

Introduction to Data Science

Lab 1 – Exploring Data in Microsoft Excel Online

Overview

Rosie Reeves is an entrepreneurial middle-school student who sells homemade lemonade from a stand at the park near her house. To promote her lemonade-stand, she distributes leaflets in the park. Rosie records details of her sales and flyer (leaflet) distribution, along with weather measurements including the temperature and rainfall each day.

In this lab, you will explore and visualize the data Rosie recorded.

What You'll Need

To complete the labs, you will need the following:

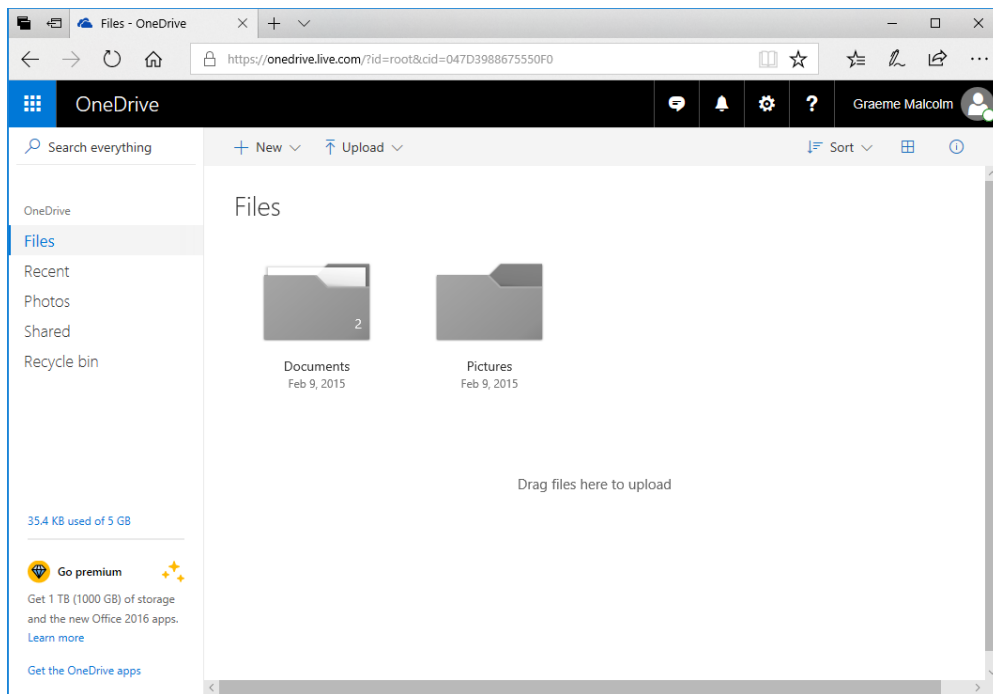
- A Windows, Linux, or Mac OS X computer with a web browser.
- A Microsoft account (for example a *hotmail.com*, *live.com*, or *outlook.com* account). If you do not already have a Microsoft account, sign up for one at <https://signup.live.com>.
- The lab files for this course. Download these from <https://aka.ms/edx-dat101x-labfiles>, and extract them to a folder on your computer.

Exercise 1: Viewing a Table of Data in Excel

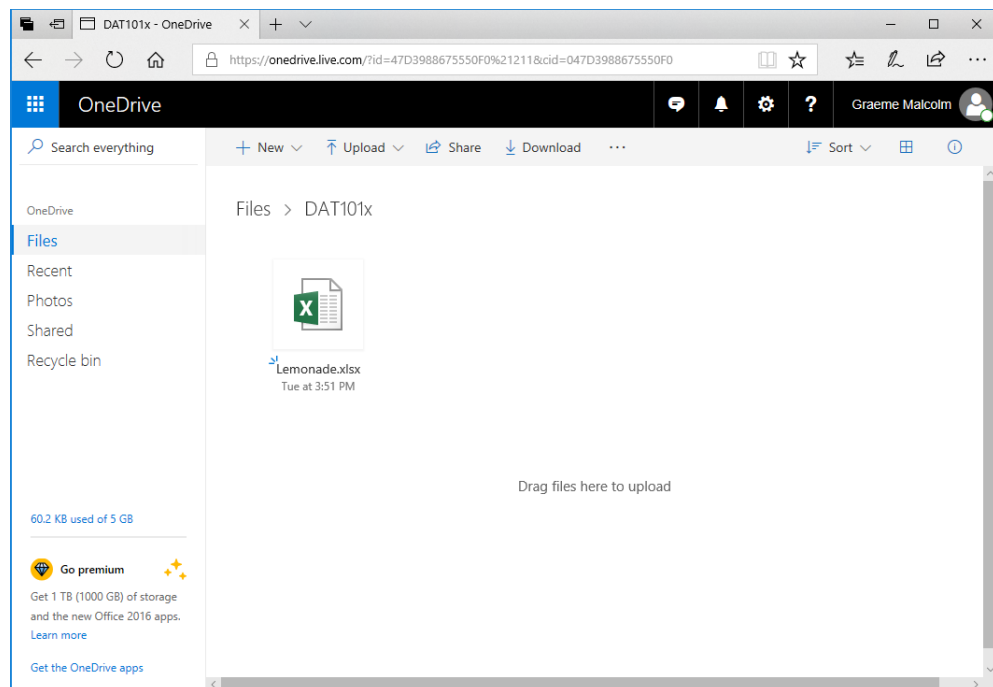
In this exercise, you will upload the Excel workbook containing Rosie's data to the OneDrive cloud storage account associated with your Microsoft account, and then explore the data in Microsoft Excel Online.

Upload the Workbook to OneDrive

1. In your web browser, navigate to <https://onedrive.live.com>, and sign in using your Microsoft account credentials. You should see the files and folders in your OneDrive, like this:



2. On the **+** **New** menu, click **Folder** to create a new folder. You can name this anything you like, for example **DAT101x**.
3. Click your new folder to open it, and then drag the **Lemonade.xlsx** Excel workbook file from the folder where you extracted the lab files for this course into the browser window to upload it to your folder. It should appear in your folder like this:



Open the Workbook in Excel Online

1. Click the **Lemonade.xlsx** file in your OneDrive folder to open it in Excel Online. When opened, it should look like this:

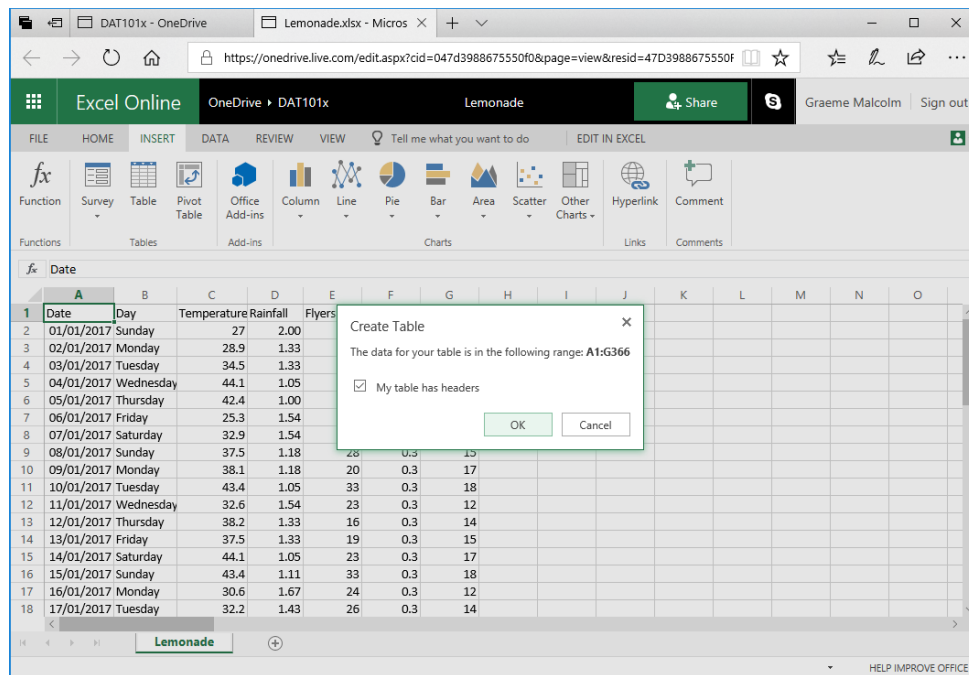
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Date	Day	Temperature	Rainfall	Flyers	Price	Sales								
2	#####	Sunday	27	2.00	15	0.3	10								
3	#####	Monday	28.9	1.33	15	0.3	13								
4	#####	Tuesday	34.5	1.33	27	0.3	15								
5	#####	Wednesday	44.1	1.05	28	0.3	17								
6	#####	Thursday	42.4	1.00	33	0.3	18								
7	#####	Friday	25.3	1.54	23	0.3	11								
8	#####	Saturday	32.9	1.54	19	0.3	13								
9	#####	Sunday	37.5	1.18	28	0.3	15								
10	#####	Monday	38.1	1.18	20	0.3	17								
11	#####	Tuesday	43.4	1.05	33	0.3	18								
12	#####	Wednesday	32.6	1.54	23	0.3	12								
13	#####	Thursday	38.2	1.33	16	0.3	14								
14	#####	Friday	37.5	1.33	19	0.3	15								
15	#####	Saturday	44.1	1.05	23	0.3	17								
16	#####	Sunday	43.4	1.11	33	0.3	18								
17	#####	Monday	30.6	1.67	24	0.3	12								
18	#####	Tuesday	32.2	1.43	26	0.3	14								

- The dates column **A** may be too wide to be displayed, so the cells may contain ##### as shown above. To see the dates, double-click the line between the **A** and **B** column headers. The dates will then be shown in the format for the locale associated with your Microsoft account. For example, in the following image, the dates are shown in UK format (*dd/MM/yyyy*):

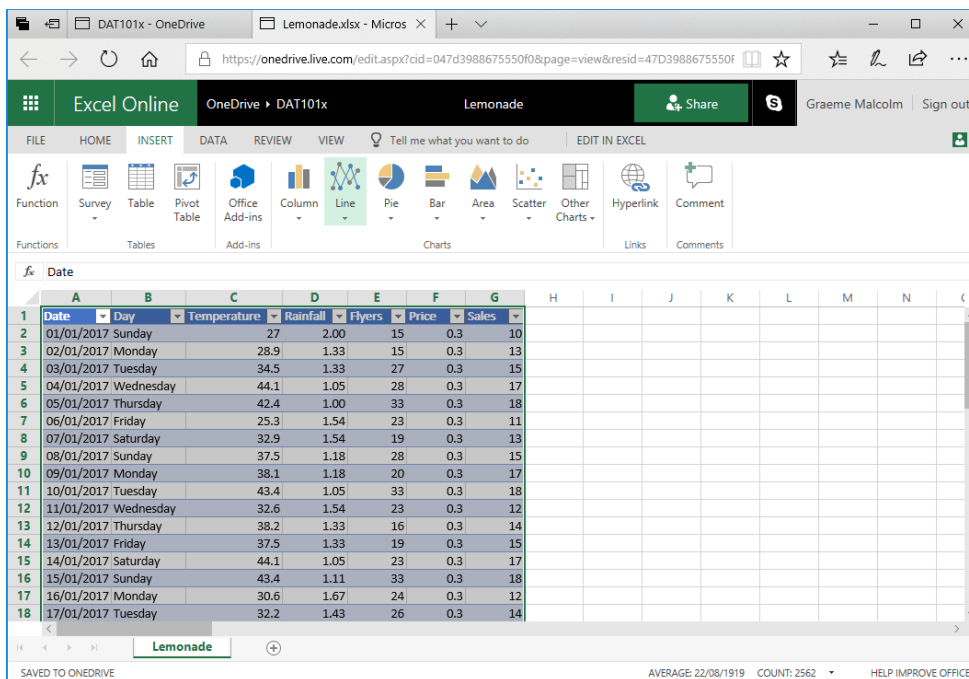
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Date	Day	Temperature	Rainfall	Flyers	Price	Sales								
2	01/01/2017	Sunday	27	2.00	15	0.3	10								
3	02/01/2017	Monday	28.9	1.33	15	0.3	13								
4	03/01/2017	Tuesday	34.5	1.33	27	0.3	15								
5	04/01/2017	Wednesday	44.1	1.05	28	0.3	17								
6	05/01/2017	Thursday	42.4	1.00	33	0.3	18								
7	06/01/2017	Friday	25.3	1.54	23	0.3	11								
8	07/01/2017	Saturday	32.9	1.54	19	0.3	13								
9	08/01/2017	Sunday	37.5	1.18	28	0.3	15								
10	09/01/2017	Monday	38.1	1.18	20	0.3	17								
11	10/01/2017	Tuesday	43.4	1.05	33	0.3	18								
12	11/01/2017	Wednesday	32.6	1.54	23	0.3	12								
13	12/01/2017	Thursday	38.2	1.33	16	0.3	14								
14	13/01/2017	Friday	37.5	1.33	19	0.3	15								
15	14/01/2017	Saturday	44.1	1.05	23	0.3	17								
16	15/01/2017	Sunday	43.4	1.11	33	0.3	18								
17	16/01/2017	Monday	30.6	1.67	24	0.3	12								
18	17/01/2017	Tuesday	32.2	1.43	26	0.3	14								

Filter and Sort the Data

- Select cell **A1**, and then on the **Insert** tab of the ribbon above the worksheet, click **Table**. Verify that Excel has automatically detected the data in the range **A1:G366**, and that the **My table has headers** checkbox is selected, and then click **OK**; as shown here:



Excel automatically formats the data as a table and adds drop-down buttons to the header row as shown here:



- Click any cell to deselect the table, and then click the drop-down button for the **Day** column, and click **Filter...**
- In the **Filter** dialog box, clear the **(Select All)** checkbox, and then select only the **Saturday** and **Sunday** checkboxes as shown here before clicking **OK**:

Filter

Select item:

☒ (Select All)
☐ Friday
☐ Monday
☒ Saturday
☒ Sunday
☐ Thursday
☐ Tuesday
☐ Wednesday

OK Cancel

The table of data is filtered to show only the records for weekend days (Saturday and Sunday).

- Click the drop-down arrow for the **Rainfall** column and click **Sort Descending**. The table of data is sorted in descending order of rainfall, so the first row contains the data for the weekend day with the most rain. This was a Sunday on which there was 2.50 cm of rain as shown here:

	Date	Day	Temperature	Rainfall	Flyers	Price	Sales
2	31/12/2017	Sunday	15.1	2.50	9	0.3	7
8	01/01/2017	Sunday	27	2.00	15	0.3	10
9	10/12/2017	Sunday	31.3	1.82	15	0.3	11
15	07/01/2017	Saturday	32.9	1.54	19	0.3	13
16	09/12/2017	Saturday	31.2	1.43	19	0.3	14
22	30/12/2017	Saturday	30.9	1.43	22	0.3	13
23	28/01/2017	Saturday	34.9	1.33	15	0.3	13
29	29/01/2017	Sunday	35.2	1.33	27	0.3	14
30	17/12/2017	Sunday	32.2	1.33	16	0.3	14
36	21/01/2017	Saturday	36.2	1.25	16	0.3	14
37	16/12/2017	Saturday	35.5	1.25	30	0.3	15
43	24/12/2017	Sunday	35.8	1.25	26	0.3	16
44	08/01/2017	Sunday	37.5	1.18	28	0.3	15
50	03/12/2017	Sunday	33.5	1.18	19	0.3	15
51	15/01/2017	Sunday	43.4	1.11	33	0.3	18
57	22/01/2017	Sunday	40.8	1.11	19	0.3	16
58	05/02/2017	Sunday	45.4	1.11	32	0.3	18

- Click the drop-down arrow for the **Day** column again and then click **Clear Filter from 'Day'**. The table now shows all the data.
- Click the drop-down arrow for **Date** and click **Sort Ascending** to re-order the data into chronological order.

Challenge: Find the Weekday with the Lowest Temperature

- Using the filter and sort capabilities in Excel Online, filter the data so that only weekdays (Monday to Friday) are shown, and sort the data so that the first row contains data for the weekday with the lowest temperature.

2. Make a note of the day and the temperature, and then clear the filter and re-sort the data back into chronological order.

Exercise 2: Using Formulae to Explore Data in Excel

In this exercise, you will use formulae to create derived columns that extend the data recorded by Rosie.

Add Derived Columns

1. Click the **B** column header to select the entire **B** column. Then on the **Home** tab of the ribbon, in the **Insert** drop-down menu, click **Insert Sheet Columns**. This inserts a new **Column1** column between the **Date** and **Day** columns as shown here:

	A	B	C	D	E	F	G	H	I	J
1	Date	Column1	Day	Temperature	Rainfall	Flyers	Price	Sales		
2	01/01/2017		Sunday	27	2.00	15	0.3	10		
3	02/01/2017		Monday	28.9	1.33	15	0.3	13		
4	03/01/2017		Tuesday	34.5	1.33	27	0.3	15		
5	04/01/2017		Wednesday	44.1	1.05	28	0.3	17		
6	05/01/2017		Thursday	42.4	1.00	33	0.3	18		
7	06/01/2017		Friday	25.3	1.54	23	0.3	11		
8	07/01/2017		Saturday	32.9	1.54	19	0.3	13		
9	08/01/2017		Sunday	37.5	1.18	28	0.3	15		
10	09/01/2017		Monday	38.1	1.18	20	0.3	17		
11	10/01/2017		Tuesday	43.4	1.05	33	0.3	18		
12	11/01/2017		Wednesday	32.6	1.54	23	0.3	12		
13	12/01/2017		Thursday	38.2	1.33	16	0.3	14		
14	13/01/2017		Friday	37.5	1.33	19	0.3	15		
15	14/01/2017		Saturday	44.1	1.05	23	0.3	17		
16	15/01/2017		Sunday	43.4	1.11	33	0.3	18		
17	16/01/2017		Monday	30.6	1.67	24	0.3	12		
18	17/01/2017		Tuesday	32.2	1.43	26	0.3	14		

2. In cell **B1**, rename **Column1** to **Month**. Then in cell **B2**, enter the following formula:

`=TEXT (A2, "mmmm")`

After you enter the formula, it should be copied automatically to all the other **Month** cells in the table, and the name of the month for each record should be displayed as shown here:

Excel Online interface showing a table with the following data:

	Date	Month	Day	Temperature	Rainfall	Flyers	Price	Sales
1	01/01/2017	January	Sunday	27	2.00	15	0.3	10
2	02/01/2017	January	Monday	28.9	1.33	15	0.3	13
3	03/01/2017	January	Tuesday	34.5	1.33	27	0.3	15
4	04/01/2017	January	Wednesday	44.1	1.05	28	0.3	17
5	05/01/2017	January	Thursday	42.4	1.00	33	0.3	18
6	06/01/2017	January	Friday	25.3	1.54	23	0.3	11
7	07/01/2017	January	Saturday	32.9	1.54	19	0.3	13
8	08/01/2017	January	Sunday	37.5	1.18	28	0.3	15
9	09/01/2017	January	Monday	38.1	1.18	20	0.3	17
10	10/01/2017	January	Tuesday	43.4	1.05	33	0.3	18
11	11/01/2017	January	Wednesday	32.6	1.54	23	0.3	12
12	12/01/2017	January	Thursday	38.2	1.33	16	0.3	14
13	13/01/2017	January	Friday	37.5	1.33	19	0.3	15
14	14/01/2017	January	Saturday	44.1	1.05	23	0.3	17
15	15/01/2017	January	Sunday	43.4	1.11	33	0.3	18
16	16/01/2017	January	Monday	30.6	1.67	24	0.3	12
17	17/01/2017	January	Tuesday	32.2	1.43	26	0.3	14

- In cell I1, enter the text **Revenue** to add a new **Revenue** column to the table. Then in cell I2, enter the following formula:

$$= G2 * H2$$

The formula is again automatically copied to the remaining rows in the table, and the revenue (calculated as **Price** multiplied by **Sales**) is displayed as shown here:

Excel Online interface showing the table with the new **Revenue** column:

	Date	Month	Day	Temperature	Rainfall	Flyers	Price	Sales	Revenue
1	01/01/2017	January	Sunday	27	2.00	15	0.3	10	3
2	02/01/2017	January	Monday	28.9	1.33	15	0.3	13	3.9
3	03/01/2017	January	Tuesday	34.5	1.33	27	0.3	15	4.5
4	04/01/2017	January	Wednesday	44.1	1.05	28	0.3	17	5.1
5	05/01/2017	January	Thursday	42.4	1.00	33	0.3	18	5.4
6	06/01/2017	January	Friday	25.3	1.54	23	0.3	11	3.3
7	07/01/2017	January	Saturday	32.9	1.54	19	0.3	13	3.9
8	08/01/2017	January	Sunday	37.5	1.18	28	0.3	15	4.5
9	09/01/2017	January	Monday	38.1	1.18	20	0.3	17	5.1
10	10/01/2017	January	Tuesday	43.4	1.05	33	0.3	18	5.4
11	11/01/2017	January	Wednesday	32.6	1.54	23	0.3	12	3.6
12	12/01/2017	January	Thursday	38.2	1.33	16	0.3	14	4.2
13	13/01/2017	January	Friday	37.5	1.33	19	0.3	15	4.5
14	14/01/2017	January	Saturday	44.1	1.05	23	0.3	17	5.1
15	15/01/2017	January	Sunday	43.4	1.11	33	0.3	18	5.4
16	16/01/2017	January	Monday	30.6	1.67	24	0.3	12	3.6
17	17/01/2017	January	Tuesday	32.2	1.43	26	0.3	14	4.2

- Click the I column header to select the entire column, and then on the **Home** tab of the ribbon, in the **Number** section, in the *Accounting Number Format* (\$) drop-down list, select **\$ English (United States)**. This formats the revenue data as US dollars:

5. Scroll down to the bottom of the table of data, select cell **I367** (under the **Revenue** column). Then on the **Home** tab of the ribbon, in the **Editing** section, in the **AutoSum** (Σ) drop-down menu, click **Σ Sum**. This enters the following formula:

The screenshot shows the Microsoft Excel Online interface. The browser address bar displays the URL: <https://onedrive.live.com/edit.aspx?cid=047d3988675550f0&page=view&resid=47D3988675550F01>. The Excel ribbon is set to 'Home' with various tabs like File, Home, Insert, Data, Review, View, and Tell me what you want to do. The formula bar shows the formula: `=SUBTOTAL(109,[Revenue])`. The spreadsheet displays data for 'Lemonade.xlsx' with columns for Date, Month, Day, Temperature, Rainfall, Flyers, Price, Sales, and Revenue. The Revenue column is highlighted in green, and the total value '\$3,183.70' is shown in cell B367.

- Filter the **Month** column to show only the records for July, and then look at the subtotal at the bottom of the **Revenue** column (you may need to scroll to find it). It now shows the total revenue for July:

The screenshot shows an Excel Online interface with a table of data. The 'Month' column is filtered to show only July records. The 'Revenue' column has a subtotal for July, which is \$556.50.

Date	Month	Day	Temperature	Rainfall	Flyers	Price	Sales	Revenue
24/07/2017	July	Monday	83.5	0.57	69	0.5	35	\$ 17.50
25/07/2017	July	Tuesday	79.9	0.57	64	0.5	33	\$ 16.50
26/07/2017	July	Wednesday	76.6	0.59	37	0.5	32	\$ 16.00
27/07/2017	July	Thursday	97.9	0.47	74	0.5	43	\$ 21.50
28/07/2017	July	Friday	87.4	0.51	58	0.5	38	\$ 19.00
29/07/2017	July	Saturday	85.5	0.57	50	0.5	35	\$ 17.50
30/07/2017	July	Sunday	78.2	0.59	52	0.5	34	\$ 17.00
31/07/2017	July	Monday	74.6	0.61	38	0.5	32	\$ 16.00
Subtotal								\$ 556.50

- Clear the filter on **Month** to show all the data.

Challenge: Find the Total Number of Flyers Distributed

- Add a cell under the **Flyers** column that contains the total number of flyers Rosie distributed. Format this column using the *Comma Style* (,) number format so that the total is formatted like 00,000.00.
- Note the total amount for the year, and then filter the data to find the number of flyers distributed in the month of January. Don't forget to clear the filter when you're done!

Exercise 3: Using Conditional Formatting to Explore Data

In this exercise, you will apply conditional formatting to data to highlight key values of interest.

Highlighting Extremes and Outliers

- Select cell **D2** and then hold the **Shift** and **Ctrl** keys and press the **Down-Arrow** key to select all the values in the **Temperature** column (if you are using a Mac OSX computer, hold the **Shift** and **⌘** keys, and press the **Down-Arrow** key).
- On the **Home** tab of the ribbon, in the **Conditional Formatting** drop-down list, point to **Color Scales**, and select the **Red-White Color Scale** (with red at the top and white at the bottom). The **Temperature** cells are reformatted so that the hottest days are colored an intense red, and the coolest days are much lighter in color intensity. Scrolling through the data now, it is easier to find days that are particularly hot or cool.

Excel Online interface showing the 'Lemonade' spreadsheet. The 'Rainfall' column (D) is selected, and the 'Conditional Formatting' menu is open, showing the 'Data Bars' option.

Date	Month	Day	Temperature	Rainfall	Flyers	Price	Sales	Revenue
01/01/2017	January	Sunday	27	2.00	15	0.3	10	\$ 3.00
02/01/2017	January	Monday	28.9	1.33	15	0.3	13	\$ 3.90
03/01/2017	January	Tuesday	34.5	1.33	27	0.3	15	\$ 4.50
04/01/2017	January	Wednesday	44.1	1.05	28	0.3	17	\$ 5.10
05/01/2017	January	Thursday	42.4	1.00	33	0.3	18	\$ 5.40
06/01/2017	January	Friday	25.3	1.54	23	0.3	11	\$ 3.30
07/01/2017	January	Saturday	32.9	1.54	19	0.3	13	\$ 3.90
08/01/2017	January	Sunday	37.5	1.18	28	0.3	15	\$ 4.50
09/01/2017	January	Monday	38.1	1.18	20	0.3	17	\$ 5.10
10/01/2017	January	Tuesday	43.4	1.05	33	0.3	18	\$ 5.40
11/01/2017	January	Wednesday	32.6	1.54	23	0.3	12	\$ 3.60
12/01/2017	January	Thursday	38.2	1.33	16	0.3	14	\$ 4.20
13/01/2017	January	Friday	37.5	1.33	19	0.3	15	\$ 4.50
14/01/2017	January	Saturday	44.1	1.05	23	0.3	17	\$ 5.10
15/01/2017	January	Sunday	43.4	1.11	33	0.3	18	\$ 5.40
16/01/2017	January	Monday	30.6	1.67	24	0.3	12	\$ 3.60
17/01/2017	January	Tuesday	32.2	1.43	26	0.3	14	\$ 4.20

3. Select all the values in the **Rainfall** column, and then in the **Conditional Formatting** drop-down list, point to **Data Bars**, and select the **Light Blue Data Bar** gradient fill. The cells are formatted with a visual indication of the comparative level of rainfall for each day.

Excel Online interface showing the 'Lemonade' spreadsheet. The 'Rainfall' column (D) is selected, and the 'Conditional Formatting' menu is open, showing the 'Data Bars' option.

Date	Month	Day	Temperature	Rainfall	Flyers	Price	Sales	Revenue
01/01/2017	January	Sunday	27	2.00	15	0.3	10	\$ 3.00
02/01/2017	January	Monday	28.9	1.33	15	0.3	13	\$ 3.90
03/01/2017	January	Tuesday	34.5	1.33	27	0.3	15	\$ 4.50
04/01/2017	January	Wednesday	44.1	1.05	28	0.3	17	\$ 5.10
05/01/2017	January	Thursday	42.4	1.00	33	0.3	18	\$ 5.40
06/01/2017	January	Friday	25.3	1.54	23	0.3	11	\$ 3.30
07/01/2017	January	Saturday	32.9	1.54	19	0.3	13	\$ 3.90
08/01/2017	January	Sunday	37.5	1.18	28	0.3	15	\$ 4.50
09/01/2017	January	Monday	38.1	1.18	20	0.3	17	\$ 5.10
10/01/2017	January	Tuesday	43.4	1.05	33	0.3	18	\$ 5.40
11/01/2017	January	Wednesday	32.6	1.54	23	0.3	12	\$ 3.60
12/01/2017	January	Thursday	38.2	1.33	16	0.3	14	\$ 4.20
13/01/2017	January	Friday	37.5	1.33	19	0.3	15	\$ 4.50
14/01/2017	January	Saturday	44.1	1.05	23	0.3	17	\$ 5.10
15/01/2017	January	Sunday	43.4	1.11	33	0.3	18	\$ 5.40
16/01/2017	January	Monday	30.6	1.67	24	0.3	12	\$ 3.60
17/01/2017	January	Tuesday	32.2	1.43	26	0.3	14	\$ 4.20

4. Select all the values in the **Sales** column, and then in the **Conditional Formatting** drop-down list, point to **Top/Bottom Rules**, and select **Top 10%**. Then in the **Top 10%** dialog box, select **Green Fill with Dark Green Text** and click **OK**. The cells containing sales values in the top 10% are highlighted in green (you may need to scroll to see them).
5. Reselect the values in the **Sales** column if you deselected them, and then in the **Conditional Formatting** drop-down list, point to **Top/Bottom Rules**, and select **Bottom 10%**. Then in the

Bottom 10% dialog box, select **Red Fill with Dark Red Text** and click **OK**. The cells containing sales values in the bottom 10% are highlighted in red (again, you may need to scroll to see them).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	Date	Month	Day	Temperature	Rainfall	Flyers	Price	Sales	Revenue					
1	01/01/2017	January	Sunday	27	2.00	15	0.3	10	\$ 3.00					
2	02/01/2017	January	Monday	28.9	1.33	15	0.3	13	\$ 3.90					
3	03/01/2017	January	Tuesday	34.5	1.33	27	0.3	15	\$ 4.50					
4	04/01/2017	January	Wednesday	44.1	1.05	28	0.3	17	\$ 5.10					
5	05/01/2017	January	Thursday	42.4	1.00	33	0.3	18	\$ 5.40					
6	06/01/2017	January	Friday	25.3	1.54	23	0.3	11	\$ 3.30					
7	07/01/2017	January	Saturday	32.9	1.54	19	0.3	13	\$ 3.90					
8	08/01/2017	January	Sunday	37.5	1.18	28	0.3	15	\$ 4.50					
9	09/01/2017	January	Monday	38.1	1.18	20	0.3	17	\$ 5.10					
10	10/01/2017	January	Tuesday	43.4	1.05	33	0.3	18	\$ 5.40					
11	11/01/2017	January	Wednesday	32.6	1.54	23	0.3	12	\$ 3.60					
12	12/01/2017	January	Thursday	38.2	1.33	16	0.3	14	\$ 4.20					
13	13/01/2017	January	Friday	37.5	1.33	19	0.3	15	\$ 4.50					
14	14/01/2017	January	Saturday	44.1	1.05	23	0.3	17	\$ 5.10					
15	15/01/2017	January	Sunday	43.4	1.11	33	0.3	18	\$ 5.40					
16	16/01/2017	January	Monday	30.6	1.67	24	0.3	12	\$ 3.60					
17	17/01/2017	January	Tuesday	32.2	1.43	26	0.3	14	\$ 4.20					

Challenge: Compare Temperature, Rainfall, and Sales

Now that you've highlighted the cells, you can more easily make visual comparisons between temperature, rainfall, and sales values.

Scroll through the data, and just by looking at the visual formatting you've added, try to see if you can spot any relationship between temperature, rainfall, and sales that might form the basis of a hypothesis you'll want to investigate more thoroughly.