

Data 301 Data Analytics

Spreadsheets: Microsoft Excel

Part 1 of 3

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Why Spreadsheets and Microsoft Excel?

Spreadsheets are the most common, general-purpose software for data analysis and reporting.

Microsoft Excel is the most popular spreadsheet program with hundreds of millions of installations.

- ▶ The spreadsheet concepts translate to other products.

Excel and spreadsheets are not always the best tool for data analysis, but they are great for quick analysis, reporting, and sharing.

Follow along with the examples by downloading the **03ExcelPart1.xlsx** and **DemoPart1.xlsx** file from CANVAS.

Spreadsheet Overview

A spreadsheet organizes information into a two-dimensional array of cells (a table).

A cell has two components:

- ▶ an address - specified given a column letter and row number
- ▶ a location - that can store a number, text, or formula

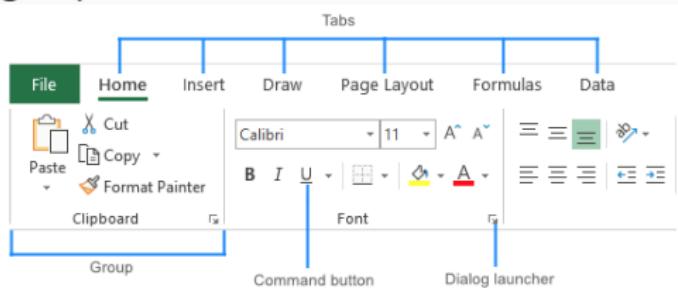
The power of a spreadsheet is that we can write simple formulas (commands) to perform calculations and immediately see the results of those calculations.

Spreadsheets are very common in business and reporting applications.

Excel Ribbon

ribbon The Excel ribbon is the strip of icons above the worksheet area. It replaces the menus and toolbars found in Excel 2003 and earlier.

ribbon tab contains multiple commands logically sub-divided into groups



[img source.](#)

Workbook vs. worksheets

workbook A workbook is the name given to an Excel file and contains one or more worksheets.

worksheet A worksheet (or sheet/spreadsheet) is a single page in a file created with an electronic spreadsheet program.

For example 03ExcelPartI.xlsx is a *workbook* that contains two *worksheets*. The name of these worksheets are QuarterSales and AnnualSales.

Adding and renaming worksheets

To add a new worksheet we simply the plus sign located to the right of the worksheets.

The screenshot shows a Microsoft Excel window with the following details:

- Ribbon:** The ribbon is visible at the top with tabs for Home, Insert, Page Layout, Formulas, Data, Review, View, Share, and a search bar labeled "Name of workbook".
- Table:** A data table is displayed in the main area, showing sales data across six columns (Category, Product, Month, Volume, Price, Cost, Revenue) and 12 rows. The table includes a header row and data for Food, Clothing, and Toys categories.
- Worksheet Tab Area:** At the bottom, there are tabs for "QuarterSales" and "AnnualSales", both highlighted with red circles. To the right of these tabs is a blue circle containing a plus sign (+) with the text "click to add a new worksheet" next to it. The word "Worksheets" is also written in red below the tabs.
- Toolbar:** The standard Excel toolbar is visible above the ribbon, with icons for Paste, Font, Alignment, Number, Conditional Formatting, Format as Table, Cell Styles, Cells, and Editing.
- Status Bar:** The status bar at the bottom right shows the zoom level as 75%.

By default, the worksheets are named Sheet1, Sheet2, Sheet3, and so on, but you can change these names by double clicking on the tab and typing an alternate name.

- ▶ To **Move a sheet**, drag the sheet tab to the location that you want along the row of sheet tabs.
- ▶ To **Copy a sheet**
 1. Hold down **Ctrl** / **Option** (Windows/Mac).
 2. Drag the sheet tab to the location that you want the copied sheet to appear along the row of sheet tabs.

Important Release the mouse button before you release **Option** / **Ctrl**.

- ▶ To move/copy your worksheet to another workbook, you can right click the corresponding worksheet tab and select **Move or Copy**. Select the desired workbook from the dropdown menu. Alternatively, you could follow the options outlined [here](#)

Spreadsheet Addressing

A *cell* is identified by a column letter and row number.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Category	Product	Month	Volume	Price	Cost	Revenue						
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00						
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00						
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00						
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00						
6	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00						
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00						
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00						
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00						
10	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00						
11	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00						
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 500.00						
13					Total:		\$3,190.00						
14													

Notice how the *active cell* (the cell highlighted by the green rectangle in the spreadsheet) also displays its cell identifier in name box located to the left of the formula bar.

Spreadsheet Addressing

- ▶ The *rows* in a spreadsheet are *numbered* starting from 1.
- ▶ The *columns* are represented by *letters*.
 - ▶ A is column 1, B is column 2, ..., Z is column 26, AA is column 27, ...
- ▶ A cell is identified by putting the column letter first then the row number.
 - ▶ e.g. **B3** is the 2nd column and the 3rd row.

Question: What column number is AD? How about BAD?

AD	AE
Result	Formula
30	=COLUMN()
1382	=COLUMN(BAD1)

Spreadsheet Data Entry

An entry is added to a cell by clicking on it and typing in the data.

- The spreadsheet attempts to detect the data type and format it accordingly. It is also possible to manually *format* the data

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx - Excel". The data is organized into columns: Category, Product, Month, Volume, Price, Cost, and Revenue. Row 13 contains a formula to calculate the total revenue. The "Volume" column is currently selected. A blue circle highlights the "Number" button in the ribbon's "Home" tab, which is part of a dropdown menu. A blue arrow points from the word "format" to this "Number" button. The ribbon tabs include File, Home, Insert, Page Layout, Formulas, Data, Page Layout, View, Developer, Team, Tell me..., Sign in, and Share. The status bar at the bottom shows "QuarterSales" as the active sheet, along with other tabs like QuarterSalesFormat and QuarterPivot, and the zoom level set to 100%.

Category	Product	Month	Volume	Price	Cost	Revenue
Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00
Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00
Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00
Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00
Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00
Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00
Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00
Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00
Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00
Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00
Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00
				Total:		\$3,190.00

Date and Type Formats

- ▶ Excel stores dates and time as a date serial number.
- ▶ The earliest date permitted by Excel is January 1, 1900 (which has a date serial number equal to 1).
- ▶ **DATEVALUE()** function converts text to a date serial number which we can then format to display the day however we want
- ▶ Alternatively we could use the **DATE(year, month, day)** function which takes the arguments:
 - year** - Number for year.
 - month** - *Number* for month.
 - day** - Number for day.

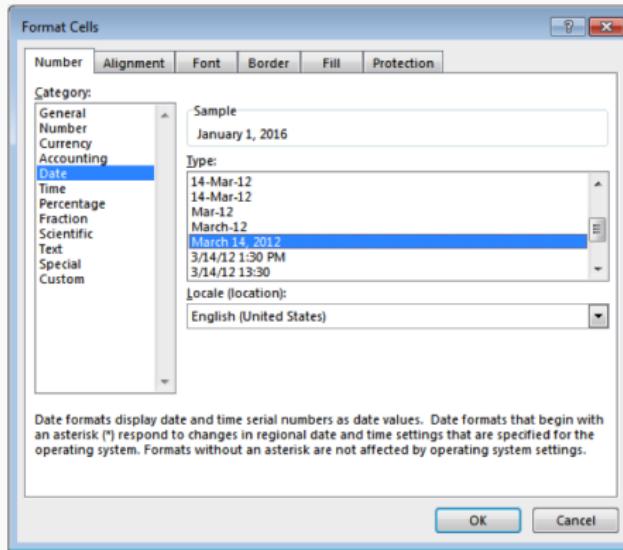
Date and Type Formats

- ▶ It is important to note that Excel dates require a year, month, *and* day.
- ▶ That is, if you are missing a year, for example, Excel won't be able to format that cell as a date unless we provide a year.
- ▶ One trick is to give your data an arbitrary year that you hide when you format your cells.
- ▶ For example, we could replace January with January 1, 2019 and format the cell to only display the month.

Cell Format	Cell display	
General	January	(treated as text)
Date	2019-01-01	(treated as serial number 43466)
Custom	January	(treated as serial number 43466)

Date and Type Formats

- ▶ Formatting data helps users read and understand data and is especially important for numbers and dates.
- ▶ To change the format of a serial date, click the down arrow in the format drop down menu and select **More Number Formats**; this will open up the *Format Cells* pop-up box



Date and Type Formats

- ▶ You can use either built-in or custom formats or **custom formatting** (see a summary of these on the next slide)
- ▶ For example, applying the custom format of dd/mmm-yy on the date *January 1, 2005* would display 01/Jan-05.
- ▶ You can also accomplish this type of formatting using the **TEXT()** function. These cells, however, will be treated as text, not dates.

Custom Date Options

Here are some examples of custom formatting options. Source: ablebits.com

Example (January 1, 2005)

Code	Description	Result
m	Month number without a leading zero	1
mm	Month number with a leading zero	01
mmm	Month name, short form	Jan
mmmm	Month name, full form	January
mmmmm	Month as the first letter	J ¹
d	Day number without a leading zero	1
dd	Day number with a leading zero	01
ddd	Day of the week, short form	Mon
dddd	Day of the week, full form	Monday
yy	Year (last 2 digits)	05
yyyy	Year (4 digits)	2005

¹(stands for January, June and July)

Currency vs Accounting

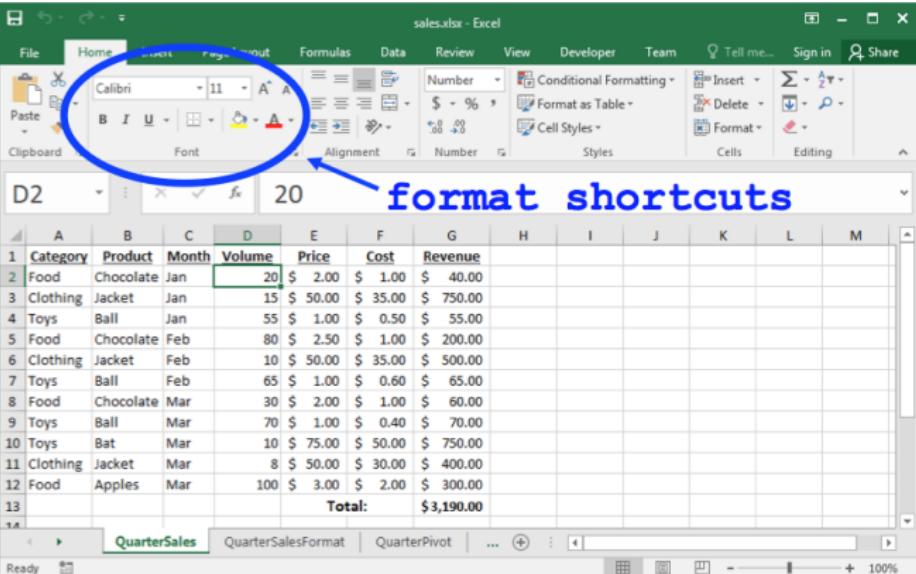
It is worth mentioning the difference between *Currency* and *Accounting* as they are very similar.

- ▶ Currency places the dollar sign to the immediate left of the number while Accounting places the dollar sign on the left edge of the cell.
- ▶ Currency displaces zeros as \$0.00 while Accounting denotes zeros with dashes
- ▶ The Accounting format displays negative numbers in parentheses.

	A	B
1	Accounting	Currency
2	\$ 12,345,678.00	\$12,345,678.00
3	\$ (37.17)	-\$37.17
4	\$ -	\$0.00
5	\$ 5.00	\$5.00

Spreadsheet Formatting (Windows)

A text editor shortcut will allow you to format cells in bold, italics, underline, fonts, colours, justify, etc.



The screenshot shows a Microsoft Excel window titled "sales.xlsx - Excel". The ribbon is visible at the top with tabs for File, Home, Insert, Page Layout, Formulas, Data, Review, View, Developer, Team, Tell me..., Sign in, and Share. The "Home" tab is selected. In the center, there is a table with columns labeled Category, Product, Month, Volume, Price, Cost, and Revenue. Row 13 contains a "Total:" label and the value \$3,190.00. A blue circle highlights the "Font" section of the ribbon, which includes font selection dropdowns and buttons for Bold (B), Italic (I), Underline (U), and other font-related options. Below the ribbon, the formula bar shows "D2" and "20". A blue arrow points from the text "format shortcuts" towards the ribbon area. The status bar at the bottom right shows "Ready" and "100%".

format shortcuts

Category	Product	Month	Volume	Price	Cost	Revenue
Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00
Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00
Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00
Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00
Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00
Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00
Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00
Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00
Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00
Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00
Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00
			Total:	\$3,190.00		

Try It!

Exercise

Make a copy of the QuarterSales worksheet and call it QuarterSalesFormat. Format the headers of the QuarterSales worksheet to be **bold**, underlined and centered.

Exercise

Format all monetary cells to the format *Currency*

Spreadsheet Selecting Multiple Cells

There are a number of ways of selecting multiple cells at a time:

1. With the mouse, (left) click and drag mouse to select a rectangle region of cells.
2. With keyboard, hold **SHIFT** key and use arrow keys to select a rectangle region of cells.
3. With mouse and keyboard, while holding **CTRL** (windows)/**Cmnd** (mac) key, (left) click on individual cells to select non-contiguous cells.
4. Click on a row number to select a whole row² or select the first column in that row and press **SHIFT** + **Cmnd** / **Cntrl** + **→**
5. Click on a column header to select a whole column² or select the first row in that column and **SHIFT** + **Cmnd** / **Ctrl** + **↓**

See more keyboard shortcuts [here](#). (eg. **Cmnd** / **Ctrl** + **A** select entire worksheet) [See demo](#)

²or until the first empty cell

Range Selecting Cells Example

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx - Excel". The active cell is A3, containing the text "Clothing". The formula bar also displays "Clothing". The ribbon menu is visible at the top, showing tabs like File, Home, Insert, Page Layout, Formulas, Data, Review, View, Developer, Team, Tell me..., Sign in, and Share. The Home tab is selected.

The data table has the following structure:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Category	Product	Month	Volume	Price	Cost	Revenue						
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00						
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00						
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00						
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00						
6	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00						
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00						
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00						
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00						
10	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00						
11	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00						
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00						
13					Total:		\$ 3,190.00						

The cells from A1 to G13 are selected, indicated by a light blue background. The status bar at the bottom shows "QuarterSales" is the active sheet, along with other sheet names and some statistical information: Average: 115, Count: 28, Sum: 1840, and a zoom level of 100%.

Selecting non-contiguous

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx - Excel". The formula bar at the top displays the formula `=SUM(G2,G5,G8,G10,G12)`. The main area contains a table with columns: Category, Product, Month, Volume, Price, Cost, and Revenue. The Revenue column is highlighted with a green border. The table has 13 rows, numbered 1 to 13. Row 14 is a blank header row. The "QuarterSales" tab is selected in the bottom navigation bar.

	A	B	C	D	SUM(number1, [number2], [number3], [number4], [number5], [number6], ...)				L	M
1	Category	Product	Month	Volume	Price	Cost	Revenue			
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00			
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00			
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00			
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00			
6	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00			
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00			
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00			
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00			
10	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00			
11	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00			
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00			
13					Total:		G10,G12			
14										

QuarterSales

Manipulating Cells

Once you have selected one or more cells, there are several common actions you can perform:

1. DELETE

- ▶ delete the contents of all cells by pressing **[Delete]** key
- ▶ delete the contents and the cell locations (then shift remaining) by selecting Edit menu, Delete... or Delete... pop-up menu (brought up by right click).

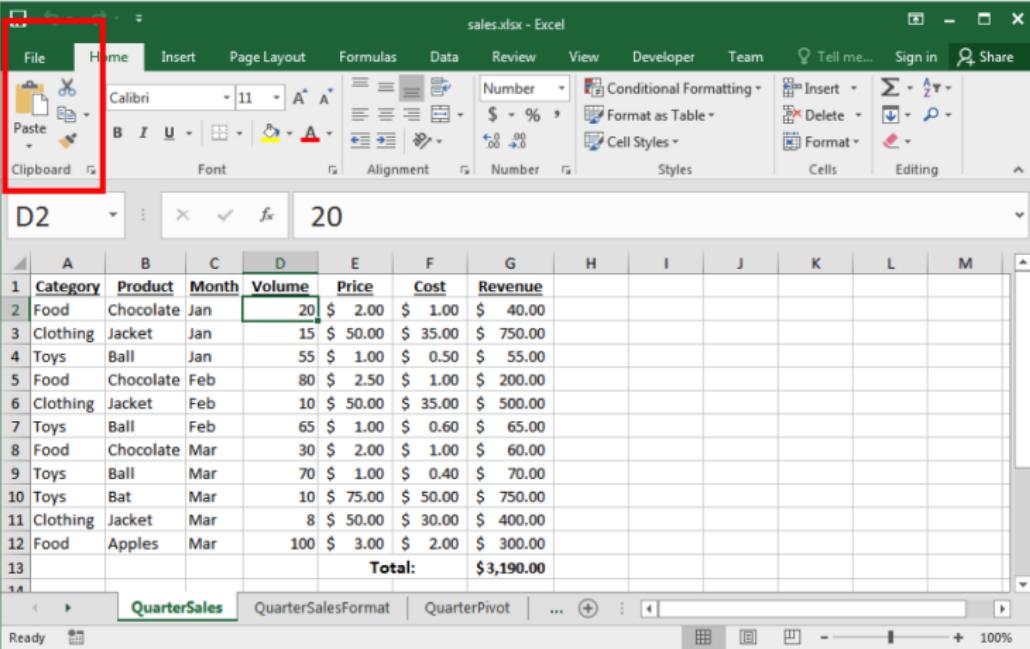
2. Cut, Copy, Paste

- ▶ cut - copies selected cells to clipboard and removes from document (**[Cmnd]/[Ctrl] + [X]**)
- ▶ copy - copies selected cells to clipboard (**[Cmnd]/[Ctrl] + [C]**)
- ▶ paste - copies cells in clipboard to sheet starting at currently selected cell (**[Cmnd]/[Ctrl] + [V]**)

3. Add selected cells to a formula (requires that you were previously constructing a formula before selecting the cells).

Cut, Copy, Paste

Alternatively you could use the command button shortcuts located in the Home tab on the ribbon.



The screenshot shows a Microsoft Excel window titled "sales.xlsx - Excel". The ribbon is visible at the top with the "Home" tab selected. A red box highlights the "Paste" button in the "Clipboard" group of the ribbon. The main area displays a data table with columns: Category, Product, Month, Volume, Price, Cost, and Revenue. The cell D2 contains the value 20. The formula bar also shows "20". The table data is as follows:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Category	Product	Month	Volume	Price	Cost	Revenue						
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00						
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00						
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00						
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00						
6	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00						
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00						
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00						
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00						
10	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00						
11	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00						
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00						
13					Total:		\$ 3,190.00						

The bottom navigation bar shows tabs: QuarterSales (selected), QuarterSalesFormat, QuarterPivot, and others. The status bar indicates "Ready" and "100%".

Paste Button Ribbon

- ▶ Some buttons in the ribbon open a menu with additional options.
- ▶ For example, the Paste button opens a menu with additional pasting options such as **Paste Values**, **Formulas**,... which will be useful to us later.

The screenshot shows the Microsoft Excel ribbon with the "Home" tab selected. In the top-left corner of the ribbon, there is a dropdown arrow next to the "Paste" button. A dropdown menu is open, listing various options under categories: "Paste", "Paste Values", and "Other Paste Options".

Paste

- Paste
- Formulas
- Formulas & Number Formatting
- Keep Source Formatting
- No Borders
- Keep Source Column Widths
- Transpose

Paste Values

- Paste Values
- Values & Number Formatting
- Values & Source Formatting

Other Paste Options

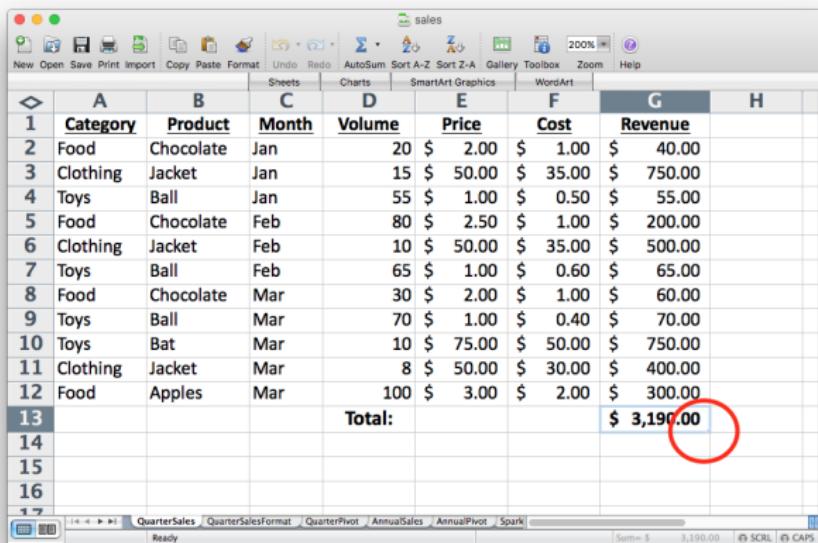
- Formatting
- Paste Link
- Paste as Picture

The main workspace shows a table with columns labeled E, F, G, H, I, J. The first three rows of the table have green borders. Row 4 has a green border around the entire row. Cell F4 contains the value "1". The formula bar above the table shows the formula =B2*2.5. The status bar at the bottom indicates "Quarter Sales!\$F\$4".

E	F	G	H	I	J
0	2	1	40		
5	50	35	750		
5	1	0.5	55		
0	2.5	1	200		
0	50	35	500		
5	1	0.6	65		
0	2	1	60		
0	1	0.4	70		
0	75	50	750		
8	50	30	400		
0	3	2	300		

Manipulating Cells - Filling

Filling combines copy and paste. There is a small box or tab beyond the cell's lower right corner (fill handle). Grab it with the cursor and pull to other cells.



The screenshot shows a Microsoft Excel spreadsheet titled "QuarterSales". The data is organized into columns: Category, Product, Month, Volume, Price, Cost, and Revenue. Row 13 contains a formula to calculate the total revenue, which is circled in red. The formula is =SUM(G2:G12).

	A	B	C	D	E	F	G	H
1	Category	Product	Month	Volume	Price	Cost	Revenue	
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00	
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00	
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00	
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00	
6	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00	
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00	
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00	
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00	
10	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00	
11	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00	
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00	
13				Total:			\$ 3,190.00	
14								
15								
16								

Manipulating Cells - Filling

Double clicking that lower corner will quickly copy and paste that formula to the end of the data (or until the first blank row).

	A	B	C	D	E	F	G	H	I
1	Category	Product	Month	Volume	Price	Cost			
2	Food	Chocolate	Jan	20	\$2.00	\$4.00			
3	Clothing	Jacket	Jan	15	\$50.00	\$75.00			
4	Toys	Ball	Jan	55	\$1.00	\$0.50	\$0.00	2	
5	Food	Chocolate	Feb	80	\$2.50	\$1.00	\$200.00		
6	Clothing	Jacket	Feb	10	\$50.00	\$35.00	\$500.00		
7	Toys	Ball	Feb	65	\$1.00	\$0.60	\$65.00	2	
8	Food	Chocolate	Mar	30	\$2.00	\$1.00	\$60.00	2	
9	Toys	Ball	Mar	70	\$1.00	\$0.40	\$70.00	2	
10	Toys	Bat	Mar	10	\$75.00	\$50.00	\$750.00	2	
11	Clothing	Jacket	Mar	8	\$50.00	\$30.00	\$400.00	2	
12	Food	Apples	Mar	100	\$3.00	\$2.00	\$300.00	2	
13									
14					Total food cost	\$5.00			
15									
16									

See demo on YouTube

Hiding Columns and Rows

You can hide a column or row by right-clicking on the column or row header and selecting *Hide*.

- The column/row still exists but will not be displayed or printed until we select *Unhide*. [Link to my demo on YouTube](#)

A screenshot of Microsoft Excel showing a context menu for column F. The menu is open at cell F1 and includes options like Cut, Copy, Paste Options, Insert, Delete, Clear Contents, Format Cells, Column Width, Hide, and Unhide. The 'Hide' option is highlighted.

A	B	C	D	E	F
1	Category	Product	Month	Volume	Price
2	Food	Chocolate	Jan	20	\$ 2.00
3	Clothing	Jacket	Jan	15	\$ 50.00
4	Toys	Ball	Jan	55	\$ 1.00
5	Food	Chocolate	Feb	80	\$ 2.50
6	Clothing	Jacket	Feb	10	\$ 50.00
7	Toys	Ball	Feb	65	\$ 1.00
8	Food	Chocolate	Mar	30	\$ 2.00
9	Toys	Ball	Mar	70	\$ 1.00
10	Toys	Bat	Mar	10	\$ 75.00
11	Clothing	Jacket	Mar	8	\$ 50.00
12	Food	Apples	Mar	100	\$ 3.00
13					Total:

The 'QuarterSales' sheet is selected in the bottom left corner. The status bar at the bottom shows: Average: 14.22727273 Count: 12 Sum: 156.5

Selecting Cells Question

Example 1

Which method allows you to select non-contiguous cells in a spreadsheet?

- A) hold **SHIFT** key and use arrow keys
- B) With the mouse left click on a cell and drag mouse
- C) hold **CTRL** (windows)/**Cmnd** (mac) key and use arrow keys
- D) hold **CTRL** (windows)/**Cmnd** (mac) key and left click on cells

Selecting Cells Question

Answer

Which method allows you to select non-contiguous cells in a spreadsheet?

- A) hold **SHIFT** key and use arrow keys
- B) With the mouse left click on a cell and drag mouse
- C) hold **CTRL** (windows)/**Cmnd** (mac) key and use arrow keys
- D) **hold *CTRL* (windows)/*Cmnd* (mac) key and left click on cells**

Entering Formulas

A *formula* is any expression that begins with an equal sign (=).

- ▶ The equal sign means that a calculation must be done to compute the cell value.

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx - Excel". The ribbon menu is visible at the top, with the "Home" tab selected. In the formula bar, the cell reference "G13" is displayed, followed by the formula "=SUM(G2:G12)". The main worksheet area contains a table with data from rows 1 to 13. The table has columns labeled "Category", "Product", "Month", "Volume", "Price", "Cost", and "Revenue". Row 13 is highlighted in green, and the cell G13 contains the value "\$ 3,190.00". The status bar at the bottom right shows "100%".

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Category	Product	Month	Volume	Price	Cost	Revenue						
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00						
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00						
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00						
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00						
6	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00						
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00						
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00						
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00						
10	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00						
11	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00						
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00						
13							Total:	\$ 3,190.00					

Formula Expressions

A formula expression can consist of literals (numbers, text strings), operators, functions (eg. MAX(), AVERAGE()), and cell references.

Simple mathematical expressions:

- ▶ = 1 + 5
- ▶ = 1.5 * 3.14 + 42

Common functions:

- ▶ = ROUND(PI(),2) // Result is 3.14
- ▶ = CONCATENATE("Hello", " World") // Hello World

Other common functions for trigonometry, dates, and finance are available. See a full list of functions [here](#)

Using Formulas

- ▶ In order to use functions correctly, you need to follow a certain structure, or *syntax*.
- ▶ The basic syntax for a function is the equals sign (=), the function name (eg, SUM), and one or more *arguments/inputs* within parenthesis. For example:

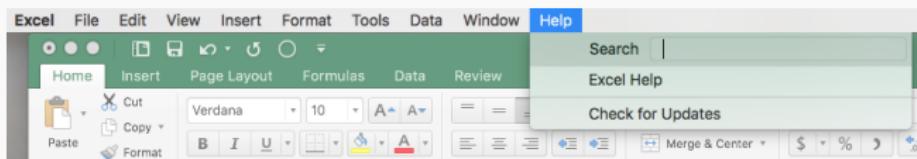
$$=\text{SUM}(1,2,3)$$

Once we press **ENTER** (or leave the cell), it will display the result, i.e. *output*, of the formula (in this case is 6). Returning to that cell will display the formula in the formula bar.

- ▶ N.B. if your function has no arguments, you will still need to type the parenthesis. For example =NOW() returns the current date and time as output.

Using Excel Functions

- ▶ You can get help on any function by searching its name in Excel's drop down Help menu



- ▶ Alternatively, you can navigate to the **Formulas** tab in the ribbon and select the **Insert Function** button (there is also a shortcut to this button directly beside the formula bar fx). This will bring up a **Formula Builder** window which contains the name of all the functions in Excel, with a search and description on how to use each function.

Arrays

Alternatively we could have created an array using {} to compute our sum:

```
=SUM({1,2,3})
```

This is equivalent to the following calculation:

	A	B	C
1	1	Output	Formula
2	2	6 =SUM(1,2,3)	
3	3	6 =SUM({1,2,3})	
4		6 =SUM(A1:A3)	

These examples and others can be found in **DemoPart1.xlsx** on Canvas

Cell Referencing

The power of formulas comes from using cell references (similar to variable names in programming).

Cell reference examples:

- ▶ = **A1** + **A2**
- ▶ = **B1** + **A3** - **A4**

Cell address will appear in different coloured font within your formula for ease of viewing. In addition, the cell itself will be outlined with the same colour when the formula is selected.

The screenshot shows a Microsoft Excel spreadsheet with four columns labeled A, B, C, and D. Row 1 contains values 6, 86, and 98 in columns A, B, and C respectively. Row 2 contains values 50, 96, and 9 in columns A, B, and C respectively. Row 3 contains values 94, 26, and 31 in columns A, B, and C respectively. Column D is empty. The formula bar at the top shows '=B1+A3-A4'. Cell A3 is highlighted with a red border, and its value '94' is displayed in red. Cell D3 is also highlighted with a green border, and its formula '=B1+A3-A4' is displayed in blue. The formula bar also displays the formula '=B1+A3-A4'.

	A	B	C	D
1	6	86	98	
2	50	96	9	
3	94	26	31	=B1+A3-A4
4	92	68	5	

Cell Referencing

TIP Rather than typing out cell names while constructing a formula, you can select them using your mouse or keyboard as done on [this slide](#). You can refer to a single cell, a range of cells, a location in another worksheet, or a location in another workbook.

Figure: Example of using cell references across worksheets. General syntax: <SheetName>!<CellAddress>

The screenshot shows a Microsoft Excel interface with the following details:

- Toolbar:** Home, Insert, Page Layout, Formulas, Data, Review, View, Share.
- Clipboard:** Paste, Font, Alignment, Number, Conditional Formatting, Format as Table, Cell Styles.
- Cells:** A1 is selected.
- Formula Bar:** The formula `=QuarterSales!D2+AnnualSales!F2` is entered in the formula bar.
- Worksheet:** The current sheet is "Sheet1". Other sheets visible are "QuarterSales" and "AnnualSales".
- Data:** The cell A1 contains the value `$ 21.00`.
- View:** The zoom level is set to 170%.

Formula Questions

Excel follows the BEDMAS order of operations (Brackets, Exponents, Division, Multiplication, Addition, Subtraction).

Example 2

Question: A cell contains the following: =2+4*3 What is the value of the cell?

- A) 14
- B) 18
- C) =2+4*3
- D) None of the above

Formula Questions

Answer:

A cell contains the following: $=2+4*3$ What is the value of the cell?

- A) 14
- B) 18
- C) $=2+4*3$
- D) None of the above

Formula Questions

Excel follows the BEDMAS order of operations (Brackets, Exponents, Division, Multiplication, Addition, Subtraction).

Example 3

Question: A cell contains the following: =(2+4)*3^2 What is the value of the cell?

- A) 38
- B) 54
- C) 324
- D) None of the above

Formula Questions

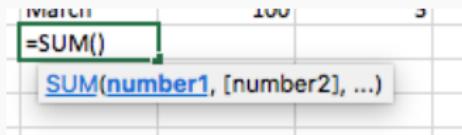
Answer:

A cell contains the following: $=(2+4)*3^2$ What is the value of the cell?

- A) 38
- B) 54
- C) 324
- D) None of the above

Using Excel Functions

- ▶ Excel will attempt to autocomplete your formulas.
- ▶ To accept a suggestion, press **TAB**.
- ▶ Excel will provide a guideline of how the function is used in the lower right corner of the cell. Optional arguments appear in square brackets []



Using Excel Functions

For example, in H6 we have $=\text{POWER}(G2, 2) = 25^2 = 625$. POWER is the function and G2 and 2 are the inputs and 625 is the output.

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx - Excel". The spreadsheet contains several rows of data and formulas:

	A	B	C	D	E	F	G	H	I
1	String Functions		Date Functions				Math Functions		
2	Test message!		Friday, July 01, 2016				25	2.2	
4	LEN(A2)	13	YEAR(D2)	2016		ROUND(H2,0)	2		
5	UPPER(A2)	TEST MESSAGE!	MONTH(D2)	7		SQRT(G2)	5		
6	LOWER(A2)	test message!	DAY(D2)	1		POWER(G2, 2)	625		
7			WEEKDAY(D2)	6					
8			NOW()	12/3/2015 12:37					
9									
10									
11									
12									
13									
14									
15									
16									

The formula bar at the top shows the formula `=POWER(G2, 2)`. The status bar at the bottom indicates "AbsoluteAddress". The ribbon tabs show "Functions" is selected. The zoom level is set to 100%.

Try Entering Formulas

Exercise

Calculate the total Revenue in cell **G13**. Add the label of **Total Revenue:** to cell **F13**.



Tip: Try using the button (located in the **Formula** tab in the ribbon) to save time! **Directions:** Select a cell next to the numbers you want to sum (or simply select cell **G13**, click the AutoSum button, then press **Enter**).

Try Entering Formulas

Exercise

Add a column for expenses and profit as below. (Expense is volume multiplied by cost and profit is revenue minus expense).

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx - Excel". The ribbon menu is visible at the top, and the "Home" tab is selected. The formula bar shows "H13". The spreadsheet contains the following data:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Category	Product	Month	Volume	Price	Cost	Revenue	Expenses	Profit				
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00	\$ 20.00	\$ 20.00				
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00	\$ 525.00	\$ 225.00				
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00	\$ 27.50	\$ 27.50				
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00	\$ 80.00	\$ 120.00				
6	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00	\$ 350.00	\$ 150.00				
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00	\$ 39.00	\$ 26.00				
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00	\$ 30.00	\$ 30.00				
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00	\$ 28.00	\$ 42.00				
10	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00	\$ 500.00	\$ 250.00				
11	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00	\$ 240.00	\$ 160.00				
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00	\$ 200.00	\$ 100.00				
13					Total:		\$ 3,190.00						
14													

The formula bar shows "QuarterSalesTryIt1" and "QuarterSalesT...". The status bar shows "Ready" and "100%".

Concatenation

String concatenation is when two or more strings are combined by appending them in order. The function to do this in Excel is CONCATENATE() or & operator.

Concatenate	
HelloWorld	More than one string.
Output	Code
More than one string.	=CONCATENATE(C1," ", C2," ",C3)
More than one string.	=C1&C2&" "&C3
Numbers work as arguments too:	More than 1 string.

Notice that we needed to add spaces " " in order for the words to be separated. In addition, numbers work as arguments too!

Titles and Merged Cells

- ▶ On the previous slide I added a title to my spreadsheet. To do this:
 1. Click **View** from the toolbar menu and select **Header and Footer**.
 2. Click on the **Add Header** box and insert the desired text.
 3. To return to the default view, click **View** from the toolbar menu and select **Normal**.
- ▶ I also utilize the merge cell option in order to center text over a section of a spreadsheet. To do this:
 1. Highlight or select a range of cells.
 2. Right-click on the highlighted cells and select **Format Cells....**
 3. Click the **Alignment** tab and place a checkmark in the checkbox labeled **Merge cells**.

Alternatively, you can merge and center a group of cells using the Merge and Center button  located on the Home tab.

Formulas Question

Example 4

A cell contains the following: = 'ABC'+'DEF'. What is the value of the cell?

- A)** error
- B)** ABCDEF
- C)** 'ABC'+'DEF'

Formulas Question

Answer

A cell contains the following: = 'ABC'+'DEF'. What is the value of the cell?

- A) *error*
- B) ABCDEF
- C) 'ABC'+'DEF'

LOOKUP function

- ▶ The LOOKUP function searches for a value in either a row (or column) and returns a corresponding value from a neighbouring row (or column).
 - ▶ This function works like searching for numbers in a phonebook: by searching for their name in the phonebook, you can determine their listed phone number.
- ▶ VLOOKUP does the same thing, only it is restricted to Vertical (column) searches
- ▶ HLOOKUP on the other hand, is restricted to Horizontal (row) searches
- ▶ Some consider LOOKUP as better than VLOOKUP [Source] while others consider VLOOKUP is an improved version of LOOKUP [Source].
- ▶ We will go through the advantages and disadvantages of each.

LOOKUP function

The LOOKUP function has the following form:

`LOOKUP(lookup_value, lookup_vector, [result_vector])`

- ▶ `lookup_value` is the value we would like to match (eg. the name in our phonebook analogy)
- ▶ `lookup_vector` the corresponding column (or row) containing the values from which we are searching for `lookup_vector` (eg. the column of names in our phonebook analogy)
- ▶ `result_vector` the corresponding column (or row) containing the information we are trying to obtain (eg. the column of phone numbers in our phonebook analogy); this has to be the same size as the `lookup_vector`

LOOKUP function

It is common that we store the `lookup_value` in a cell so that we might change it easily for future use of the formula.

Product Id	Product Name	Product Price	Lookup Example	<code>lookup_value</code>	
1	Apple	\$ 3.99	Product Id	2	
2	Banana	\$ 2.99	Price (LOOKUP)	=LOOKUP(F2, A2:A6,C2:	
3	Lettuce	\$ 1.99	Price (VLOOKUP)	C6)	
4	Squash	\$ 6.99	Product (INDEX):	Lettuce	Lettuce
5	Pumpkin	\$ 5.99			
<code>lookup_vector</code>		<code>result_vector</code>			

Formula: =LOOKUP(F2, A2:A6,C2:C6)

Output: \$2.99

[YouTube Demo](#)

A comment on LOOKUP function

Important

- ▶ The values in `lookup_vector` must be placed in **ascending order**: ..., -2, -1, 0, 1, 2, ..., A-Z, FALSE, TRUE; otherwise, LOOKUP might not return the correct value.
- ▶ Uppercase and lowercase text are treated as equivalent.

Example 5

Use the lookup function to determine the product ID of a certain product name.

1. What happens when you try and look up the ID of *Pumpkin*?
2. How can we fix this problem?

VLOOKUP function

```
VLOOKUP(lookup_value, table_array, col_index_num,  
[range_lookup])
```

- ▶ `lookup_value` is the value we would like to match (eg. the name in our phonebook analogy)
- ▶ `table_array` the corresponding array (or matrix) containing the values from which we are searching for **and** the information we are trying to obtain. (eg. a matrix contain the columns of names **and** phone numbers in our phonebook analogy)
- ▶ `col_index_num` corresponding to the column number containing the information we are trying to obtain (eg. the column of phone numbers in our phonebook analogy)
- ▶ `range_lookup` An [optional argument] indicating if you want exact (FALSE) or approximate (TRUE (default)) matching.

VLOOKUP function

column 1	column 2	column 3		
Product Id	Product Name	Product Price	desired result column	Lookup Example
1	Apple	\$ 3.99		Product Id
2	Banana	\$ 2.99		Price (LOOKUP)
3	Lettuce	\$ 1.99		Price (VLOOKUP)
4	Squash	\$ 6.99		
5	Pumpkin	\$ 5.99		

table_array

desired result column

lookup_value

=VLOOKUP(F2,A2:C6,3)

Product (INDEX): Lettuce Lettuce

Formula: =VLOOKUP(F2,A2:C6,3)

Output: \$2.99

[Youtube Demo](#)

VLOOKUP function

Some warnings about VLOOKUP

- ▶ The column of lookup values (the equivalent `lookup_vector` from the LOOKUP example) is expected to be in the left-most column of the `table_array`.
- ▶ If the fourth optional argument `range_lookup` is left blank, it defaults to TRUE
 - ▶ FALSE allows only exact matches while TRUE allows for partial matches
- ▶ If `range_lookup` is TRUE (the default setting) the first row of the table must be sorted in ascending order. Otherwise, VLOOKUP may return an incorrect or unexpected value.

N.B. HLOOKUP works in the exact same way as VLOOKUP only now we look across rows instead of columns.

VLOOKUP function

Product Id	Product Name	Product Price	Lookup Exam
1	Apple	\$ 3.99	Product Id
2	Banana	\$ 2.99	Price (LOOK
3	Lettuce	\$ 1.99	Price (VLOO
4	Squash	\$ 6.99	
5	Pumpkin	\$ 5.99	Product (INI
		3.99	row = 1, col
Partial Lookup		Squash	4th product
range=TRUE	Apple	1.2	=VLOOKUP(\$B\$9,A2:C6,2,TRUE)
range=FALSE		#N/A	#N/A

Formula: =VLOOKUP(B9,A2:C6,2,TRUE³) where **B9** = 1.2

Output: Apple

Formula: =VLOOKUP(B9,A2:C6,2,FALSE) where **B9** = 1.2

Output: #N/A

³N.B doesn't look for the "nearest" value but the greatest value smaller than or equal to the lookup value.

Example 6

1. Can you use vlookup function to determine the product ID of a certain product name?
2. Use vlookup function to determine the price a certain product name. Use the default setting of `range_lookup = TRUE`?
3. Test this function with the entry: *Pumpkin*.
4. Test this function with the entry: *Pumpkin*, this time using `range_lookup = FALSE`

LOOKUP vs. VLOOKUP

The pros (left) and cons (right) of LOOKUP

- ▶ Accommodates left-to-right and right-to-left lookups
- ▶ Less restrictive in terms of lookup/result_vector
- ▶ Requires ascending ordered lookup_vector
- ▶ Partial matching (no option to for exact matches)

The pros (left) and cons (right) of VLOOKUP

- ▶ option to force exact matches
- ▶ Accommodates only left-to-right lookups
- ▶ Requires a table (more restrictive)
- ▶ Requires ascending ordered lookup_vector

Both have unexpected behaviour with duplicates

INDEX function

The syntax for the INDEX function in Microsoft Excel is:

`INDEX(table, row_number, column_number)`

It returns the value from within a table or range (i.e. an array of cells) at the given index. (Think of indexing a matrix in R using `mat[i,j]` with i is your `row_number` and j is your `col_number`)

Product Id	Product Name	Product Price	Lookup Example		
1	Apple	\$ 3.99	Product Id	2	
2	Banana	\$ 2.99	Price (LOOKUP)	\$ 2.99	
3	Lettuce	\$ 1.99	Price (VLOOKUP)	\$ 2.99	
4	Squash	\$ 6.99	Product (INDEX):		
5	Pumpkin	\$ 5.99	3.99 row = 1, col = 3	=INDEX(A2:C6,1,3)	
Partial Lookup			Squash	4th product name	=INDEX(B2:B6,4)

Formulas Question

Example 7

How many of the following statements are TRUE?

1. CONCATENATE function can take 3 arguments.
2. There is an Excel function that has 0 arguments.
3. =INDEX({1,3,5},2) returns 5.
4. =LOOKUP(5,{1,3,5}, {"a","b","c"}) returns "c".

- A) 0
- B) 1
- C) 2
- D) 3

Formulas Question

Answer:

How many of the following statements are TRUE?

1. **CONCATENATE** function can take 3 arguments.
2. There is an Excel function that has 0 arguments. eg. NOW()
3. =INDEX({1,3,5},2) returns 5.
4. =LOOKUP(5,{1,3,5}, {"a","b","c"}) returns "c".

- A) 0
- B) 1
- C) 2
- D) 3

Formulas Question

Answer:

How many of the following statements are TRUE?

1. CONCATENATE function can take 3 arguments.
2. There is an Excel function that has 0 arguments. eg. NOW()
3. =INDEX({1,3,5},2) returns 5.
4. =LOOKUP(5,{1,3,5}, {"a","b","c"}) returns "c".

- A) 0
- B) 1
- C) 2
- D) 3

Formulas Question

Answer:

How many of the following statements are TRUE?

1. CONCATENATE function can take 3 arguments.
2. There is an Excel function that has 0 arguments. eg. NOW()
3. =INDEX({1,3,5},2) returns 5.
4. =LOOKUP(5,{1,3,5}, {"a","b","c"}) returns "c".

- A) 0
- B) 1
- C) 2
- D) 3

Formulas Question

Answer:

How many of the following statements are TRUE?

1. CONCATENATE function can take 3 arguments.
2. There is an Excel function that has 0 arguments. eg. NOW()
3. =INDEX({1,3,5},2) returns 5.
4. =LOOKUP(5,{1,3,5}, {"a","b","c"}) returns "c".

- A) 0
B) 1
C) 2
D) 3

Advanced Spreadsheet Addressing

The dollar sign “\$” is a symbol that indicates an *absolute address*.

- ▶ By default, addresses are "relative" in the sense that if they are in a formula that is copied to another cell, they will be changed relative to where they were copied from their origin.

Example:

- ▶ Cell **A1** has the formula =A2+B1
- ▶ Copy contents of cell **A1** to cell **C4** (+ 2 columns + 3 rows).
- ▶ Formula changes to =C5+D4 because moved down three rows and over two columns. (eg. col**A** + 2col = **C**, row**2** + 3 = 5; hence **A2** changes to **C5**)

If cell **A1** had the formula =**A\$2+\$B\$1**, then the same formula would be copied in cell **C4**.

Advanced Spreadsheet Addressing

There are three different ways you can specify an absolute address

- ▶ By row eg. =B\$1 (column will change but row will not)
- ▶ By column eg. =\$B1 (row will change but col will not)
- ▶ By cell (row and column) eg. =\$B\$1 (neither row nor col will change)

Question: How would the formula =\$A2+B\$3 in cell **D3** be changed when copied to **E5**?

Advanced Spreadsheet Addressing

There are three different ways you can specify an absolute address

- ▶ By row eg. =B\$1 (column will change but row will not)
- ▶ By column eg. =\$B1 (row will change but col will not)
- ▶ By cell (row and column) eg. =\$B\$1 (neither row nor col will change)

Question: How would the formula =\$A2+B\$3 in cell **D3** be changed when copied to **E5**?

D3 to **E5**: → one column, ↓ two rows

Advanced Spreadsheet Addressing

There are three different ways you can specify an absolute address

- ▶ By row eg. =B\$1 (column will change but row will not)
- ▶ By column eg. =\$B1 (row will change but col will not)
- ▶ By cell (row and column) eg. =\$B\$1 (neither row nor col will change)

Question: How would the formula =\$A2+B\$3 in cell **D3** be changed when copied to **E5**?

D3 to **E5**: → one column, ↓ two rows

- ▶ \$A2: + → one column, ↓ two rows = \$A4

Advanced Spreadsheet Addressing

There are three different ways you can specify an absolute address

- ▶ By row eg. =B\$1 (column will change but row will not)
- ▶ By column eg. =\\$B1 (row will change but col will not)
- ▶ By cell (row and column) eg. =\\$B\$1 (neither row nor col will change)

Question: How would the formula =\$A2+B\$3 in cell **D3** be changed when copied to **E5**?

D3 to **E5**: → one column, ↓ two rows

- ▶ \$A2: + → ~~one column~~, ↓ two rows = \$A4
- ▶ B\$3: + → one column, + ~~two rows~~ = C\$3

Advanced Spreadsheet Addressing

There are three different ways you can specify an absolute address

- ▶ By row eg. =B\$1 (column will change but row will not)
- ▶ By column eg. =\\$B1 (row will change but col will not)
- ▶ By cell (row and column) eg. =\\$B\$1 (neither row nor col will change)

Question: How would the formula =\$A2+B\$3 in cell **D3** be changed when copied to **E5**?

D3 to **E5**: → one column, ↓ two rows

- ▶ \$A2: + → one column, ↓ two rows = \$A4
- ▶ B\$3: + → one column, + ↓ two rows = C\$3

Answer: The copied formula would appear as =\$A4+C\$3 in cell **E5**

Formulas and Reference Question

Example 8

Cell **A1** contains the following: $=\$B2+D\4 . What is the formula if the cell is copied to cell D3?

- ▶ error
- ▶ $=\$B2+D\4
- ▶ $=\$B4+F\4
- ▶ $=\$B4+G\4

For more examples see the **Absolute** worksheet on DemoPart1

Formulas and Reference Answer

Answer:

Cell A1 contains the following: $=\$B2+D\4 . What is the formula if the cell is copied to cell D3?

- ▶ error
- ▶ $=\$B2+D\4
- ▶ $=\$B4+F\4
- ▶ **$=\$B4+G\4**

Tips

Tip:

You can change a cell from relative to absolute with the shortcut **F4**. You can continue to press F4 to have Excel cycle through the different reference types.

Tip:

To show all the formulas in a worksheet (rather than their result),



click the **Show Formulas** button located in the **Formulas** tab in the ribbon.

Naming Cells

Instead of referring to cells by their address, you can give a cell a name and use that name in cell formulas.

- ▶ This makes it easier to read and understand formulas.
- ▶ Like programming variables where we use names instead of addresses to refer to data locations.

Naming Cells

Step for naming cells:

- ▶ Select the cell(s) you want to name
- ▶ Click the Name box located to the left of the formula bar
- ▶ Type a valid one-word name for the list, e.g. Hours
- ▶ Press **ENTER**

[See YouTube demo here](#)

Alternatively: click the letter of the column you want to change and then click the “Formulas” tab. Click “Define Name” in the Defined Names group in the Ribbon to open the New Name window.

The screenshot shows the Microsoft Excel ribbon with the "Formulas" tab selected. A red arrow points from the text "Name Box" to the cell reference "C3" in the formula bar. Another red circle highlights the "Define Name" button in the "Defined Names" group of the ribbon's "Formulas" tab. The table below has a green border around its third row.

	A	B	C	D	E	F	G
1		Activity List					
2	Date	Description	Hours	Rate	Total	Total (names)	
3	37376	Meet with client	8	50	400	400	48
4	37377	Design prototype	5	80	400	400	
5	37378	Write initial code	9	40	360	360	
6	37379	Write initial code	9	40	360	360	
7	37380	Test prototype	6	50	300	300	
8	37381	Deploy prototype	5	25	125	125	
9	37382	System-wide	6	35	210	210	

Naming Rules

- ▶ While these names can include numbers, the first character must be a letter or an underscore.
- ▶ These names cannot include spaces or special characters beside underscores and periods.
- ▶ Finally this name should not conflict with an existing name in the workbook.
- ▶ For example, I wouldn't want to use the name DAY1 since that already exists as a cell address by default.

Try It!

Complete the following in the *NamedCells* worksheet in the DemoPartI workbook.

Example 9

Rename **A3** *Day_1* and **A9** *Day_7*. Calculate the difference between these two dates using the **DATEDIF** function.

Example 10

Find the total hours using named cells. That is, rename the cells **E3:E9** *Total* and calculate =SUM(*Total*).

Example 11 (Advanced array formulas)

Recalculate the Totals using the named cells. That is, rename the cells **C3:C9** *Hours* and **D3:D9** *Rate*, and calculate *Hours***Rate*.

To answer this last exercise, we will need to know more about **array formulas**.

Array Formulas

- ▶ If you are using Office 2010 – Office 2019 array formulas require first selecting the entire output range, then confirming the formula with **Ctrl** + **Shift** + **Enter**. They are commonly referred to as CSE formulas.
- ▶ In Office 365 any formula that can return multiple results will automatically spill them either down, or across into neighboring cells by pressing **Enter**.
- ▶ To see Total cost of each activity, select cells **F3:F9**, enter the formula `=Hours*Rate`, and then press **Ctrl** + **Shift** + **Enter**.
- ▶ N.B. To see the grand Total of all activities, we could select cell **F10** and enter the formula `=SUM(Hours*Rate)` and then press **Ctrl** + **Shift** + **Enter**.

Read more about array formulas [here](#). See my YouTube demo [here](#).

Aggregate Functions

An *aggregate* function computes a summary function over a range of cells. The values can either be data values or cell locations.

Common functions are:

=MIN(<value list>)	returns minimum value in list
=MAX(<value list>)	returns maximum value in list
=SUM(<value list>)	returns sum of all values in list
=AVERAGE(<value list>)	returns average of values in list
=COUNT(<value list>)	returns count of values in list
=MEDIAN(<value list>)	returns median value of list

If specifying an array, give the upper left and lower right corners, separated by a colon.

AVERAGE(A3:E6)	returns the average value in the array of 4 rows and 5 columns
----------------	--

Aggregate Functions Example

sales.xlsx - Excel

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx". The active cell is D2, containing the formula =max(D2:D12). The formula bar also displays this formula. The spreadsheet contains data for various products across three months (Jan, Feb, Mar) categorized by food, clothing, and toys. The columns are labeled A through M, and the rows are numbered 1 through 14. The "Volume" column (D) has a green dashed border around its range (D2:D12), indicating it is selected. The formula =max(D2:D12) is also visible in the status bar at the bottom.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Category	Product	Month	Volume	Price	Cost	Revenue	Expenses	Profit				
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00	\$ 20.00	\$ 20.00				
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00	\$ 525.00	\$ 225.00				
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00	\$ 27.50	\$ 27.50				
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00	\$ 80.00	\$ 120.00				
6	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00	\$ 350.00	\$ 150.00				
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00	\$ 39.00	\$ 26.00				
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00	\$ 30.00	\$ 30.00				
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00	\$ 28.00	\$ 42.00				
10	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00	\$ 500.00	\$ 250.00				
11	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00	\$ 240.00	\$ 160.00				
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00	\$ 200.00	\$ 100.00				
13				=max(D2:D12)	tal:		\$ 3,190.00						
14					MAX(number1, [number2], ...)								

QuarterSales QuarterSalesFormat QuarterPivot

Point 100%

Try it!

Exercise

Find the a) maximum volume b) average price c) minimum cost and d) total revenue in the *QrSales* worksheet.

Aggregate Functions Question

Example 12

Assume the cells in the range A1:C4 each contain a number that is equal to their row number (e.g. B3 contains 3). How many of the following statements are TRUE?

1. The number of cells in the range is 12.
2. The value of $\text{SUM}(A1:C4)$ is 20.
3. The value of $\text{COUNTIF}(A1:B4, ">2")$ is 4.
4. $\text{AVERAGE}(A1:C4) > \text{MAX}(C2:C3)$

- A) 0 B) 1 C) 2 D) 3 E) 4

Aggregate Functions Question

Answer:

Assume the cells in the range A1:C4 each contain a number that is equal to their row number (e.g. B3 contains 3). How many of the following statements are TRUE?

1. The number of cells in the range is 12.
2. The value of $\text{SUM}(A1:C4)$ is 20... should be 30.
3. The value of $\text{COUNTIF}(A1:B4, ">2")$ is 4.
4. $\text{AVERAGE}(A1:C4) > \text{MAX}(C2:C3)$

- A) 0 B) 1 C) 2 D) 3 E) 4

Aggregate Functions Question

Answer:

Assume the cells in the range A1:C4 each contain a number that is equal to their row number (e.g. B3 contains 3). How many of the following statements are TRUE?

1. The number of cells in the range is 12.
2. The value of $\text{SUM}(A1:C4)$ is 20... should be 30.
3. The value of $\text{COUNTIF}(A1:B4, ">2")$ is 4.
4. $\text{AVERAGE}(A1:C4) > \text{MAX}(C2:C3)$

A) 0

B) 1

C) 2

D) 3

E) 4

Aggregate Functions Question

Answer:

Assume the cells in the range A1:C4 each contain a number that is equal to their row number (e.g. B3 contains 3). How many of the following statements are TRUE?

1. The number of cells in the range is 12.
2. The value of $\text{SUM}(A1:C4)$ is 20... should be 30.
3. The value of $\text{COUNTIF}(A1:B4, ">2")$ is 4.
4. $\text{AVERAGE}(A1:C4) > \text{MAX}(C2:C3)$

- A) 0 B) 1 C) 2 D) 3 E) 4

Aggregate Functions Question

Answer:

Assume the cells in the range A1:C4 each contain a number that is equal to their row number (e.g. B3 contains 3). How many of the following statements are TRUE?

1. The number of cells in the range is 12.
2. The value of $\text{SUM}(A1:C4)$ is 20... should be 30.
3. The value of $\text{COUNTIF}(A1:B4, ">2")$ is 4.
4. $\text{AVERAGE}(A1:C4) > \text{MAX}(C2:C3)$

A) 0

B) 1

C) 2

D) 3

E) 4

Aggregate Functions Question

Answer:

Assume the cells in the range A1:C4 each contain a number that is equal to their row number (e.g. B3 contains 3). How many of the following statements are TRUE?

1. The number of cells in the range is 12.
2. The value of $\text{SUM}(A1:C4)$ is 20... should be 30.
3. The value of $\text{COUNTIF}(A1:B4, ">2")$ is 4.
4. $\text{AVERAGE}(A1:C4) > \text{MAX}(C2:C3)$

- A) 0 B) 1 C) 2 D) 3 E) 4

Aggregate Functions Question

Answer:

Assume the cells in the range A1:C4 each contain a number that is equal to their row number (e.g. B3 contains 3). How many of the following statements are TRUE?

1. The number of cells in the range is 12.
2. The value of $\text{SUM}(A1:C4)$ is 20... should be 30.
3. The value of $\text{COUNTIF}(A1:B4, ">2")$ is 4.
4. $\text{AVERAGE}(A1:C4) > \text{MAX}(C2:C3)$

- A) 0 B) 1 C) 2 D) 3 E) 4

Aggregate Functions Question

Example 13

Assume the three cells in the range A1:C1 contain numbers.
Which of these formula output results is ALWAYS the largest?

- A) MAX(A1:C1)
- B) MIN(A1:C1)
- C) COUNT(A1:C1)
- D) SUM(A1:C1)
- E) None of the above are always guaranteed to be the largest

Aggregate Functions Question

Answer:

Assume the three cells in the range A1:C1 contain numbers.
Which of these formula output results is ALWAYS the largest?

- A) MAX(A1:C1)
- B) MIN(A1:C1)
- C) COUNT(A1:C1)
- D) SUM(A1:C1)
- E) *None of the above are always guaranteed to be the largest*

Other Formatting: Column Width

Resizing columns/rows:

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx". The data is organized into columns labeled A through J, with headers "Category", "Product", "Month", "Volume", "Price", "Cost", and "Revenue". The "Format" context menu is open at the bottom right of the screen, with "Column Width..." highlighted.

	A	B	C	D	E	F	G	H	I	J
1	Category	Product	Month	Volume	Price	Cost	Revenue			
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00			
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00			
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00			
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00			
6	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00			
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00			
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00			
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00			
10	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00			
11	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00			
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00			
13					Total:		\$3,190.00			

Auto-resize by double clicking on border between columns or selecting Format->Column->AutoFit Selection.

Drag the row/column border to manually resize.

Lets see an example by doing this on the *Namecells* workbook in DemoPartI

Conditional Formatting

Conditional formatting allows you to change the cell format based on data values. This is accessible under **Format->Conditional Formatting**.

- ▶ Other options: data bars, color scales, icon sets

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx" with data in columns A through G. The formula in cell G8 is =E8*D8. An open "Conditional Formatting" dialog box is overlaid on the spreadsheet, specifically the "Rules Manager" section. The rules listed are:

- Rule applied in order shown: Cell Value > 350 Format AaBbCcYvZ Applies to \$G\$2:\$G\$12 Stop If True
- Cell Value < 75 Format AaBbCcYvZ Applies to \$G\$2:\$G\$12

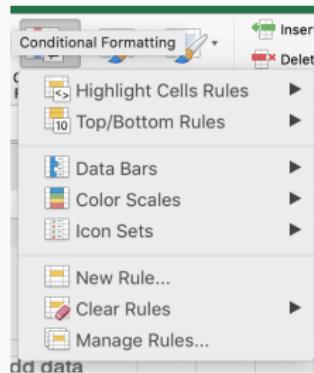
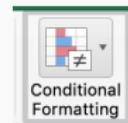
The data in the spreadsheet includes:

Category	Product	Month	Volume	Price	Cost	Revenue
Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00
Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00
Toys	Ball	Jan	35	\$ 1.00	\$ 0.50	\$ 55.00
Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00
Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00
Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00
Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 40.00
Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00
Toys	Bat	Mar	10	\$75.00	\$50.00	\$ 750.00
Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00
Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00
		Total:				\$ 3,190.00

Conditional Formatting

A shortcut to this feature (along with some great default options)

can be found in the Conditional Formatting button



Conditional Formatting Result

The format painter button allows you to copy formatting to many cells. Select the cell, click paint button, then highlight cells to have identical formatting.

The screenshot shows a Microsoft Excel spreadsheet titled "sales - Excel". The ribbon menu is visible at the top, with the "HOME" tab selected. The "Font" group on the ribbon includes the "Format Painter" icon, which is highlighted with a blue arrow. The "Format Painter" tool is also shown in a callout box on the left side of the screen, along with instructions on how to use it.

Format Painter

Like the look of a particular selection? You can apply that look to other content in the document.

To get started:

1. Select content with the formatting you like
2. Click Format Painter
3. Select something else to automatically apply the formatting

FYI: To apply the formatting in multiple places, double-click Format Painter.

Tell me more

1	Category											
2	Food											
3	Clothing											
4	Toys											
5	Food											
6	Clothing											
7	Toys											
8	Food											
9	Toys											
10	Toys											
11	Clothing	Jacket	Mar									
12	Food	Apples	Mar									
13												

QuarterSales **QuarterSalesFormat** **QuarterPivot** **Data 301 Data Analytics**

Try it: Conditional Formatting

Format Volume column to be:

1. bold/green if volume > 50
2. italics/red if volume < 10
3. yellow background otherwise as below:

The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx - Excel". The ribbon is visible at the top with tabs for Home, Insert, Page Layout, Formulas, Data, Review, View, Developer, Team, Tell me..., Sign in, and Share. The Home tab is selected.

The data is organized into columns: Category, Product, Month, Volume, Price, Cost, and Revenue. The Volume column contains numerical values ranging from 10 to 100. The Revenue column contains dollar amounts ranging from \$40.00 to \$3,190.00.

Conditional formatting is applied to the Volume column:

- Cells with a value greater than 50 are bolded and colored green.
- Cells with a value less than 10 are italicized and colored red.
- Cells with a value between 10 and 50 have a yellow background.

The Revenue column also uses conditional formatting, where cells with a value greater than \$100 are bolded and colored green, while others are standard black text.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Category	Product	Month	Volume	Price	Cost	Revenue						
2	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00						
3	Clothing	Jacket	Jan	15	\$50.00	\$35.00	\$ 750.00						
4	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00						
5	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00						
6	Clothing	Jacket	Feb	10	\$50.00	\$35.00	\$ 500.00						
7	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00						
8	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00						
9	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00						
10	Toys	Bat	Mar	10	\$75.00	\$50.00	\$ 750.00						
11	Clothing	Jacket	Mar	8	\$50.00	\$30.00	\$ 400.00						
12	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00						
13					Total:		\$ 3,190.00						

The bottom status bar shows "QuarterSalesTryIt2" and "QuarterSalesTryIt3". The bottom right corner shows a 100% zoom level.

Try it: Conditional Formatting

Question:

Take the previous formatting and apply it to whole row:

Hint: Highlight the whole table, go to Conditional Formatting, select the "Classic" option from the Style drop down menu and select "Use a formula to determine which cells to format"

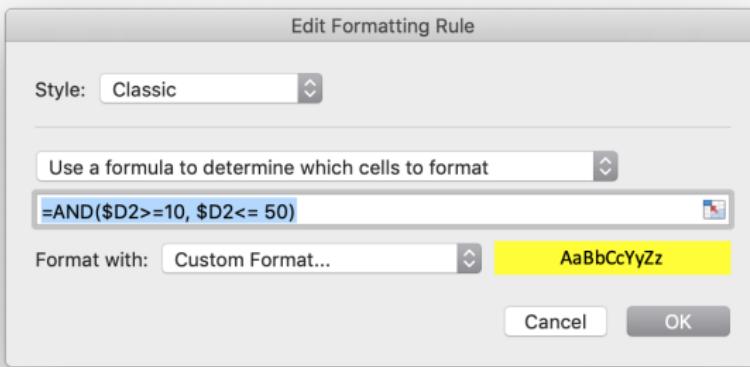
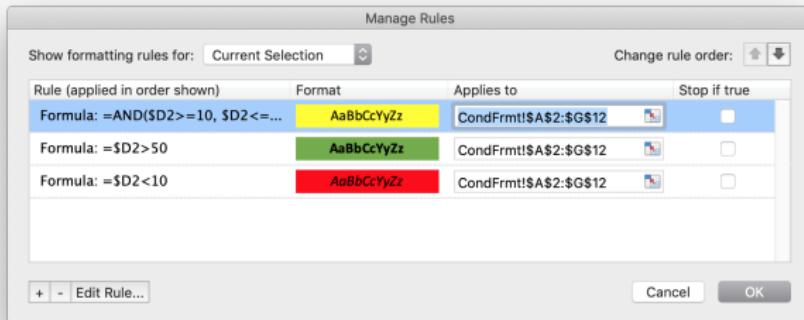
The screenshot shows a Microsoft Excel spreadsheet titled "sales.xlsx - Excel". The ribbon is visible at the top with tabs for Home, Insert, Page Layout, Formulas, Data, Review, View, Developer, Team, Tell me..., Sign in, and Share. The Home tab is selected.

The data is organized into columns labeled A through M. Row 1 contains the headers: Category, Product, Month, Volume, Price, Cost, and Revenue. Rows 2 through 13 contain data entries. The data is color-coded by category:

- Food:** Rows 2, 5, 8, 10, 12. Cells in these rows are green.
- Clothing:** Rows 3, 6, 11. Cells in these rows are yellow.
- Toys:** Rows 4, 7, 9, 10. Cells in these rows are red.
- Chocolate:** Rows 2, 5, 8. Cells in these rows are green.
- Jacket:** Rows 3, 6, 11. Cells in these rows are yellow.
- Ball:** Rows 4, 7, 9. Cells in these rows are red.
- Apples:** Row 12. Cell is green.
- Total:** Row 13, column D. Cell is green.

The "Conditional Formatting" button in the Home tab's ribbon is highlighted. The status bar at the bottom shows "QuarterSalesTryIt3" and "Data 301 Data Analytics".

Category	Product	Month	Volume	Price	Cost	Revenue
Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00
Clothing	Jacket	Jan	15	\$50.00	\$35.00	\$ 750.00
Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00
Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00
Clothing	Jacket	Feb	10	\$50.00	\$35.00	\$ 500.00
Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00
Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00
Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00
Toys	Bat	Mar	10	\$75.00	\$50.00	\$ 750.00
Clothing	Jacket	Mar	8	\$50.00	\$30.00	\$ 400.00
Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00
				Total:		\$ 3,190.00



Spreadsheet for Data Management

A spreadsheet is often used as a "database". A *database* collects, stores and manages information so users can retrieve, add, update or remove such information.

- ▶ Examples: schedules and calendars, timesheets, expenses and finances, records, notes, and recipes, data research/analysis

We can use a spreadsheet as a database by:

- ▶ Using a row to store all the information about something we want to represent.
- ▶ Giving each column a meaningful name. A column represents a property or feature of the object stored in the row.
- ▶ Using the formulas to calculate new facts from the data.
- ▶ Using sorting to organize the data by key features.
- ▶ Using simple filtering (querying) to only show the most important data or data of interest.

Sorting Data

Data can be sorted by selecting the **Sort** option under the **Data** menu. Select the column(s) to sort on and order to sort by.

The screenshot shows a Microsoft Excel window with the following details:

- File Ribbon:** File, Home, Insert, Page Layout, Formulas, **Data**, Review, View, Developer, Team, Tell me..., Sign in, Share.
- Data Tab Buttons:** Get External Data, New Query, Refresh All, Connections, Sort, Filter, Advanced, Text to Columns, What-If Analysis, Forecast, Outline.
- Cell A2:** Contains the value "Food".
- Table Data:** A grid of 12 rows and 7 columns. The columns are labeled: Category, Product, Month, Volume, Price, Cost, Revenue. The data includes entries for Food (Chocolate, Jacket), Clothing (Jacket, Chocolate), Toys (Ball, Chocolate), and so on through March. Row 13 is a summary row with "Total:" and "\$ 3,190.00".
- Sort Dialog Box:** Opened from the Data tab, it shows sorting criteria:
 - Sort On:** Values, Order: Jan, Feb, Mar, Apr, May, Jun, Jul (with a checked checkbox "My data has headers").
 - Then by:** Category, Order: A to Z.
- Bottom Status Bar:** Average: 91.97727273, Count: 77, Sum: 4047, 100%.

Try it: Sorting Data

Exercise: Sort the data by revenue (desc) then product (asc).

The screenshot shows a Microsoft Excel window titled "sales.xlsx - Excel". The ribbon is visible at the top with the "Data" tab selected. The main area displays a table of sales data with columns: Category, Product, Month, Volume, Price, Cost, and Revenue. Row 13 contains a formula for the total revenue: =SUM(G2:G12). The status bar at the bottom shows the formula as "Total: \$3,190.00". The "TryItSort" tab is active in the bottom navigation bar.

1	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Category	Product	Month	Volume	Price	Cost	Revenue						
2	Toys	Bat	Mar	10	\$ 75.00	\$ 50.00	\$ 750.00						
3	Clothing	Jacket	Jan	15	\$ 50.00	\$ 35.00	\$ 750.00						
4	Clothing	Jacket	Feb	10	\$ 50.00	\$ 35.00	\$ 500.00						
5	Clothing	Jacket	Mar	8	\$ 50.00	\$ 30.00	\$ 400.00						
6	Food	Apples	Mar	100	\$ 3.00	\$ 2.00	\$ 300.00						
7	Food	Chocolate	Feb	80	\$ 2.50	\$ 1.00	\$ 200.00						
8	Toys	Ball	Mar	70	\$ 1.00	\$ 0.40	\$ 70.00						
9	Toys	Ball	Feb	65	\$ 1.00	\$ 0.60	\$ 65.00						
10	Food	Chocolate	Mar	30	\$ 2.00	\$ 1.00	\$ 60.00						
11	Toys	Ball	Jan	55	\$ 1.00	\$ 0.50	\$ 55.00						
12	Food	Chocolate	Jan	20	\$ 2.00	\$ 1.00	\$ 40.00						
13					Total:	\$3,190.00							

Filtering

A *filter* shows a subset of the rows in the spreadsheet that pass a given condition (test).

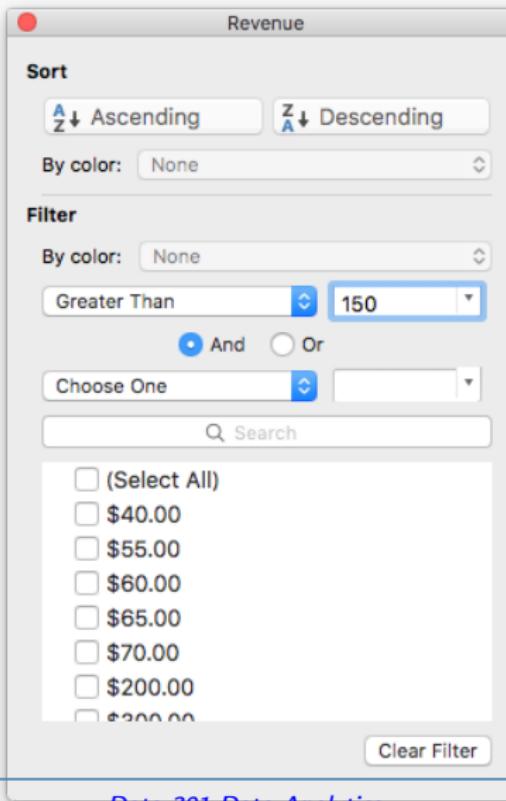
Select **Auto Filter** under the **Data** then **Filter** menu.

Once you select **Auto Filter**, each column heading has a drop-down list. By selecting a filtering criteria from the list, you can limit the rows that are displayed.

It is possible to filter on more than one column at the same time.

Filter Example

Filter on Revenue column: Select value(s), Top 10, or custom filter.



Filter Example

Filter on Revenue column: Custom filter with Revenue > 150

The screenshot shows a Microsoft Excel spreadsheet titled "03ExcelPart1". The Data tab is selected in the ribbon. A custom filter is applied to the "Revenue" column, displaying only rows where the Revenue value is greater than 150. The visible data includes:

	A	B	C	D	E	F	G
1	Category	Product	Month	Volume	Price	Cost	Revenue
3	Clothing	Jacket	Jan	15	\$50.00	\$35.00	\$750.00
5	Food	Chocolate	Feb	80	\$2.50	\$1.00	\$200.00
6	Clothing	Jacket	Feb	10	\$50.00	\$35.00	\$500.00
10	Toys	Bat	Mar	10	\$75.00	\$50.00	\$750.00
11	Clothing	Jacket	Mar	8	\$50.00	\$30.00	\$400.00
12	Food	Apples	Mar	100	\$3.00	\$2.00	\$300.00
13							
14							
15							
16							
17							
18							
19							
20							

At the bottom of the screen, the status bar shows: Ready, 6 of 11 records found, Average: 315.8333333, Count: 7, Sum: 1895, and a zoom level of 179%.

Try It: Filter Challenge

Exercise: Filter the data so only products with volume < 20 or revenue $\geq \$500$ are shown.

The screenshot shows a Microsoft Excel spreadsheet titled "03ExcelPart1". The Data tab is selected. A green box highlights the formula bar with the text "FilterChallenge". The table has columns: Product, Month, Volume, Price, Cost, Revenue, Expenses, and Profit. Row 16 is selected, indicated by a green border around the entire row.

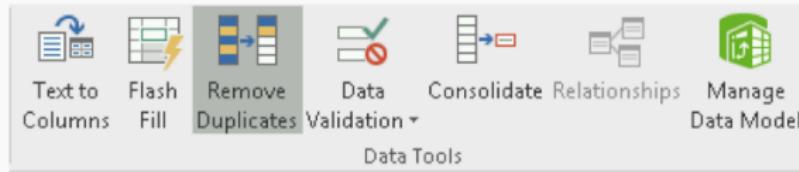
	B	C	D	E	F	G	H	I
1	Product	Month	Volume	Price	Cost	Revenue	Expenses	Profit
3	Jacket	Jan	15	\$50.00	\$35.00	\$750.00	\$525.00	\$225.00
6	Jacket	Feb	10	\$50.00	\$35.00	\$500.00	\$350.00	\$150.00
10	Bat	Mar	10	\$75.00	\$50.00	\$750.00	\$500.00	\$250.00
13								
14								
15								
16								
17								
18								
19								

Formula Bar: FilterChallenge

Bottom Status Bar: Ready 3 of 11 records found

Removing Duplicates

To remove duplicates, select your Data then **Remove Duplicates** from the **Data** tab in the ribbon.

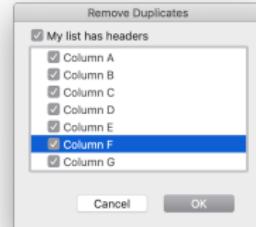


Note that we can also remove duplicates using a filter:

Data > Sort&Filter > Advanced

By default, it will look for duplicates over the all of the selected columns.

You can delete entire rows based on particular columns by selecting them the pop-up window:



Removing Duplicates

Notice how the Removing Duplicates feature is NOT case sensitive:

The screenshot shows an Excel spreadsheet with two main sections: 'Original' data and 'Duplicates removed' results.

Original Data (Range A3:B11):

	A	B
1		
2	Original	
3	Num	Char
4	1	A
5	1	a
6	1	B
7	1	b
8	2	A
9	2	b
10	3	a
11	3	B
12		
13		

Duplicates removed (Range D3:E6):

	D	E
1		
2	Duplicates removed	
3	Num	Char
4	1	A
5	1	B
6	2	A
7	2	b
8	3	a
9	3	B
10		
11		
12		
13		

The 'Duplicates removed' section shows that both '1 A' and '1 a' are grouped together, indicating they are considered duplicates due to case insensitivity.

Sorting Question

Question:

Given this spreadsheet and sort order, what is the output?

Column	Sort On	Order
Sort by	Num	Values Largest to Smallest
Then by	Char	Values A to Z

Num	Char
1	A
1	a
1	B
1	b
2	A
2	b
3	a
3	B

Sorting Question

Clicker Question:

Given this spreadsheet and sort order, what is the output?

A)

Num	Char
3	B
3	a
2	A
2	b
1	A
1	B
1	a
1	b

B)

Num	Char
3	a
3	B
2	A
2	b
1	a
1	A
1	b
1	B

C)

Num	Char
3	a
3	B
2	A
2	b
1	A
1	a
1	B
1	b

Sorting Question

Question:

Given this spreadsheet and sort order, what is the output?

- A) Wrong: Char desc
from Z to A

Num	Char
3	B
3	a
2	A
2	b
1	A
1	B
1	a
1	b

- B) Wrong:
case-sensitive

Num	Char
3	a
3	B
2	A
2	b
1	a
1	A
1	b
1	B

- C) Correct: default is
not case-sensitive

Num	Char
3	a
3	B
2	A
2	b
1	A
1	B
1	a
1	b

Sorting Question

Question:

Given this spreadsheet and sort order, what is the output?

A) Wrong: Char desc from Z to A

Num	Char
3	B
3	a
2	A
2	b
1	A
1	B
1	a
1	b

B) Wrong:
case-sensitive

Num	Char
3	a
3	B
2	A
2	b
1	a
1	A
1	b
1	B

C) Correct: default is
not case-sensitive

Num	Char
3	a
3	B
2	A
2	b
1	A
1	B
1	a
1	b

Sorting Question

Question:

Given this spreadsheet and sort order, what is the output?

A) Wrong: Char desc
from Z to A

Num	Char
3	B
3	a
2	A
2	b
1	A
1	B
1	a
1	b

B) Wrong:
case-sensitive

Num	Char
3	a
3	B
2	A
2	b
1	a
1	A
1	b
1	B

C) Correct: default is
not case-sensitive

Num	Char
3	a
3	B
2	A
2	b
1	A
1	B
1	a
1	b

Sorting Question

Question:

Given this spreadsheet and sort order, what is the output?

A) Wrong: Char desc from Z to A

Num	Char
3	B
3	a
2	A
2	b
1	A
1	B
1	a
1	b

B) Wrong: case-sensitive

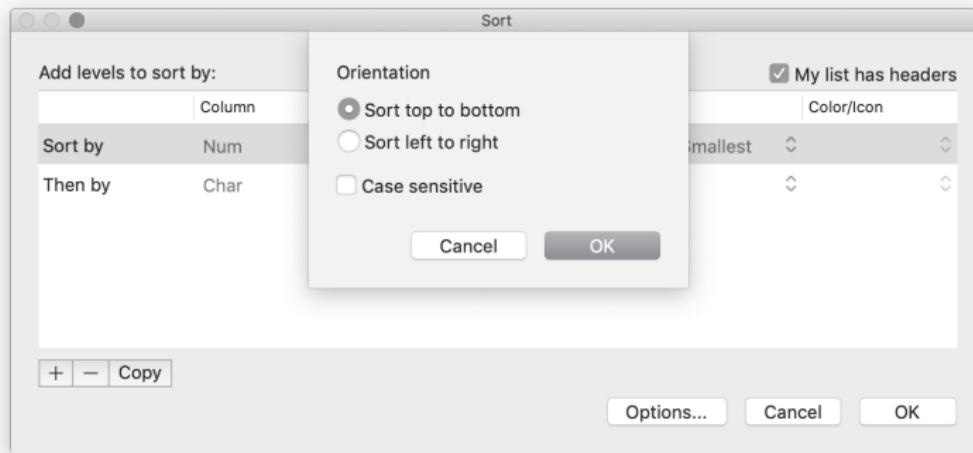
Num	Char
3	a
3	B
2	A
2	b
1	a
1	A
1	b
1	B

C) Correct: default is not case-sensitive

Num	Char
3	a
3	B
2	A
2	b
1	A
1	B
1	a
1	b

Sorting

If you want to make sorting on characters case sensitive, we need to select that in Options:



Filtering Question

Example 14

Given this spreadsheet, how many of these statements are TRUE?

	A	B
1	Number	Letter
2	1	a
3	2	b
4	3	c
5	4	d
6	5	e
7		

1. The data is sorted ascending by Number.
2. Filter Number > 3 shows 3 rows.
3. Filter Letter \geq "c" shows 3 rows.
4. Filter Number < 3 OR Letter > "b" shows 5 rows.

- A) 0 B) 1 C) 2 D) 3 E) 4**

Filtering Question

Answer:

Given this spreadsheet, how many of these statements are TRUE?

	A	B
1	Number	Letter
2	1	a
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Filtering Question

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Filtering Question

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Filtering Question

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Filtering Question

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- A) 0 B) 1 C) 2 D) 3 E) 4

Filtering Question

N.B. The solution to the previous question required some **Advanced Filtering** options:

The screenshot shows a Microsoft Excel spreadsheet with the following data in columns A and B:

	A	B
1	Number	Letter
2	1	a
3	2	b
4	3	c
5	4	d
6	5	e
7		

The range D2:E4 is selected, and the formula bar shows the formula `=OR logic`. The range D7:E8 is also selected, and the formula bar shows the formula `=AND logic`.

The Data tab is selected in the ribbon, and the Advanced button is highlighted. A 'Advanced Filter' dialog box is open, containing the following settings:

- Filter the list, in-place
- Copy to another location
- List range: `A1:B6`
- Criteria range: `D2:E4`
- Unique records only

Buttons at the bottom of the dialog are 'Cancel' and 'OK'.

Conclusion

Spreadsheets are general purpose tools for data analysis that consist of a table of cells which contain data and formulas.

Formulas contain data values, cell references, and functions.

- ▶ Aggregate functions summarize multiple data values into a single value.
- ▶ Functions exist for statistics, string manipulation, lookup/indexing, and decisions.

Objectives

- ▶ Explain what a spreadsheet is.
- ▶ Explain how cells are addressed in a spreadsheet.
- ▶ List some of the ways to select cells in a spreadsheet.
- ▶ Define and explain: formula, function, argument, concatenation
- ▶ Use these functions: concatenate, lookup, index
- ▶ Explain the difference between an absolute and relative address.
- ▶ Explain how an aggregate function works. List some examples.
- ▶ Explain how to use conditional formatting.