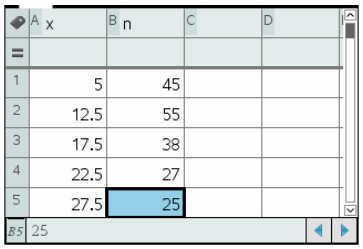
Press enter or ▼ after each number to move to the next cell.



Type 'n' in the cell to the right of 'x'.

Enter the frequencies in the second column.

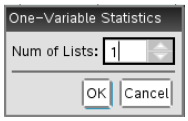
Use the ▲ ▼ ▶ ◀ keys on the touchpad to navigate the spreadsheet.



To find the summary statistics

Press menu 4:Statistics | 1:Stat Calculations | 1:One-Variable Statistics…

Click the touchpad on OK or press enter.



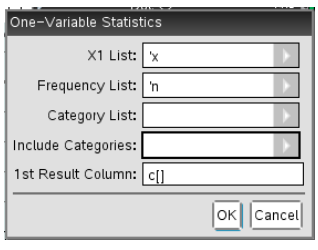
Open the drop down lists with ▶ and select using ▼ and enter.

Choose 'x' for X1 List and 'n' for Frequency List.

The next two choices remain empty.

The 1st Result Column can remain as c[] as this is the third column in the spreadsheet.

Press enter or use the touchpad to click OK.



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Estimating parameters

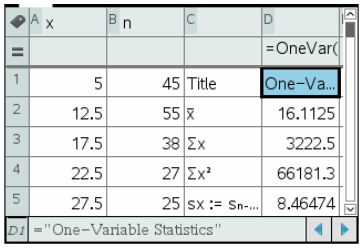
The GDC displays a list of statistics for the data.

From the sample

$\bar{x}$ = 16.1 cm, Sx= 8.46 cm.

H_0: The fish in the lake have an N(16.1, 8.46^2) distribution.

H_1: The fish in the lake do not have an N(16.1, 8.46^2) distribution.



Calculate the expected values directly in the table.

Type 'p' in the first cell of the next empty column.

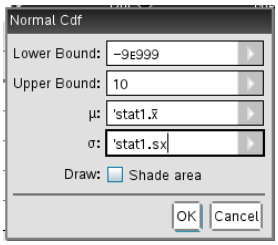
Press menu 4:Statistics | 2:Distributions | 2:Normal Cdf…

Leave Lower Bound as -9E999 and type 10 for Upper Bound

For μ open the drop down lists with ▶ and select stat1.$\bar{x}$ using ▼ and enter.

For σ select stat1.sx and enter.

Press enter.

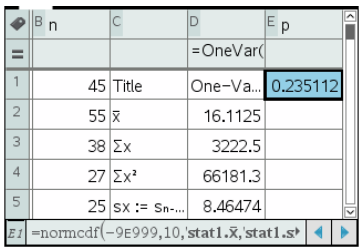


The probability is entered directly in the table.

Repeat for the remainder of the column, using the boundaries:

10-15, 15-20, 20-25, 25-30 and 30-9E999

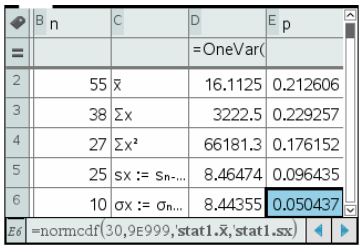
To enter E (×10□) press EE.



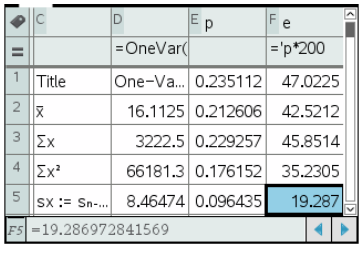
When you have entered all the probabilities, move to the next column and type 'e' in the first cell.

In the cell below type p × 200 and press enter.

You will be asked if this is p is a column or variable. Choose variable.



The GDC calculates the expected values which are shown in the column labelled 'e'.



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Estimating parameters

To calculate the *p*-value

Press menu 4:Statistics | 4:Stat Tests | 7: χ^2 GOF…

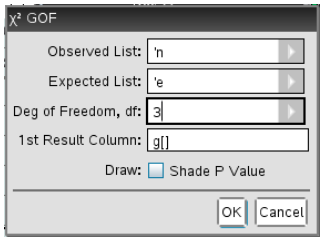
Open the drop down lists with ▶ and select using ▼ and enter

Observed List: n

Expected List: e

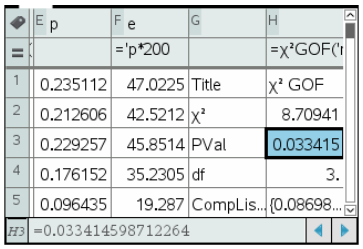
Since the mean and standard deviation were both estimated, the number of degrees of freedom is 6 – 1 – 1 – 1 = 3.

Click the touchpad on OK or press enter



p-value = 0.0334.

0.0334 < 0.05, the result is not significant so there is insufficient evidence to reject the null hypothesis that the lengths of fish in the lake follow a normal distribution.



	E p	F e	G	H
=		='p*200		=χ²GOF('r
1	0.235112	47.0225	Title	χ² GOF
2	0.212606	42.5212	χ²	8.70941
3	0.229257	45.8514	PVal	0.033415
4	0.176152	35.2305	df	3.
5	0.096435	19.287	CompLis...	{0.08698...

#3 =0.033414598712264