

Exploring Data

Concepts

- Dot plots
- Box plots
- Circle charts
- Bar charts
- Scatter plots
- Mean
- Median
- Quartiles

Overview

This activity describes steps for entering and investigating numerical and categorical data. Students will perform exploratory data analysis on a small set of data using graphical and numerical techniques.

Materials

- TI-Nspire™ Math and Science Learning Handheld
- *backpack.tns*

NCTM Standards

The students should...

Grades 6-8 Data Analysis and Probability Standards

- Formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population;
- select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatterplots;
- find, use, and interpret measures of center and spread, including mean in Interquartile range;
- discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots, and scatter plots;
- make conjectures about possible relationships between two characteristics of a sample on the basis of scatter plots of the data and approximate lines of fit;
- use conjectures to formulate new questions and plan new studies to answer them.

Grades 9-12 Data Analysis and Probability

Standards

- Understand histograms, parallel box plots, and scatter plots; and use them to display data;
- for univariate measurement data, be able to display the distribution, describe its shape, and select and calculate summary statistics;
- for bivariate measurement data, be able to display a scatter plot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools;
- display and discuss bivariate data where at least one variable is categorical;
- identify trends in bivariate data, and find functions that model the data or transform the data so that they can be modeled.

Data

Newspaper stories have reported that some research studies indicate that students who carry very heavy backpacks can experience balance problems and/or have chronic back pain. Erin surveyed several of her classmates and collected the data shown in the table below. She rounded both student weights and backpack weights to the nearest kilogram.

Note: An internet search, using the search criteria “student backpack weight + back pain” will display many articles related to this issue. A recommendation on safe backpack weight as a percentage of student body weight is often included.

Student Weight and Backpack Weight

Name	Gender	Backpack Color	Student Weight (kg)	Backpack Weight (kg)
Erin	female	Blue	40	6
Sara	female	Red	38	4
Jane	female	Green	35	7
Judy	female	Blue	39	8
Kendra	female	Red	37	5
Kate	female	Green	42	7
Cami	female	Blue	36	5
Bill	male	Red	55	7
Will	male	Blue	51	5
Jack	male	Blue	40	3
Luis	male	Red	47	4
Tony	male	Blue	52	6

Classroom Management

A TI-Nspire™ document, *backpack.tns*, is provided for this activity. However, teachers might prefer to enter backpack data collected by their students or to create a different .tns document of their own. Steps for entering and graphing data are provided.

Page 1.1 of the *backpack.tns* document contains a spreadsheet with the data displayed in the table.

Questions for students are provided on the Exploring Data Student Worksheet. Students are directed to add one or more pages, as needed, to create graphs to help them answer the questions about Erin and her friends.

Creating the .tns Document and Entering Categorical Data

1. Press for Home 6:New Document to open a new TI-Nspire™ handheld document.
2. Press for 3:Add Lists & Spreadsheet to add a new application page.
3. Scroll to the top of the column A.
4. Enter the list name `student`, and press (Figure 1).
5. To enter categorical data, move to cell A1, and press to open a phrase with a quotation mark.
6. Then press the letters for the name of the student and .
 - For example, to enter the name Erin, press .
 - The “quotes” are closed without pressing the quotation mark key after the last letter in the name (Figures 2 and 3).
7. Repeat to enter the names of the other students into the list in column A.
8. Name column B `gender`.
9. In cell B1, enter the word `female`, remembering to first press .
10. Press .
11. Scroll back up to cell B1.

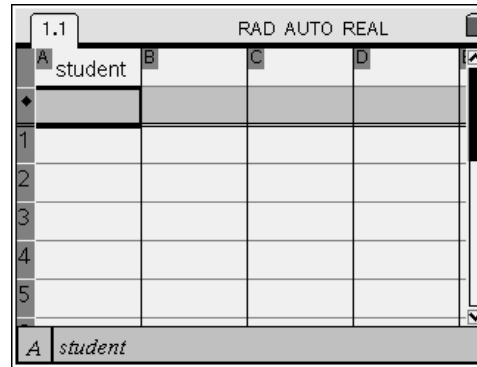


Figure 1

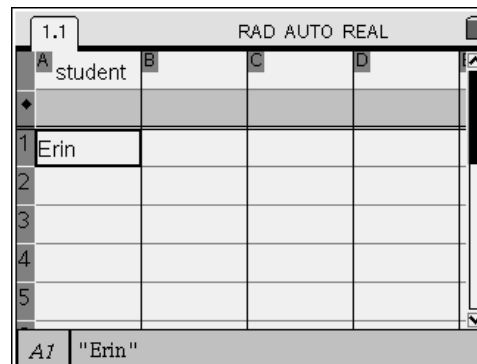


Figure 2

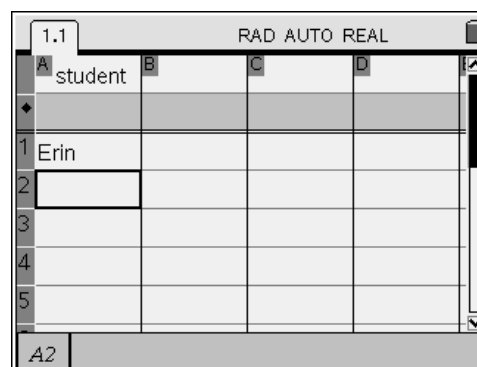












Figure 3

12. Press    for Menu 3:Data, 3:Fill Down (Figure 4).
 - Cell B1 should be outlined.
 13. Press  until you have all the cells to B7 highlighted (cell A7 contains the last female in that list).
 14. Press  (Figure 5).
 15. Scroll down to the next cell, B8, and enter the word `male`, first pressing .
 16. Repeat the “Fill Down” steps above to enter the word `male` into cells B8 to B12.
 17. Name the third column `bpcolor`.
 18. In the C1, enter the word “`blue`”.
 19. In cell C2, enter the word “`red`”.
 20. In cell C3, enter the word “`green`” (Figure 6).
 21. To enter the other colors, copy and paste the desired color.
 - For example, move to cell C1 (blue).
 - Press   to copy the word `blue`.
 - Move to a cell on the row of another student who has a blue backpack.
 - Press   to paste the word `blue`. Repeat for all students who have this color backpack (Figure 7).
- Note: The numeral zero is simply a placeholder between the cells that contain the word `blue`.

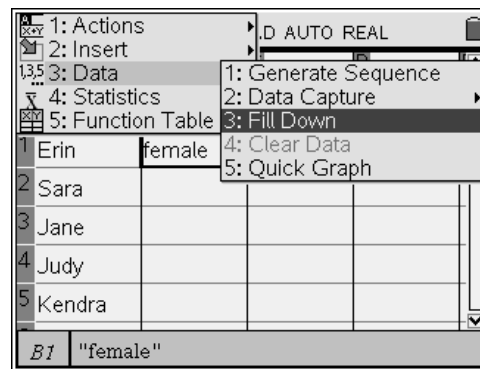


Figure 4

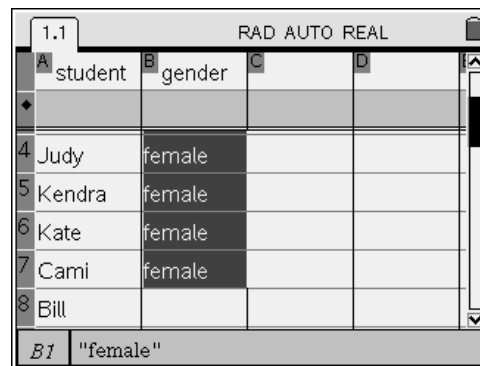


Figure 5

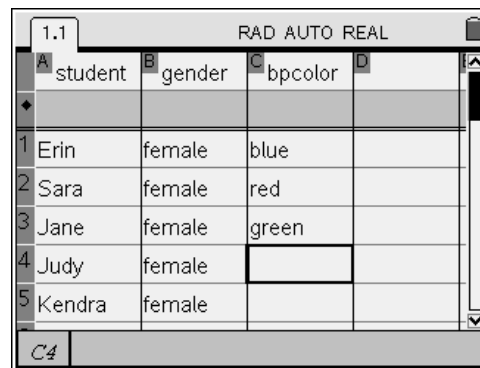


Figure 6

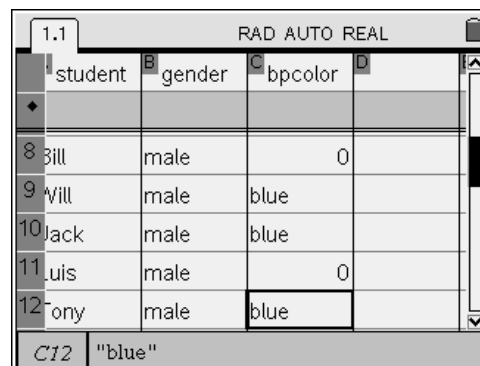








Figure 7

22. Repeat the Copy and Paste procedure to enter the other colors into their appropriate cells.
23. When pasting into a cell that contains the number zero, a Data Loss dialogue box will appear (Figure 8).
24. Press  or  to choose OK.

Note: The other colors in the list could also be entered by just re-typing the words.

25. Scroll to the top of column D.
26. Enter the list name *weight* and press .
27. Enter the students' weights.
28. Scroll to the top of column E.
29. Enter the list name *bpweight* and press .
30. Enter the backpack weight for each student (Figure 9).
31. Save the document using the name *backpack*.

Graphing Categorical Data

1. Open the *backpack.tns* document.
 - Page 1.1 contains the data from the table above.
2. Press   for Home 5:Data & Statistics to insert a Data & Statistics application.
 - A case plot with a caption indicating the first column of data, alphabetically, is displayed (Figure 10).

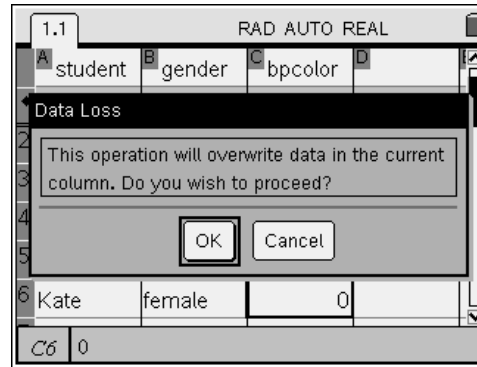


Figure 8

	gender	bpcolor	weight	bpweight
1	female	blue	40	6
2	female	red	38	4
3	female	green	35	7
4	female	blue	39	8
5	female	red	37	5

Figure 9

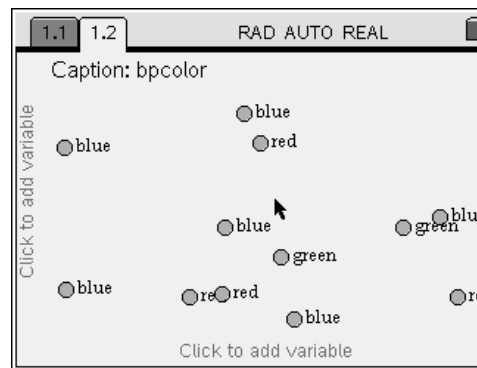




Figure 10

3. Move to a data point, and press **ctrl**  to display data for that student (Figure 11).
4. Press **esc**, then move to an empty region of the screen, and press **enter** or  to deselect a data point.

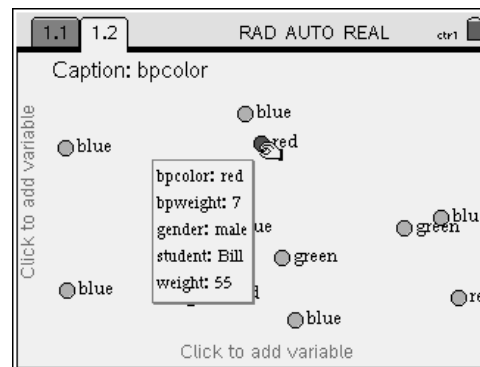


Figure 11

5. Move to the caption region, and click to display data list options (Figure 12).

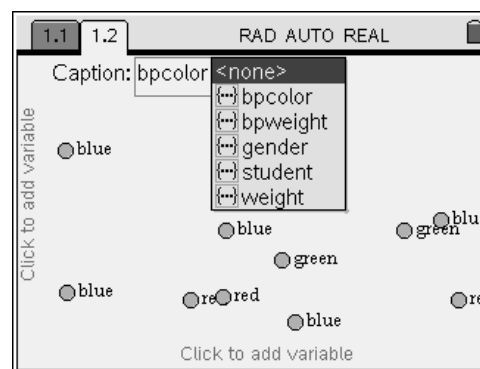



Figure 12

6. Select the list **gender** (Figure 13).
7. To separate the data by category, move to a data point, and press **ctrl**  to select it.

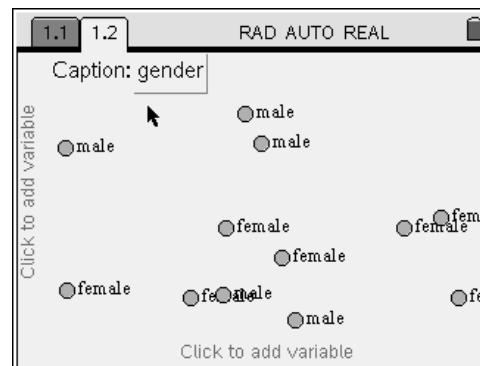


Figure 13

8. Drag the point (Figure 14).

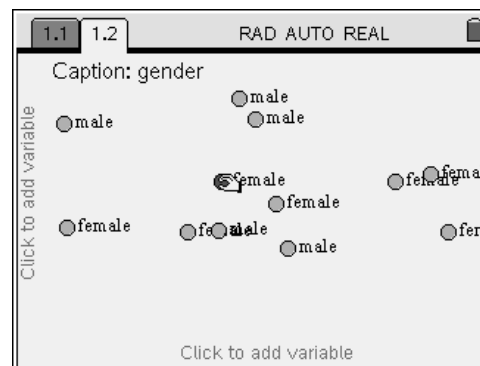





Figure 14



9. Press , and the data are graphed by the chosen category (Figure 15).

Note: Press  or  in an open region of the screen to deselect the data point.



Note: A horizontal or vertical plot will appear depending on the direction of motion when dragging the point. Drag the point horizontally to obtain the graph displayed in Figure 15.

10. Move to the word **gender**, and press .

11. Select the list **bpcolor**.

12. Move to an open region of the screen, and press   for the Context Menu (or 'right-click menu') to display other plot options (Figure 16).

13. Choose Pie Chart.

14. Press   to select a region of the graph (Figure 17).

15. Repeat for a Bar Chart (Figure 18).

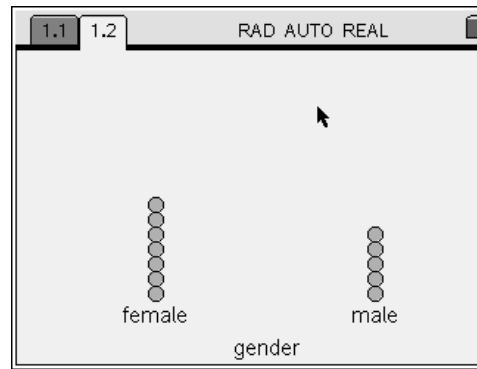


Figure 15

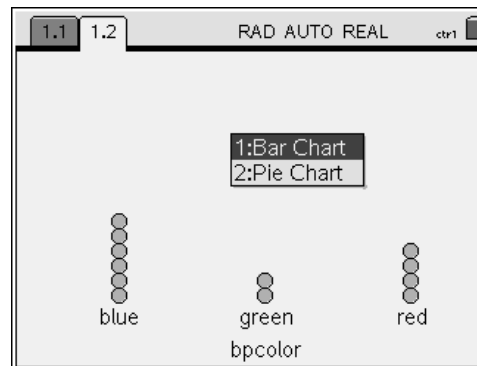


Figure 16

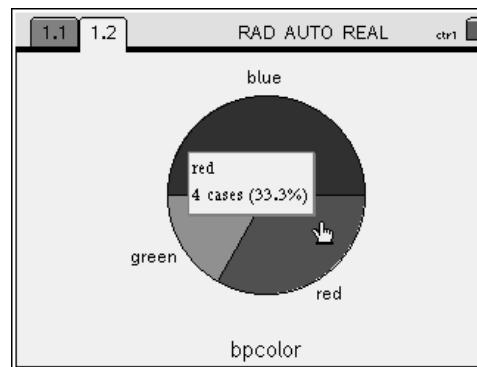


Figure 17

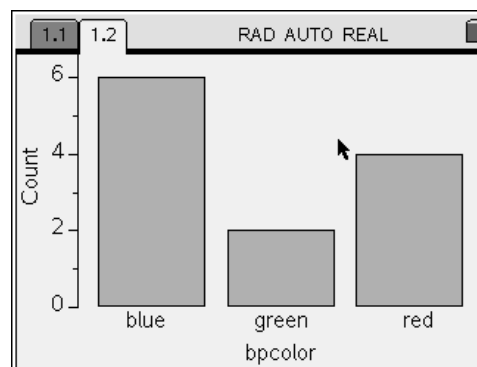


Figure 18

16. For other plots (e.g., backpack weight for males and females):
- click on the variable name on the horizontal axis and change it to **gender**;
 - Change the variable on the vertical axis to **bpweight** (Figure 19).

17. Press **ctrl** **menu** for the Context Menu to display other plot options (Figure 20).

18. Press **1** for 1:Box Plot (Figure 21).

19. Move the cursor to different regions of the plot to display quartile, minimum, maximum, or median values (Figure 22).
20. Click on the plot to display data points in different quartiles.

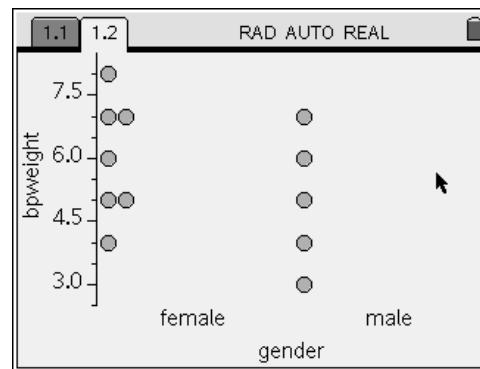


Figure 19

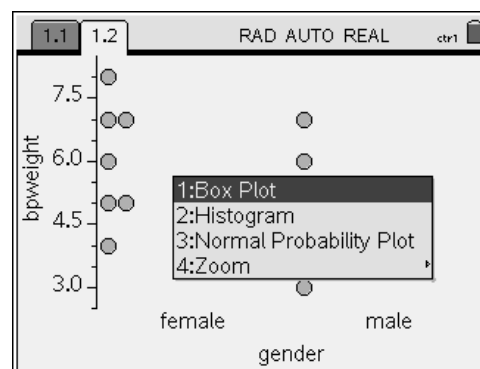


Figure 20

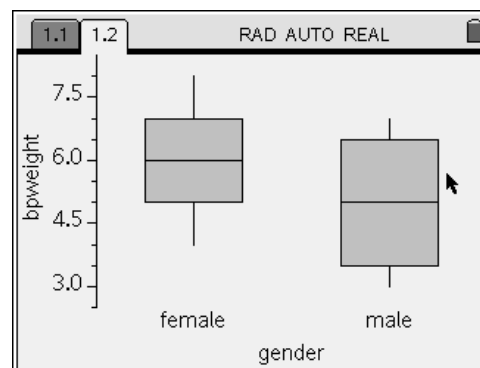


Figure 21

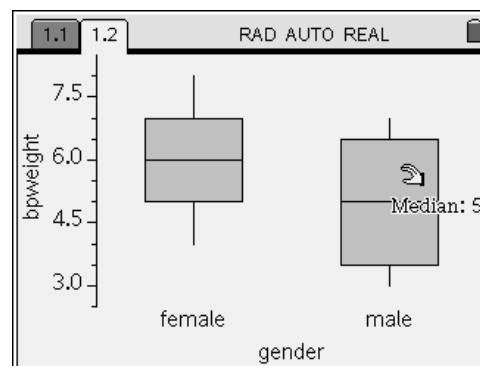


Figure 22

21. Change the variable on the vertical axis to gender.

- Horizontal box plots are displayed (Figure 23).

22. Explore other plot options.

Note: Graphs of non-categorical data can be graphed in the same Data & Statistics application page or in a new Data & Statistical application page (Figure 24).

Entering Formulae into Lists

1. To compute quotients (e.g., student backpack weight divided by student body weight), enter a new list name into the spreadsheet.

- The list name `bpwtbwt` is used in this example.

2. Move the cursor to the formula cell, and press the = key.

3. Then, press [2nd][var] , and select the list name `bpweight`.

4. Press [2nd][div] [2nd][var] , and select the list name `weight`.

5. Press [2nd][x] [1] [.] (Figure 25).

6. Press [2nd][enter] (Figure 26).

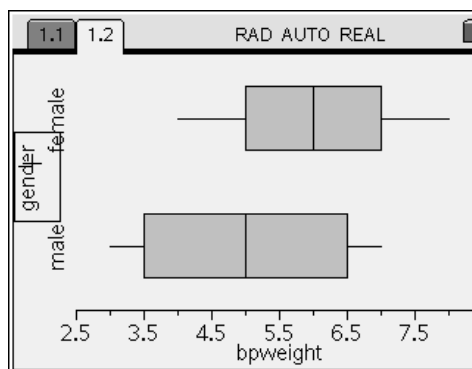


Figure 23

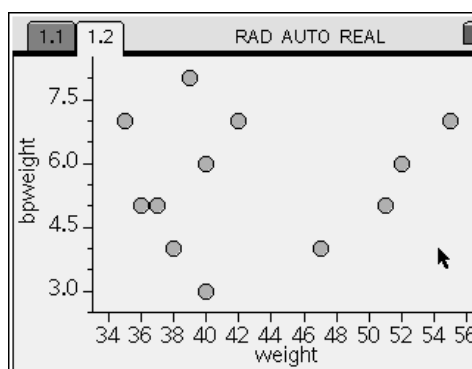


Figure 24

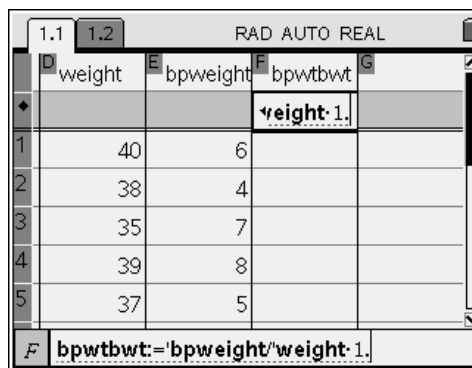


Figure 25

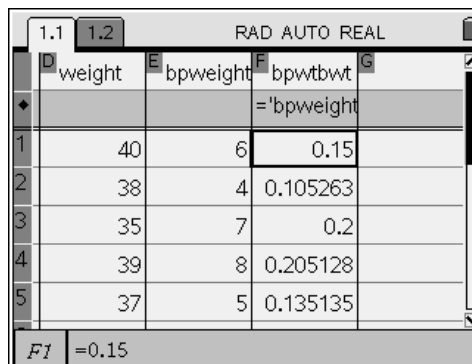


Figure 26

Note: The last part of the command ($\frac{\text{int}}{\text{x}}$ 1 \cdot) was included so that approximate values (e.g., 0.105263 rather than $\frac{2}{19}$) would be returned. Alternatively, the Documents Settings could have been changed from Auto to Approximate or the command = A P P R O X $\left\{ \right\}$ $\text{sto} \rightarrow \text{var}$ bpweight $\frac{\text{int}}{\text{x}}$ $\text{sto} \rightarrow \text{var}$ weight $\left\{ \right\}$ enter could have been used in the formula cell.

Note: Another list can be used to convert these values to percents. Name the new list, and then enter this command into the formula cell: = bpwtbwt $\frac{\text{int}}{\text{x}}$ 1 O O enter .

Computing the Mean of a Subset of List Entries

In some activities, students might find it necessary to compute the mean of a subset of the data in a list, e.g., the average backpack weight for females. This computation must be performed in a cell in the spreadsheet. Data on the backpack weight for females are found in cells E1 to E7, inclusive.

1. Enter this command into an empty cell:

= (M) (E) (A) (N) ({) (E) (1) (:)
 (E) (7) (}) (~) (enter) (Figures 27 and 28).

- (The **mean(** command can also be found in the Catalog.)

The calculator screen shows a spreadsheet with columns D, E, F, and G. Column D is labeled 'weight', E is 'bpweight', F is 'bpwtbwt', and G is empty. The data in column E is: 40, 38, 35, 39, 37. The data in column F is: 6, 4, 7, 8, 5. The data in column G is: 0.15, 0.105263, 0.2, 0.205128, 0.135135. The formula bar at the bottom shows the command: `=mean(e1:e7)`.

	D weight	E bpweight	F bpwtbwt	G
			= 'bpweight	
1	40	6	0.15	<code>=mean(e1:e7)</code>
2	38	4	0.105263	
3	35	7	0.2	
4	39	8	0.205128	
5	37	5	0.135135	
G1	<code>=mean(e1:e7)</code>			

Figure 27

The calculator screen shows the same spreadsheet as Figure 27. The formula bar at the bottom now shows the result: `6`.

	D weight	E bpweight	F bpwtbwt	G
			= 'bpweight	
1	40	6	0.15	6
2	38	4	0.105263	
3	35	7	0.2	
4	39	8	0.205128	
5	37	5	0.135135	
G2	6			

Figure 28