

# **CAMBRIDGE TECHNOLOGY IN MATHS**

## ***Year 11***

### **Univariate data for the TI-Nspire**

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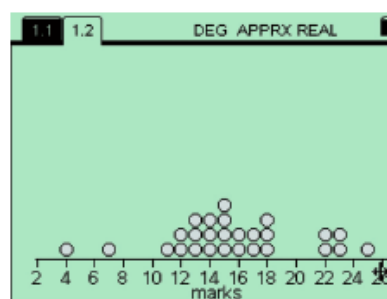
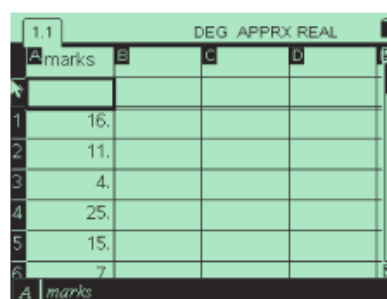
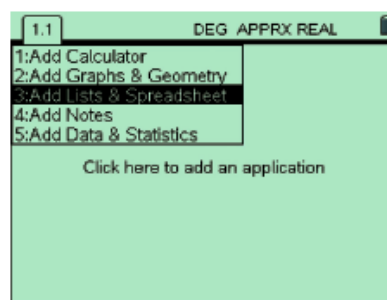
## How to construct a histogram using the TI-Nspire

Display the following set of 27 marks in the form of a histogram.

16 11 4 25 15 7 14 13 14 12 15 13 16 14  
15 12 18 22 17 18 23 15 13 17 18 22 23

### Steps

- 1 Start a new document: Press  $\left[\frac{\square}{\text{New}}$  and select **6:New Document** (or press  $\text{ctrl} + \text{N}$ ). If prompted to save an existing document move cursor to **No** and press  $\left[\text{enter}\right]$ .
- 2 Select **3:Add Lists & Spreadsheet**.  
Enter the data into a list named *marks*.
  - a Move the cursor to the name space of column A (or any other column) and type in **marks** as the list name. Press  $\left[\text{enter}\right]$ .
  - b Move the cursor down to row 1, type in the first data value and press  $\left[\text{enter}\right]$ .  
Continue until all the data has been entered.  
Press  $\left[\text{enter}\right]$  after each entry.
- 3 Statistical graphing is done through the **Data & Statistics** application.  
Press  $\left[\frac{\square}{\text{Data \& Stats}}$  and select **5:Data & Statistics**.  
**Note:** A random display of dots will appear – this is to indicate list data are available for plotting. It is not a statistical plot.
  - a Move cursor to the text box area below the horizontal axis. Press  $\left[\frac{\square}{\text{Click}}$  (click) when prompted and select the variable *marks*.  
Press  $\left[\text{enter}\right]$  to paste the variable *marks* to that axis.
  - b A dot plot is displayed as the default plot. To change the plot to a histogram press  $\left[\text{menu}\right] / 1:\text{Plot Type} / 3:\text{Histogram}$ .  
Keystrokes:  $\left[\text{menu}\right] \left[\frac{\square}{1}\right] \left[\frac{\square}{3}\right]$ .



**Original location: Chapter 1 (p.12-13), Exercise 1C Q6-8 (p.16-17)**

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Your screen should now look like that shown opposite. This histogram has a column (or bin) width of 2 and a starting point of 3.

**Notes:**

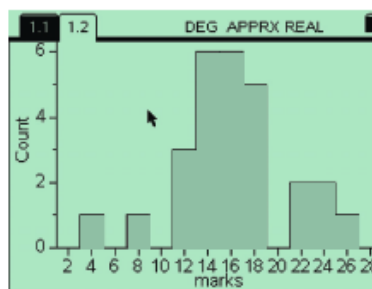
- 1 **Count** is the same as frequency.
- 2 To change the count axis to a percentage axis, press

$\text{ctrl} + \text{menu} / 4: \text{Scale} / 1: \text{Percent}$ .

**Hint:** Pressing  $\text{ctrl} + \text{menu}$  gives you a contextual menu that enables you to do things that relate only to histograms.

4 Data analysis

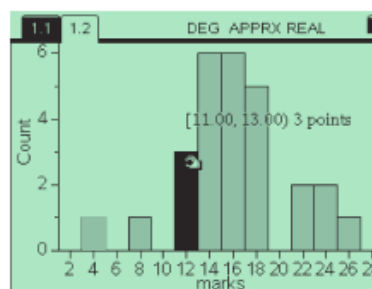
- a Move cursor onto any column and a hand  $\text{Ⓜ}$  will show. Holding down the centre mouse button ( $\text{Ⓜ}$ ) highlights the column and displays the end points of the selected column (here 11 to <13) and its frequency or count (3).



- b Press  $\text{Ⓜ}$  before moving to view other column data values.

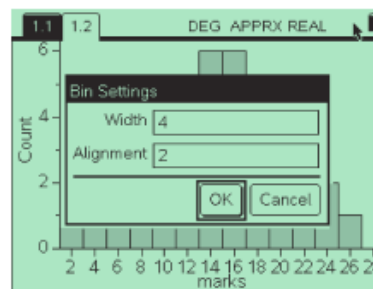
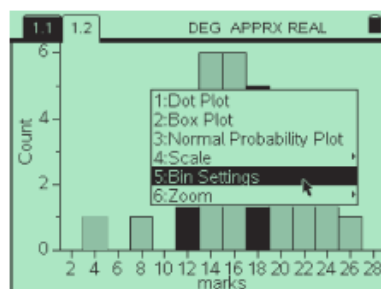
**Hint:** To unshade previously selected columns move the cursor to the open area and press  $\text{Ⓜ}$ .

**Hint:** If you accidentally move a column or data point, press  $\text{ctrl} + \text{esc}$  to undo the move.

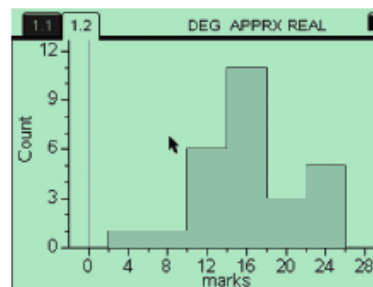
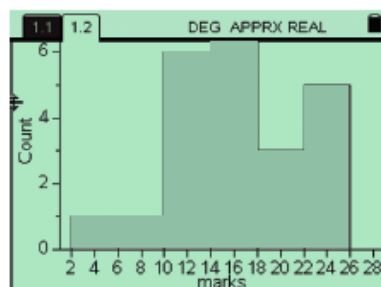


5 Change the histogram column (bin) width to 4 and the starting point to 2.

- a Press  $\text{ctrl} + \text{menu}$  to get the contextual menu as shown (below left).
- b Select **5:Bin Settings**.
- c In the settings menu (below right) change the **Width** to 4 and the Starting Point (**Alignment**) to 2 as shown. Press  $\text{enter}$ .



- d A new histogram is displayed with column width of 4 and a starting point of 2 but it no longer fits the viewing window (below left). To solve this problem press  $\text{ctrl} + \text{menu} / 6: \text{Zoom} / 2: \text{Zoom-Data}$  to obtain the histogram shown below right.



Original location: Chapter 1 (p.12-13), Exercise 1C Q6-8 (p.16-17)

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**Questions on constructing histograms using the TI-Nspire**

- 6 A student purchased 21 new textbooks from a school book supplier with the following prices (in dollars):

21.65 14.95 12.80 7.95 32.50 23.99 23.99 7.80 3.50 7.99 42.98  
18.50 19.95 3.20 8.90 17.15 4.55 21.95 7.60 5.99 14.50

- a Use a graphics calculator to construct a histogram with column width 2 and starting point 3. Name the variable *price*.
- b For this histogram:
- i what is the starting point of the third column?
  - ii what is the 'count'?
  - iii what is the modal class?
- 7 The maximum temperatures for several capital cities around the world on a particular day, in degrees Celsius, were:

17 26 36 32 17 12 32 2 16 15 18 25  
30 23 33 33 17 23 28 36 45 17 19 37

- a Use a graphics calculator to construct a histogram with column width 2 and starting point 1. Name the variable *maxtemp*.
- b For this histogram:
- i what is the starting point of the second column?
  - ii what is the 'count'?
- c Use the window menu to redraw the histogram with a column width of 5 and a starting point of 0.
- d For this histogram:
- i how many cities had maximum temperatures from 20°C to 25°C?
  - ii what is the modal class?
- 8 The numbers of words in each of the first 30 sentences of a book were recorded, with the following results.

41 30 30 12 28 29 26 31 23 36 21 25 18 23 28  
21 39 48 15 24 24 23 17 19 24 28 25 8 17 28

- a Use a graphics calculator to construct a histogram with column width 5 and starting point 5. Name the variable *words*.
- b For this histogram:
- i how many books had from 20 to fewer than 25 words in the first sentence?
  - ii what is the modal class?

**Original location: Chapter 1 (p.12-13), Exercise 1C Q6-8 (p.16-17)**

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## How to calculate measures of centre and spread using the TI-Nspire

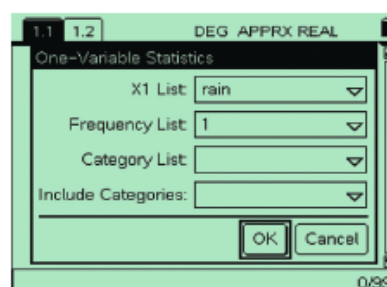
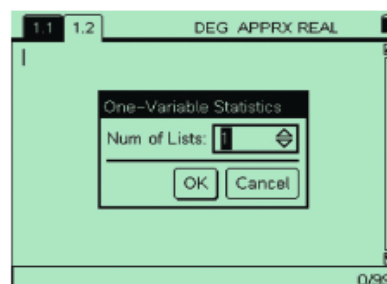
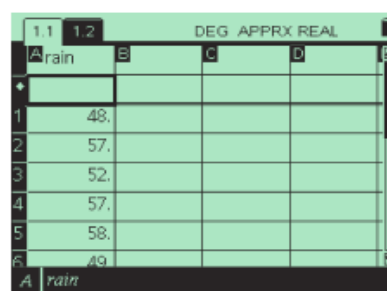
The table shows the monthly rainfall figures for a year in Melbourne.

| Month         | J  | F  | M  | A  | M  | J  | J  | A  | S  | O  | N  | D  |
|---------------|----|----|----|----|----|----|----|----|----|----|----|----|
| Rainfall (mm) | 48 | 57 | 52 | 57 | 58 | 49 | 49 | 50 | 59 | 67 | 60 | 59 |

Determine the mean and standard deviation, median and interquartile range, and the range for this data set. Give your answers correct to 1 decimal point where necessary.

### Steps

- 1 Start a new document: Press  $\left(\frac{\square}{\text{New}}$  and select **6:New Document** (or press  $\text{ctrl} + \text{N}$ ).
- 2 Select **3:Add Lists & Spreadsheet**. Enter the data into a list named **rain**, as shown.  
Statistical calculations can be done in the **Lists & Spreadsheet** application or the **Calculator** application.
- 3 Press  $\left(\frac{\square}{\text{Add}}$  and select **1:Add Calculator**.
  - a Press  $\left(\frac{\square}{\text{Menu}}\right)/6:\text{Statistics}/1:\text{Stat Calculations}/1:\text{One-Variable Statistics}$ .  
Keystrokes:  $\left(\frac{\square}{\text{Menu}}\right) 6 1 1$ .
  - b Press the  $\left(\frac{\square}{\text{Tab}}$  key to highlight **OK** and press  $\left(\frac{\square}{\text{Enter}}$ .
  - c Use the  $\blacktriangledown$  arrow and  $\left(\frac{\square}{\text{Enter}}$  to paste in the list name **rain**. Press  $\left(\frac{\square}{\text{Enter}}$  to exit the pop-up screen and generate the statistical results screen shown below.



### Notes:

- 1 The sample standard deviation is **sx**.
- 2 Use the  $\blacktriangle$   $\blacktriangledown$  arrows to scroll through the results screen to see the full range of statistical values calculated.

| OneVar rain, 1: stat results |                           |
|------------------------------|---------------------------|
| "Title"                      | "One-Variable Statistics" |
| " $\bar{x}$ "                | 55.4167                   |
| " $\Sigma x$ "               | 665                       |
| " $\Sigma x^2$ "             | 37223                     |
| " $sx := s_{n-1}x$ "         | 5.80687                   |
| " $\sigma x := \sigma_n x$ " | 5.55965                   |
| "n"                          | 12                        |
| "MinX"                       | 48                        |

|                                    |         |
|------------------------------------|---------|
| " $\sigma x := \sigma_n x$ "       | 5.55965 |
| "n"                                | 12      |
| "MinX"                             | 48      |
| " $Q_1 X$ "                        | 49.5    |
| "MedianX"                          | 57      |
| " $Q_3 X$ "                        | 59      |
| "MaxX"                             | 67      |
| " $SSX := \Sigma(x - \bar{x})^2$ " | 370.917 |

- 4 Write the answers to the required degree of accuracy (i.e. 1 decimal place).
 
$$\bar{x} = 55.4, \quad s = 5.8$$

$$M = 57, \quad IQR = Q_3 - Q_1 = 59 - 49.5 = 9.5$$

$$R = \max - \min = 67 - 48 = 19$$

Original location: Chapter 1 (p.36)

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## How to construct a boxplot using the TI-Nspire

Construct a boxplot to display the given monthly rainfall figures for Melbourne.

| Month         | J  | F  | M  | A  | M  | J  | J  | A  | S  | O  | N  | D  |
|---------------|----|----|----|----|----|----|----|----|----|----|----|----|
| Rainfall (mm) | 48 | 57 | 52 | 57 | 58 | 49 | 49 | 50 | 59 | 67 | 60 | 59 |

### Steps

- 1 Start a new document:  $\text{ctrl} + \text{N}$ .
- 2 Select **3:Add Lists & Spreadsheet**.  
Enter the data into a list called **rain**, as shown.
- 3 Statistical graphing is done through the **Data & Statistics** application.

Press  $\text{ctrl} + \text{M}$  and select **5:Data & Statistics**.

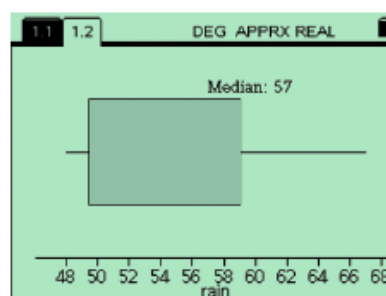
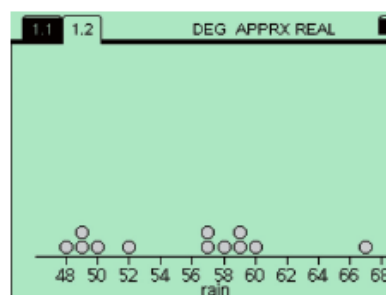
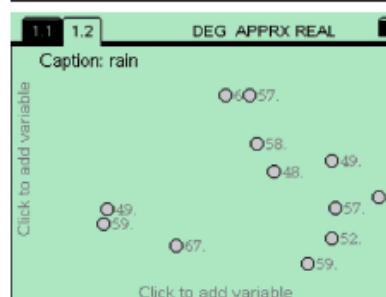
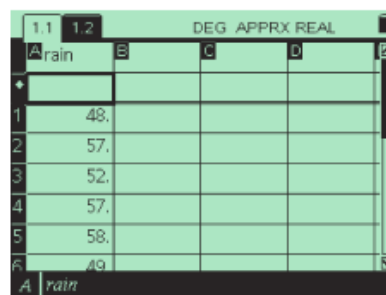
**Note:** A random display of dots will appear – this is to indicate list data are available for plotting. It is not a statistical plot.

- a Move cursor to the text box area below the horizontal axis. Press  $\text{ctrl} + \text{M}$  when prompted and select the variable **rain**. Press  $\text{enter}$  to paste the variable **rain** to that axis. A dot plot is displayed by default, see right.
- b To change the plot to a boxplot, press  $\text{menu} / 1:\text{Plot Type}/2:\text{Box Plot}$ .  
Your screen should now look like that shown below.

### 4 Data analysis

Key values can be read from the boxplot by placing the cursor on the plot and using the horizontal arrow keys ( $\leftarrow$  and  $\rightarrow$ ) to move from point to point. Starting at the far left of the plot, we see that the

- minimum value is 48 ( $\text{minX} = 48$ )
- first quartile is 49.5 ( $Q1 = 49.5$ )
- median is 57 ( $\text{Median} = 57$ )
- third quartile is 59 ( $Q3 = 59$ )
- maximum value is 67 ( $\text{maxX} = 67$ )



**Original location:** Chapter 1 (p.41), Exercise 1G Q1-5 (p.44-45)

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## Questions on constructing boxplots using the TI-Nspire

- 1 The heights (in centimetres) of a class of girls are:

160 165 123 143 154 180 133 123 157 157  
 135 140 140 150 154 159 149 167 176 163  
 154 167 168 132 145 143 157 156

The five-number summary for this data is:

Min = 123,  $Q_1 = 141.5$ ,  $M = 154$ ,  $Q_3 = 161.5$ , Max = 180

- a Construct a boxplot.      b Use a graphics calculator to construct the same boxplot.  
 c Describe the distribution in terms of shape, centre and spread.

- 2 The data shows how many weeks each of the singles in the Top 40 has been in the charts, in a particular week:

24 11 5 7 4 15 13 4 12 14 3 12 4 4  
 3 10 17 8 6 2 18 15 5 6 9 14 4 5  
 14 12 16 11 6 7 12 4 16 2 8 10 1

The five-number summary for this data is:

Min = 1,  $Q_1 = 4$ ,  $M = 8$ ,  $Q_3 = 13.5$ , Max = 24

- a Construct a boxplot.      b Use a graphics calculator to construct the same boxplot.  
 c Describe the distribution in terms of shape, centre and spread.

- 3 The amount of pocket money paid per week to a sample of Year 8 students is as follows:

\$5.00 \$10.00 \$12.00 \$8.00 \$7.50 \$12.00 \$15.00  
 \$10.00 \$10.00 \$0.00 \$5.00 \$10.00 \$20.00 \$15.00  
 \$25.00 \$13.50 \$15.00 \$5.00 \$15.00 \$25.00 \$16.00

The five-number summary for this data is:

Min = 0,  $Q_1 = 7.75$ ,  $M = 12$ ,  $Q_3 = 15$ , Max = 25

- a Construct a boxplot.      b Use a graphics calculator to construct the same boxplot.  
 c Describe the distribution in terms of shape, centre and spread.

- 4 The lengths of time, in years, that employees have been employed by a company are:

5 1 20 8 6 9 13 15 4 2  
 15 14 13 4 16 18 26 6 8 2  
 6 7 20 2 1 1 5 8

The five-number summary for this data is:

Min = 1,  $Q_1 = 4$ ,  $M = 7.5$ ,  $Q_3 = 14$ , Max = 26

- a Construct a boxplot.      b Use a graphics calculator to construct the same boxplot.  
 c Describe the distribution in terms of shape, centre and spread.

- 5 The time taken, in seconds, for a group of children to tie a shoelace is:

8 6 18 39 7 10 5 8 6 14 11 10  
8 35 6 6 14 15 6 7 6 5 8 11  
8 15 8 8 7 8 8 6 29 5 7

The five-number summary for this data is:

Min = 5,  $Q_1 = 6$ ,  $M = 8$ ,  $Q_3 = 11$ , Max = 39

- a Construct a boxplot.      b Use a graphics calculator to construct the same boxplot.  
c Describe the distribution in terms of shape, centre and spread.

## How to construct a boxplot with outliers using the TI-Nspire

Draw a box plot with outliers to show the number of hours spent on a project by individual students in a particular school.

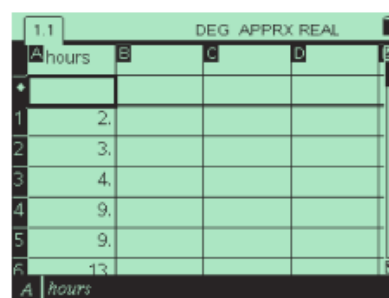
2    3    4    9    9    13    19    24    27    35    36  
 37    40    48    56    59    71    76    86    90    92    97  
 102    102    108    111    146    147    147    166    181    226    264

### Steps

1 Start a new document: + .

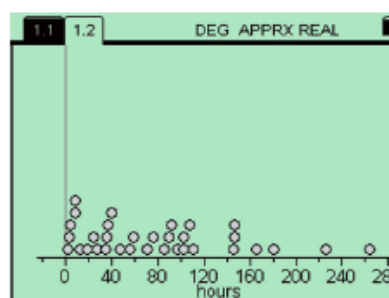
2 Select **3: Add Lists & Spreadsheet**.

Enter the data into a list called **hours**, as shown.



3 Statistical graphing is done through the **Data & Statistics** application. Press and select **5: Data & Statistics**.

**Note:** A random display of dots will appear – this is to indicate list data are available for plotting. It is not a statistical plot.



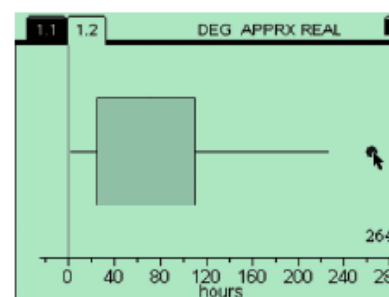
a Move the cursor to the textbox area below the horizontal axis. Press when prompted and select the variable **hours**. Press to paste the variable **hours** to that axis. A dot plot is displayed as the default plot.

b To change the plot to a boxplot, press /1:Plot Type/2:Box Plot to obtain the screen shown right. Outliers are indicated by a dot(s) lying outside the main body of the plot.

4 Data Analysis

Starting at the far left of the plot, we see that the

- minimum value is 2 (**minX = 2**)
- first quartile is 25.5 (**Q1 = 25.5**)
- median is 71 (**Median = 71**)
- third quartile is 109.5 (**Q3 = 109.5**)
- maximum value is 264 (**maxX = 264**). It is also an outlier.



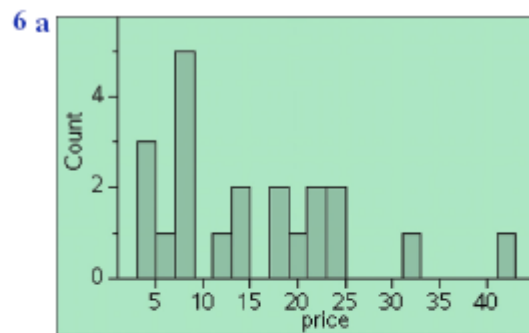
**Original location: Chapter 1 Example 19 (p.48-49)**

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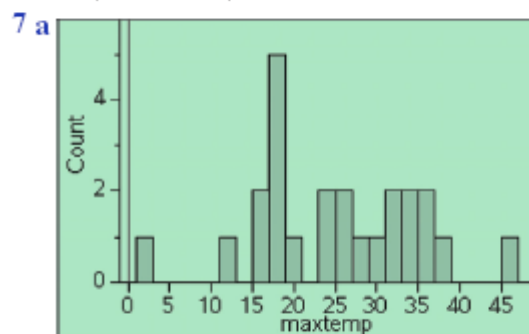
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## Answers

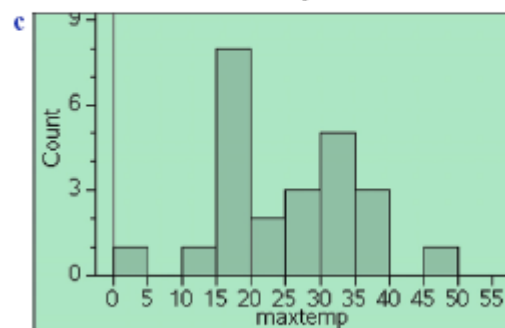
### Histogram questions



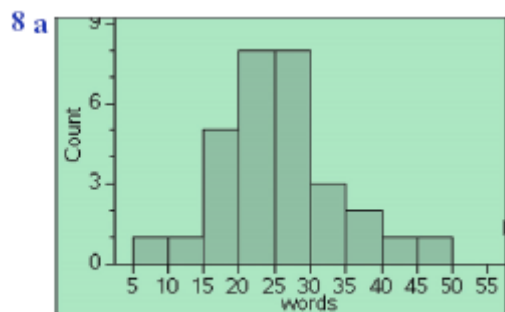
- b** i \$7.00      ii 5 books  
 iii \$7.00 – <\$9.00



- b** i 11°C      ii 1 city



- d** i 2 cities      ii 15°C to <20°C



- b** i 8 books      ii 20 to < 25 and 25 to < 30

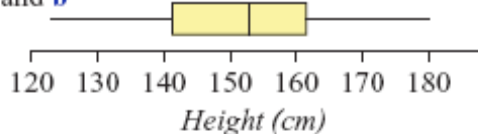
Original location: Answers (p.505, 507)

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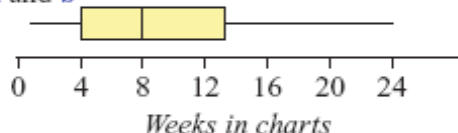
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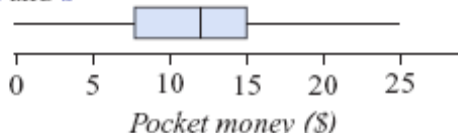
## Boxplot questions

**1 a and b**

- c** The distribution of heights is approximately symmetric, centred at 154 cm, with the middle 50% of heights ranging from 141.5 cm to 161.5 cm.

**2 a and b**

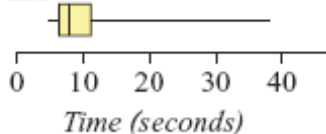
- c** The distribution is slightly positively skewed. Singles appear to stay in the charts for around 8 weeks, with the middle 50% staying in from around 4 to 13 weeks.

**3 a and b**

- c** The distribution is approximately symmetric and centred on \$12. The middle 50% of students receive pocket money of about \$7.75–\$15.

**4 a and b**

- c** The distribution is positively skewed, centred at 7.5 years. Half of the employees have been employed by the company for 4 to 14.5 years.

**5 a and b**

- c** The distribution is positively skewed, centred at 8 seconds. While 50% of the children take from 6 to 11 seconds to tie a shoelace, there were 3 students who took 29, 35 and 39 seconds.

Original location: Answers (p.505, 507)

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