

MICROSOFT EXCEL:

PRO TIPS FOR POWER USERS

75+ EXCEL TIPS TO HELP YOU WORK SMARTER, BOOST PRODUCTIVITY, AND BECOME A CERTIFIED POWER USER

★★★★★ With Best-Selling Excel instructor *Chris Dutton*



COURSE STRUCTURE & OUTLINE

PRODUCTIVITY TIPS

- CTRL & ALT Shortcuts
- Data Validation
- Autofill & Flash Fill
- Cell Protection
- Advanced Sorting & Filtering
- Etc.

FORMATTING TIPS

- Frozen Panes
- Invisible Text
- Custom Number Formats
- Snap to Grid
- Formula Formatting
- Etc.

FORMULA TIPS

- Formula Auditing Tools
- Calculation Modes
- Fuzzy-Match Lookups
- Uniques & Duplicates
- INDEX & MATCH
- Etc.

VISUALIZATION TIPS

- Filled Maps
- Sparklines
- Dynamic Ranges
- Form Controls
- Custom Templates
- Etc.

PIVOT TABLE TIPS

- Date & Value Grouping
- Custom Sort Lists
- Slicers & Timelines
- Cached Source Data
- Conditional Formatting
- Etc.

ANALYTICS TIPS

- Goal Seek & Solver
- Data Modeling
- CUBE Functions
- Outlier Detection
- Monte Carlo Simulation
- Etc.

SETTING EXPECTATIONS

1 I'm using Microsoft Office 365 ProPlus, for PC

- What you see on your screen **will not always match** what you see on mine, especially if you're using a different operating system or an older version of Excel

2 This course is **not designed** to serve as an intro to Excel

- Pro Tips are intended to showcase **specific tools and techniques**; for deeper dives, check out my other Excel & Power BI courses (Formulas, Charts, Pivots, Power Query, etc.)

3 This is a **non-linear** course, and can be taken in any order

- Each demo is **self-contained**, so feel free to skip ahead or focus on specific areas

4 Questions? Comments? **Let's talk.**

- If you need support along the way, feel free to post a question or reach out directly

PRODUCTIVITY TIPS

PRO TIP

CUSTOMIZE YOUR WORKBOOK FOOTER STATS

- The Excel footer bar typically shows the **Sum**, **Average**, and **Count** of a selected range of values, by default
- Right-click** the footer to customize your options, and display additional stats like **Numerical Count**, **Max**, and **Min**, as well as other notifications (*Flash Fill results*, *Caps Lock*, *Macro status*, etc.)



PRODUCTIVITY



1 STAR (VERY BASIC)

	A	B	C	D
1	Date	Conditions	Temp (F)	Wind Speed (MPH)
2	1/1/2016	Clear	39	32
3	1/2/2016	Clear	35	28
4	1/3/2016	Clear	36	28
5	1/4/2016	Clear	30	28
6	1/5/2016	Clear	16	23
7	1/6/2016	Clear	30	21.9
8	1/7/2016	Clear	33	18.1
9	1/8/2016	Clear	35	23
10	1/9/2016	Rain	40	18.1
11	1/10/2016	Rain	45	38.9
12	1/11/2016	Clear	40	38
13	1/12/2016	Snow	29	23
14	1/13/2016	Clear	29	47
15	1/14/2016	Clear	24	23
16	1/15/2016	Clear	31	17

Customize Status Bar

Cell Mode	Ready
Flash Fill Blank Cells	
Flash Fill Changed Cells	
Signatures	Off
Information Management Policy	Off
Permissions	Off
Caps Lock	Off
Num Lock	Off
Scroll Lock	Off
Fixed Decimal	Off
Overtype Mode	Off
End Mode	Off
Macro Recording	Not Recording
Selection Mode	
Page Number	
Average	33.29411765
Count	17
Numerical Count	17
Minimum	16
Maximum	45
Sum	566

RIGHT-CLICK

Average: 53.14246575 Count: 366 Numerical Count: 365 Min: 0 Max: 86 Sum: 19397

COMMON USE CASES:

- Quickly generating summary statistics without using formulas
- Adding a status indicator to display while macros are in recording mode

PRO TIP

QUICKLY NAVIGATE SHEETS WITH CTRL SHORTCUTS

- **CTRL-ARROW:** Jump to the edge of a contiguous range (*command+arrow* on a Mac)
 - Hold **SHIFT** to select cells at the same time
- **CTRL-HOME & CTRL-END:** Jumps to the top-left or bottom-right cell in a range (*control+fn+arrow* on a Mac)
- **CTRL-PgUp & CTRL-PgDn:** Switches between tabs (*option+arrow* on a Mac)
- **CTRL-G:** Launches the “Go-To” menu, containing any named cell, ranges or tables



PRODUCTIVITY



1 STAR (VERY BASIC)

A	B	C	D	E
1	Title	Release Date	Color/B&W	Genre
2	Over the Hill to the Poorhouse	9/15/1920	Black and White	Crime
3	Metropolis	1/26/1927	Black and White	Drama
4	The Broadway Melody	11/11/1929	Black and White	Musical
5	42nd Street	8/29/1933	Black and White	Comedy
6	Top Hat	4/15/1935	Black and White	Comedy
7	Modern Times	10/7/1936	Black and White	Comedy
8	Snow White and the Seven Dwarfs	2/2/1937	Color	Animation
9	Gone with the Wind	11/12/1939	Color	Drama
10	The Wizard of Oz	4/9/1939	Black and White	Adventure
11	Fantasia	5/18/1940	Color	Animation
12	Pinocchio	10/12/1940	Color	Animation
13				



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7	Modern Times	10/7/1936	Black and White	Comedy
8	Snow White and the Seven Dwarfs	2		

PRO TIP

ACCESS RIBBON CONTROLS WITH ALT KEY TIPS

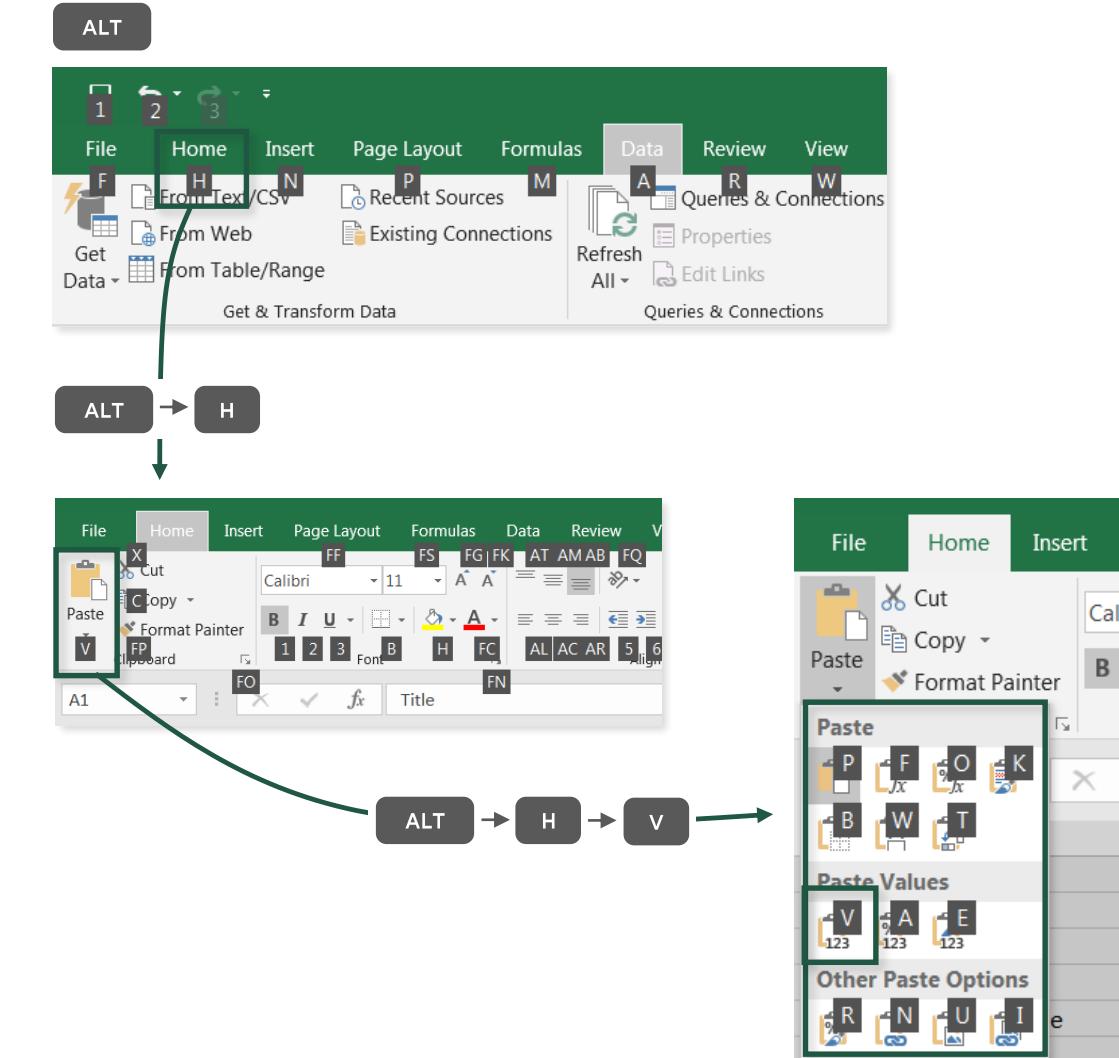
- Press and release the **ALT key** to activate ribbon shortcuts, which allow you to navigate through menu options with simple keystrokes (*no mouse required!*)
 - **ALT → H → V → V:** Paste special as values
 - **ALT → A → T:** Add or remove filters
 - **ALT → H → E → F:** Clear formats
 - **ALT → N → V:** Insert a PivotTable
- **NOTE:** Alt key tips are not available for Mac



PRODUCTIVITY



1 STAR (VERY BASIC)



COMMON USE CASES:

- Quickly accessing tools or commands that would normally require multiple clicks (i.e. paste special options)

PRO TIP

SELECT SPECIAL CELL TYPES WITH "GO TO" OPTIONS

- **CTRL-G:** Launches the default “Go To” options, which allow you to jump to specific tables or named ranges in your workbook
- The **SPECIAL** menu includes additional options to select specific *types* of cells or objects in the sheet (*blanks, formulas, conditional formats, validation cells, etc.*)



PRODUCTIVITY



1 STAR (VERY BASIC)

The screenshot shows the Microsoft Excel interface with two dialog boxes open. The top-left dialog is the standard "Go To" dialog, with the "Special..." button highlighted. The top-right dialog is the "Go To Special" dialog, with the "Formulas" option selected and several checkboxes checked: Numbers, Text, Logicals, and Errors. A green arrow points from the "Special..." button in the Go To dialog to the "Formulas" checkbox in the Go To Special dialog. Another green arrow points from the "Formulas" checkbox in the Go To Special dialog to the \$16.50 cell in a table below. The table has columns labeled XSmall, Small, Medium, Large, and XLarge, and rows for Socks, Shorts, Pants, T-Shirt, and Sweater. The T-Shirt, Large cell is highlighted in yellow. The formula bar shows =INDEX(C3:G7,MATCH(B10,B3:B7,0),MATCH(C10,C2:G2,0)).

COMMON USE CASES:

- Quickly identifying or highlighting all cells containing formulas
- Selecting and deleting all objects in a worksheet with one click
- Identifying cells that have data validation rules applied (i.e. drop-downs)

PRO TIP

REMOVE ALL BLANK ROWS IN A WORKSHEET

- **STEP 1:** Use **CTRL-G** to launch the “**Go To**” menu, click **Special**, and select **Blanks** to select all blank rows in the sheet
- **STEP 2:** Delete the selected rows, using any of the following options:
 - **Home > Delete > Delete Sheet Rows**
 - **ALT-H-D-R**
 - **CTRL+- > Shift Cells Up**



PRODUCTIVITY



2 STARS (BASIC)

The screenshot illustrates the steps to remove blank rows in an Excel worksheet. It shows three windows: 1) The 'Go To' dialog box with the 'Special...' button highlighted. 2) The 'Go To Special' dialog box with the 'Blanks' option selected. 3) The 'Delete Cells...' dialog box with the 'Delete Sheet Rows' option selected. The main worksheet area shows a list of products with their dates and IDs, and the 'Delete' dialog box is overlaid on it.

A	B	C
1 Date	Product ID	Product
2 1/1/1997	869	Nationel Grape Fruit Roll
3 1/1/1997	1472	Fort West Fudge Cookies
4 1/1/1997	76	Red Spade Sliced Chicken
		Excellent Cranberry Juice
11 1/1/1997	557	Special Wheat Puffs
12		Plato Chunky Peanut Butter
13		Tell Tale Canned Peanuts
14 1/1/1997	367	Carrington Frozen Chicken Thighs
15 1/1/1997	250	Carlson Jack Cheese
16 1/1/1997	600	Carlson 2% Milk
17 1/1/1997	702	Best Choice Golden Raisins
18 1/1/1997	786	Landslide Decaf Coffee
19 1/1/1997	536	Jumbo Large Eggs
20		Footnote Extra Lean Hamburger
21 1/1/1997	596	Fast Potato Chips
22		Landslide Hot Chocolate
23 1/1/1997	769	Cormorant D-Size Batteries
24		Tri-State Golden Delcious Apples
25 1/1/1997	1135	PigTail Frozen Peas
26 1/1/1997	1046	Robust Monthly Fashion Magazine
27 1/1/1997	170	Monarch Spaghetti
28 1/1/1997	885	
29		
30		
31 1/1/1997	616	Landslide Apple Jam
32 1/1/1997	1432	Hermanos Red Pepper
33 1/1/1997	544	Fast Avocado Dip
34 1/1/1997	320	Excellent Cranberry Juice
35 1/1/1997	952	Special Wheat Puffs
36 1/1/1997	1222	Plato Chunky Peanut Butter
37 1/1/1997	1359	Carrington Frozen Chicken Thighs
38 1/1/1997		
39		
40 1/1/1997		

COMMON USE CASES:

- Cleaning up raw data by quickly eliminating extra/blank rows, without having to manually select or use query editing tools

PRO TIP

CREATE DROP-DOWN LISTS WITH DATA VALIDATION

- **Data Validation** allows you to limit the values that a particular cell will accept (*whole numbers, ranges, dates, text, etc.*)
- The **List** option allows you to create a drop-down menu containing specific items
 - **Note:** *Items can be typed directly or referenced as a cell range (i.e. A1:A10)*
- Add **Input Messages** or **Error Alerts** to customize what users see when they select the cell or enter invalid values

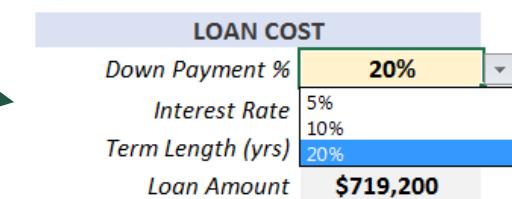
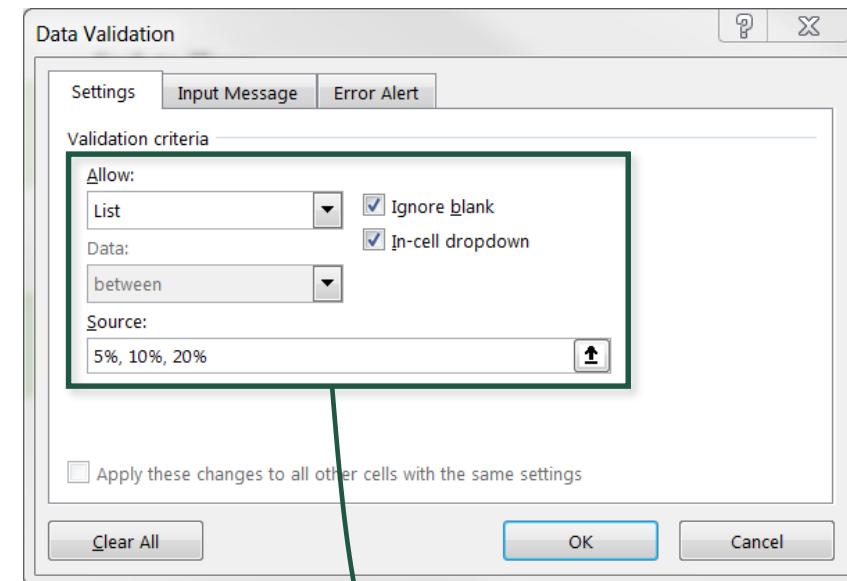
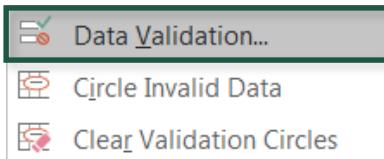


PRODUCTIVITY



2 STARS (BASIC)

(Data > Data Validation)



COMMON USE CASES:

- Creating formula-based models with variable inputs
- Preventing users from entering invalid values (decimals, negatives, etc.)

PRO TIP

POPULATE VALUES WITH AUTO FILL & FLASH FILL

- Basic **Auto Fill** options allow you to copy cells, add a sequential series, fill with or without formatting, or apply date intervals
 - Drag or double-click the **lower-right corner** of a cell to access auto fill options and apply values to new rows
- **Flash Fill** identifies patterns based on a sample set of given values, and uses those patterns to populate the whole column



PRODUCTIVITY



2 STARS (BASIC)

The screenshot shows three separate examples of filling data in Excel:

- Example 1 (P Column):** A column of dates from 1/1/2018 to 6/1/2018. A context menu is open over the first cell, showing options: Copy Cells, Fill Series, Fill Formatting Only, Fill Without Formatting, Fill Days, Fill Weekdays, Fill Months (selected), Fill Years, and Flash Fill.
- Example 2 (K Column):** A column of email addresses. A context menu is open over the first cell, showing options: Copy Cells, Fill Series, Fill Formatting Only, Fill Without Formatting, and Flash Fill.
- Example 3 (I Column):** A column of sequential numbers from 1 to 10. A context menu is open over the first cell, showing options: Copy Cells, Fill Series (selected), Fill Formatting Only, Fill Without Formatting, and Flash Fill.

COMMON USE CASES:

- Applying values to thousands of rows without dragging or copy/pasting
- Filling formulas down to new rows without overwriting existing formats
- Extracting text from strings that would be difficult to isolate using formulas
- Quickly creating sequential index columns or calendar tables

PRO TIP

CUSTOMIZE THE RIBBON WITH YOUR OWN TABS

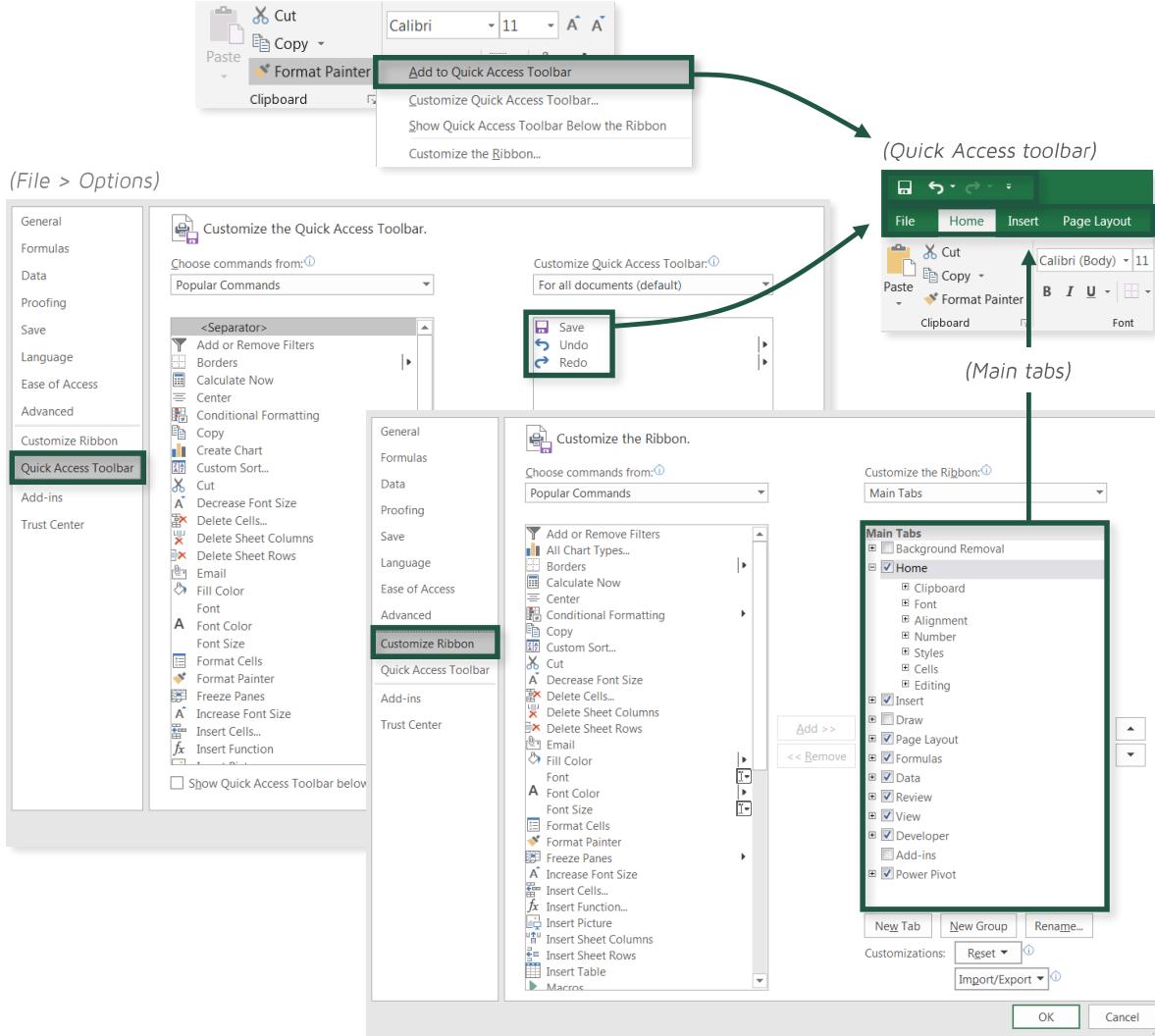
- Excel provides options to add, remove, or rearrange tabs and tools in the workbook ribbon (including the **Quick Access** toolbar)
 - **Quick Access** tools live above the ribbon, and include *Save, Undo & Redo* by default
- Use **File > Options > Customize Ribbon** to show, hide, or rearrange tabs in the ribbon, or to create your own custom tabs



PRODUCTIVITY



2 STARS (BASIC)



COMMON USE CASES:

- Consolidating commonly used tools into a single, custom tab
- Exposing the **Developer** tab to access form controls or macros

PRO TIP

SPLIT TEXT STRINGS USING TEXT TO COLUMNS

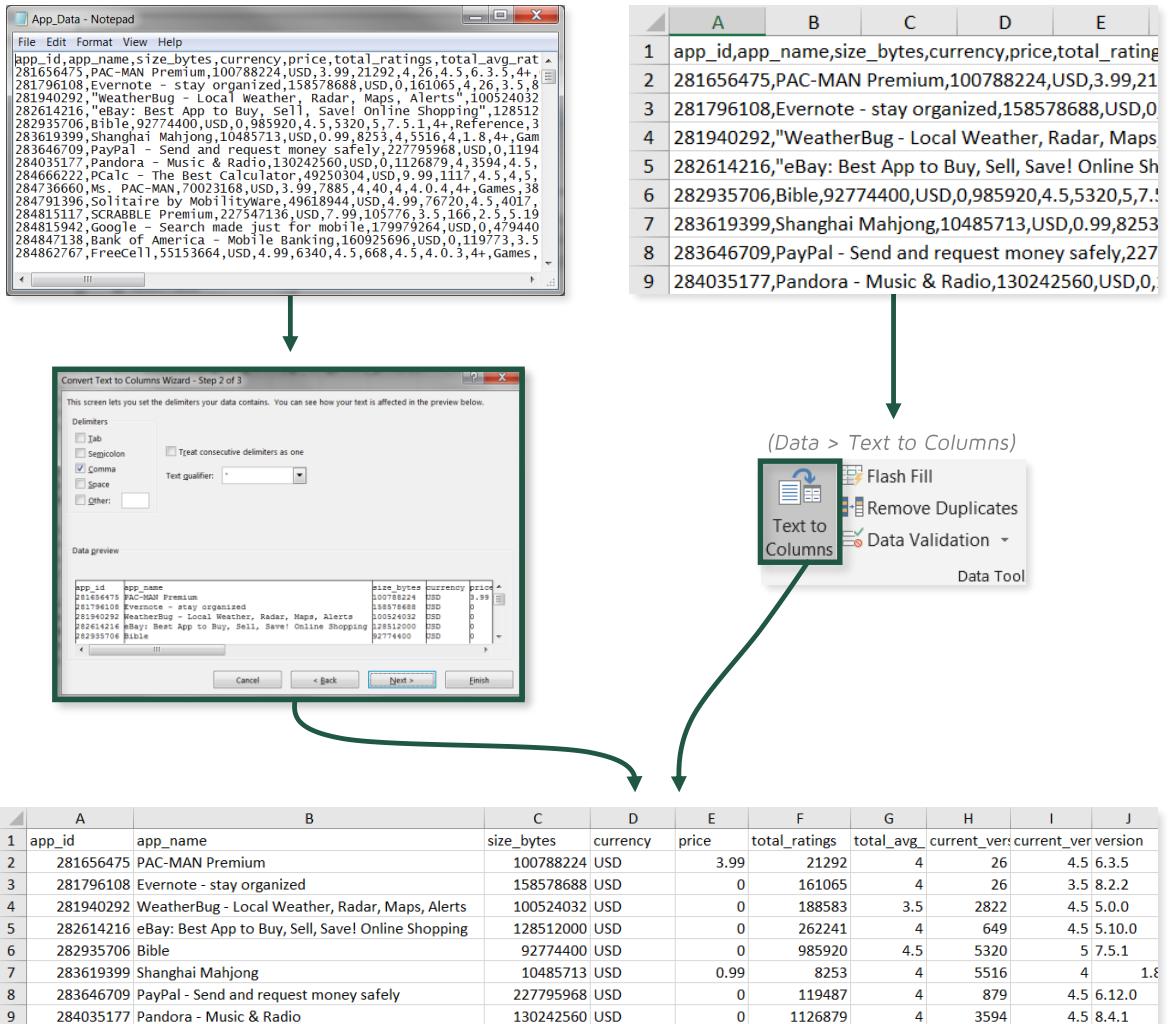
- If your data is stored as text or separated values (i.e. **.txt** or **.csv** files), use **Text to Column** to split values into columns & rows
 - OPTION 1:** Open a txt file from Excel to launch the Text to Column wizard
 - OPTION 2:** Open a csv file or copy data into one column, and use **Data > Text to Column**
- NOTE:** Both methods include options to specify delimiters, define text qualifiers, and format or exclude columns



PRODUCTIVITY



2 STARS (BASIC)



COMMON USE CASES:

- Transforming text-based data into tabular formats for analysis
- Splitting text strings without using formulas or functions

PRO TIP

COMPARE FILES WITH SYNCHRONOUS SCROLLING

- **Synchronous scrolling** allows you to arrange Excel workbooks side-by-side and scroll through them simultaneously
 - **STEP 1:** Open both workbooks that you want to compare
 - **STEP 2:** Click **View > View Side by Side** in order to “stack” your windows
 - **STEP 3:** Activate **View > Synchronous Scrolling** to allow windows to scroll simultaneously



PRODUCTIVITY



2 STARS (BASIC)

The screenshot shows two Excel workbooks side-by-side. The top ribbon has the 'View' tab selected, with arrows pointing to the 'View Side by Side' and 'Synchronous Scrolling' buttons. Both workbooks display a table of data with columns for 'Week Ending', 'Mean Temp (F)', and 'Precip (in)'. The data spans from January 1, 2016, to July 24, 2016. Below the tables are two line graphs showing temperature and precipitation over time. The bottom ribbon shows tabs for 'Tables vs. Ranges', 'Synchronous Scrolling', and 'Extracting Unique Values'. The status bar at the bottom right indicates 'Ready' and '100%'. The overall interface is clean and professional.

COMMON USE CASES:

- Spot-checking workbooks for version control issues
- Making quick visual comparisons between similar files

PRO TIP

EXTRACT UNIQUE VALUES WITH ADVANCED FILTERS

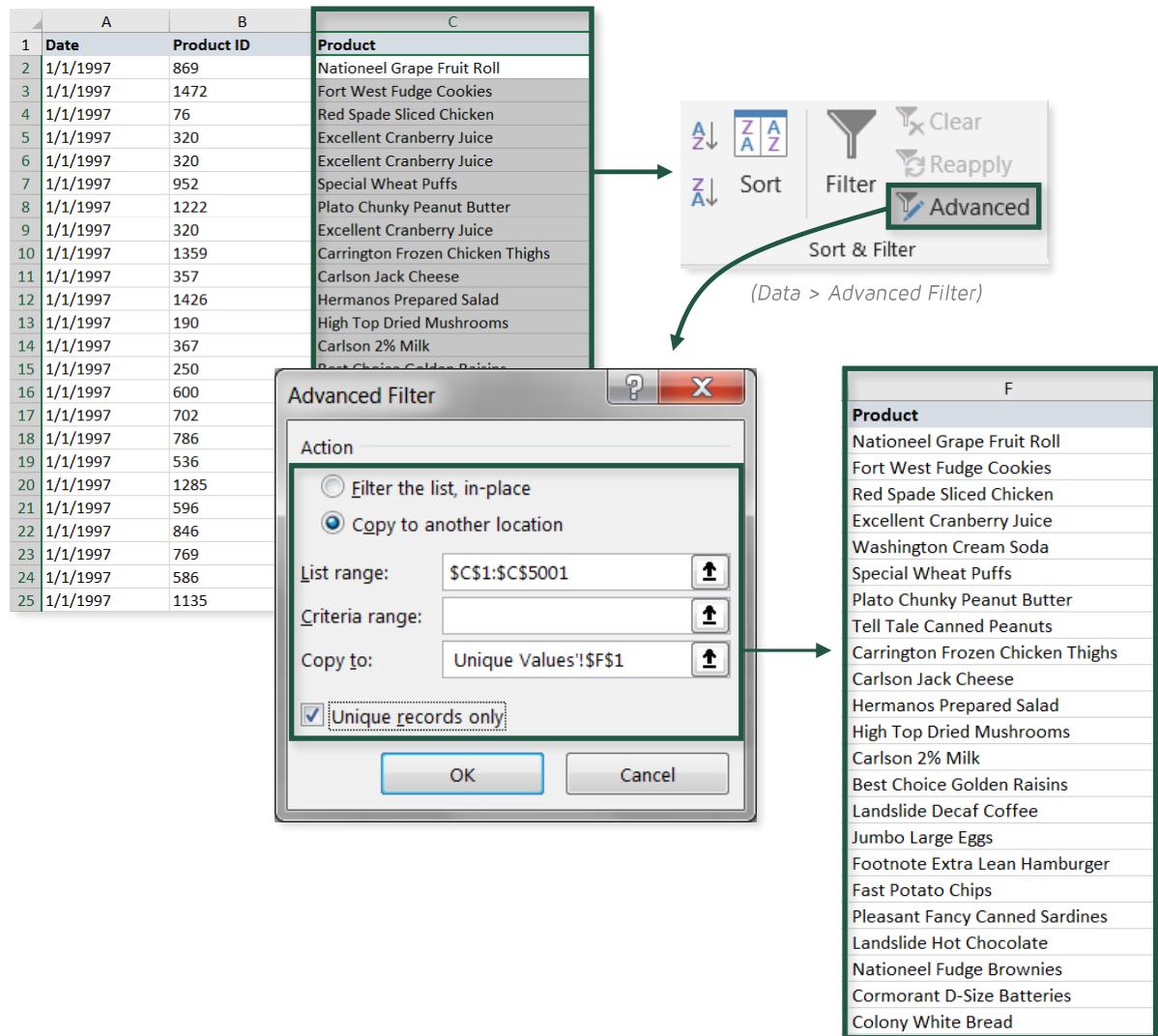
- There are several ways to remove duplicate values from a list in Excel, including the **Remove Duplicates** tool, **Advanced Filters**, **PivotTables** and **Power Query**
- The **Advanced Filter** is the most flexible option, allowing you to either filter in place or copy unique values to a new location
 - **NOTE:** To extract uniques into a new list, select “*Copy to another location*” and “*Unique records only*”



PRODUCTIVITY



2 STARS (BASIC)



COMMON USE CASES:

- Identifying unique values while preserving the original list
- Creating a new lookup or dimension table containing unique primary keys

PRO TIP

SIMPLIFY FORMULAS WITH NAMED RANGES & TABLES

- Use **Named Ranges** or **Tables** (vs. raw cell ranges) to simplify formula references
- Compared to Named Ranges, formatting as a **Table (CTRL-T)** allows you to:
 1. Automatically ingest new rows of data
 2. Access quick formatting & filtering options (*fixed headers, banded rows, etc.*)
 3. Write efficient calculated columns vs. traditional (A1-style) cell formulas



PRODUCTIVITY



3 STARS (MODERATE)

A	B	C	D	E	F
Date	Transactions	Holiday		Date	Holiday
1/1/2014	788	New Year's Day		1/1/2014	New Year's Day
1/2/2014	878	None		1/20/2014	Martin Luther King Jr. Day
1/3/2014	847	None		2/12/2014	Lincoln's Birthday
1/4/2014	369	None		2/17/2014	Presidents' Day
1/5/2014	939	None		5/26/2014	Memorial Day
1/6/2014	588	None		7/4/2014	Independence Day
1/7/2014	660	None		10/13/2014	Columbus Day
1/8/2014	980	None		11/4/2014	Election Day
1/9/2014	738	None		11/11/2014	Veterans Day
1/10/2014	322	None		11/27/2014	Thanksgiving Day
1/11/2014	756	None		11/28/2014	Lincoln's Birthday/Lincoln's Day
1/12/2014	859	None		12/24/2014	Christmas Eve
1/13/2014	149	None		12/25/2014	Christmas Day
1/14/2014	138	None		12/26/2014	Day After Christmas Day
1/15/2014	258	None		12/31/2014	New Year's Eve
1/16/2014	852	None			

Table Name:

Holidays

Resize Table

Properties

(Table Tools)

A	B	C	D
Date	Transactions	Holiday	
1/1/2014	788	New Year's Day	
1/2/2014	878	None	
1/3/2014	847	None	

COMMON USE CASES:

- Replacing cell references with tables to make formulas easier to interpret
- Converting chart source data to enable automatic updates
- Preparing data for analysis with Excel BI tools (data model, Power Pivot)

PRO TIP

ADD CUSTOM WORKBOOK PROTECTION SETTINGS

- The **Protection** tab in the **Format Cells** dialog box allows you to specify how cells behave once the worksheet is protected:
 - Locked** means that users can view the cell contents but not edit (*default*)
 - Hidden** means that users cannot see any underlying formulas or references
- NOTE:** All cells are **locked** by default; you must actively *unprotect* the specific cells that you want to remain editable



PRODUCTIVITY



3 STARS (MODERATE)

Albert Pujols

	A	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG			
1																				
2						Select Player	Albert Pujols													
3																				
4																				
5						AB	H	Avg	R	2B	3B	HR	RBI	SB	CS	SB%	BB	K	K/BB	
6						587	183	0.312	115	39	1	42	118	14	4	78%	103	76	0.7	
7						579	173	0.299	105	29	0	37	99	9	1	90%	61	58	1.0	
8						607	173	0.285	85	50	0	30	105	8	1	89%	52	76	1.5	
9						391	101	0.258	49	19	0	17	64	1	1	50%	40	55	1.4	
10						633	172	0.272	89	37	1	28	105	5	1	83%	48	71	1.5	
11						602	147	0.244	85	22	0	40	95	5	3	63%	50	72	1.4	
12						Total:	3,399	949	0.279	528	196	2	194	586	42	11	79%	354	408	1.2
13																				

CTRL 1

Format Cells

Number Alignment Font Border Fill Protection

Locked Hidden

Locking cells or hiding formulas has no effect until you protect the worksheet (Review tab, Changes group, Protect Sheet button).

Protect Sheet Protect Workbook

(Review > Protect Sheet)

COMMON USE CASES:

- Preventing users from accidentally modifying sensitive content
- Obscuring underlying formulas or cell references from view
- Limiting user interaction to a specific set of inputs or cells

PRO TIP

APPLY MULTI-LEVEL ROW & COLUMN SORTING

- Instead of using column header options, use the **Sort** tool to apply **multi-level sorting**
 - **Example:** Sort a table alphabetically by *Country*, then *Province*, and finally by *Price*
- Select entire columns and use the **Options** menu to sort **Left to Right**, which allows you to **sort columns** instead of rows
 - **NOTE:** In addition to values, you can sort based on **cell color**, **font color**, or **icon**



PRODUCTIVITY



3 STARS (MODERATE)

The screenshot illustrates the 'Sort & Filter' feature in a software application. At the top, a toolbar includes 'Add Level', 'Delete Level', 'Copy Level', 'Options...', and a checked checkbox 'My data has headers'. Below this is a 'Sort' dialog box with three levels defined: 'Sort by Country' (Cell Values, A to Z), 'Then by Province' (Cell Values, A to Z), and 'Then by Points' (Cell Values, Largest to Smallest). A green arrow points from the 'Options...' button in the main toolbar to the 'Sort Options' dialog box, which contains settings for 'Case sensitive' and 'Orientation' (set to 'Sort top to bottom'). Another green arrow points from the 'Options...' button in the 'Sort' dialog to its own 'Sort Options' dialog, which also has 'Case sensitive' and 'Orientation' settings (set to 'Sort left to right').

COMMON USE CASES:

- Applying complex or custom sorting rules to a table or range
- Rearranging columns (alphabetically or by color) to organize a large table

PRO TIP

EXPLORE TABLES WITH ADVANCED FILTERING

- **Advanced Filters** allow you to define a custom **criteria range**, which can contain complex combinations of filtering rules
 - Use advanced filtering to define rules that would be impossible with standard filters or PivotTables (*i.e. filtering on Action films rated 8.5+ plus Biography films rated 8+*)
- **NOTE:** Advanced filters iterate through all rows of the table, and can be *very slow* for large tables or very broad criteria

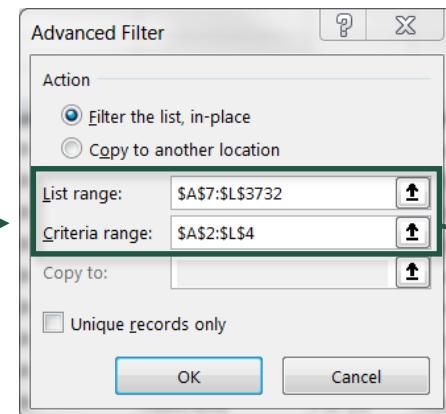
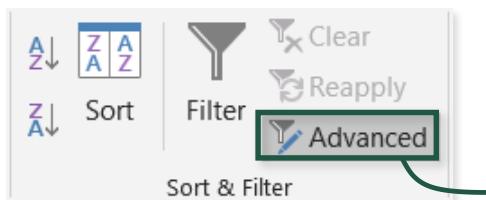


PRODUCTIVITY



5 STARS (EXPERT)

(Data > Advanced Filter)



	A	B	C	D	E	F	G	H	I
1	Filter Criteria:								
2	Title	Release Year	Color/B&W	Genre	Language	Country	Rating	Lead Actor	IMDb Score
3	The*			Biography					>8
4				Action					>8.5
5									
6									
7	Title	Release Year	Color/B&W	Genre	Language	Country	Rating	Lead Actor	IMDb Score
118	Seven Samurai	1954	B&W	Action	Japanese	Japan	Unrated	Takashi Shimura	8.7
119	The Lord of the Rings: The Fellowship of the Ring	2001	Color	Action	English	New Zealand	PG-13	Christopher Lee	8.8
209	The Dark Knight	2008	Color	Action	English	USA	PG-13	Christian Bale	9
211	Star Wars: Episode IV - A New Hope	1977	Color	Action	English	USA	PG	Harrison Ford	8.7
219	The Lord of the Rings: The Return of the King	2003	Color	Action	English	USA	PG-13	Orlando Bloom	8.9
224	The Lord of the Rings: The Two Towers	2002	Color	Action	English	USA	PG-13	Christopher Lee	8.7
237	Inception	2010	Color	Action	English	USA	PG-13	Leonardo DiCaprio	8.8
239	Star Wars: Episode V - The Empire Strikes Back	1980	Color	Action	English	USA	PG	Harrison Ford	8.8
260	Saving Private Ryan	1998	Color	Action	English	USA	R	Tom Hanks	8.6
310	The Matrix	1999	Color	Action	English	USA	R	Keanu Reeves	8.7
1323	The Pianist	2002	B&W	Biography	English	France	R	Emilia Fox	8.5
1339	The Sea Inside	2004	Color	Biography	Spanish	Spain	PG-13	Belén Rueda	8.1
1342	The Imitation Game	2014	Color	Biography	English	UK	PG-13	Benedict Cumberbatch	8.1
1379	The Act of Killing	2012	Color	Biography	Indonesian	UK	Not Rated	Anwar Congo	8.2
1395	The Wolf of Wall Street	2013	Color	Biography	English	USA	R	Leonardo DiCaprio	8.2

COMMON USE CASES:

- Applying custom or complex filtering rules that cannot be replicated with standard filter tools or PivotTables
- Adding a user-facing criteria range to provide transparency into the filter settings that have been applied to a table

FORMATTING TIPS

PRO TIP

USE CTRL TO APPLY FORMATTING SHORTCUTS

- Access common number formats using **CTRL shortcuts**:
 - CTRL-SHIFT-1 (CTRL-!)**: Number
 - CTRL-SHIFT-2 (CTRL-@)**: Time
 - CTRL-SHIFT-3 (CTRL-#)**: Date
 - CTRL-SHIFT-4 (CTRL-\$)**: Currency
 - CTRL-SHIFT-5 (CTRL-%)**: Percentage
 - CTRL-SHIFT-6 (CTRL-^)**: Scientific
- CTRL-SHIFT-~ (tilde)** reverts to General



FORMATTING



1 STAR (VERY BASIC)

	A	B	C	D
1	Release Date	FB Likes	Gross Revenue	ROI %
2	7564	0	3000000	30
3	9888	12000	26435	0.004405833
4	10908	167	2808000	7.408970976
5	12295	439	2300000	5.239179954
6	12889	1000	3000000	4.926108374
7	13430	0	163245	0.10883
8	13548	0	184925485	92.4627425
9	14561	16000	198655278	49.95103797
10	14344	14000	22202612	7.929504286

	A	B	C	D
1	Release Date	FB Likes	Gross Revenue	ROI %
2	15-Sep-20	0.00	\$3,000,000.00	3000%
3	26-Jan-27	12,000.00	\$26,435.00	0%
4	11-Nov-29	167.00	\$2,808,000.00	741%
5	29-Aug-33	439.00	\$2,300,000.00	524%
6	15-Apr-35	1,000.00	\$3,000,000.00	493%
7	7-Oct-36	0.00	\$163,245.00	11%
8	2-Feb-37	0.00	\$184,925,485.00	9246%
9	12-Nov-39	16,000.00	\$198,655,278.00	4995%
10	9-Apr-39	14,000.00	\$22,202,612.00	793%

COMMON USE CASES:

- Quickly applying common number formats without using the mouse or accessing the **Format Cells** dialog box

PRO TIP

ALIGN WORKBOOK OBJECTS USING SNAP TO GRID

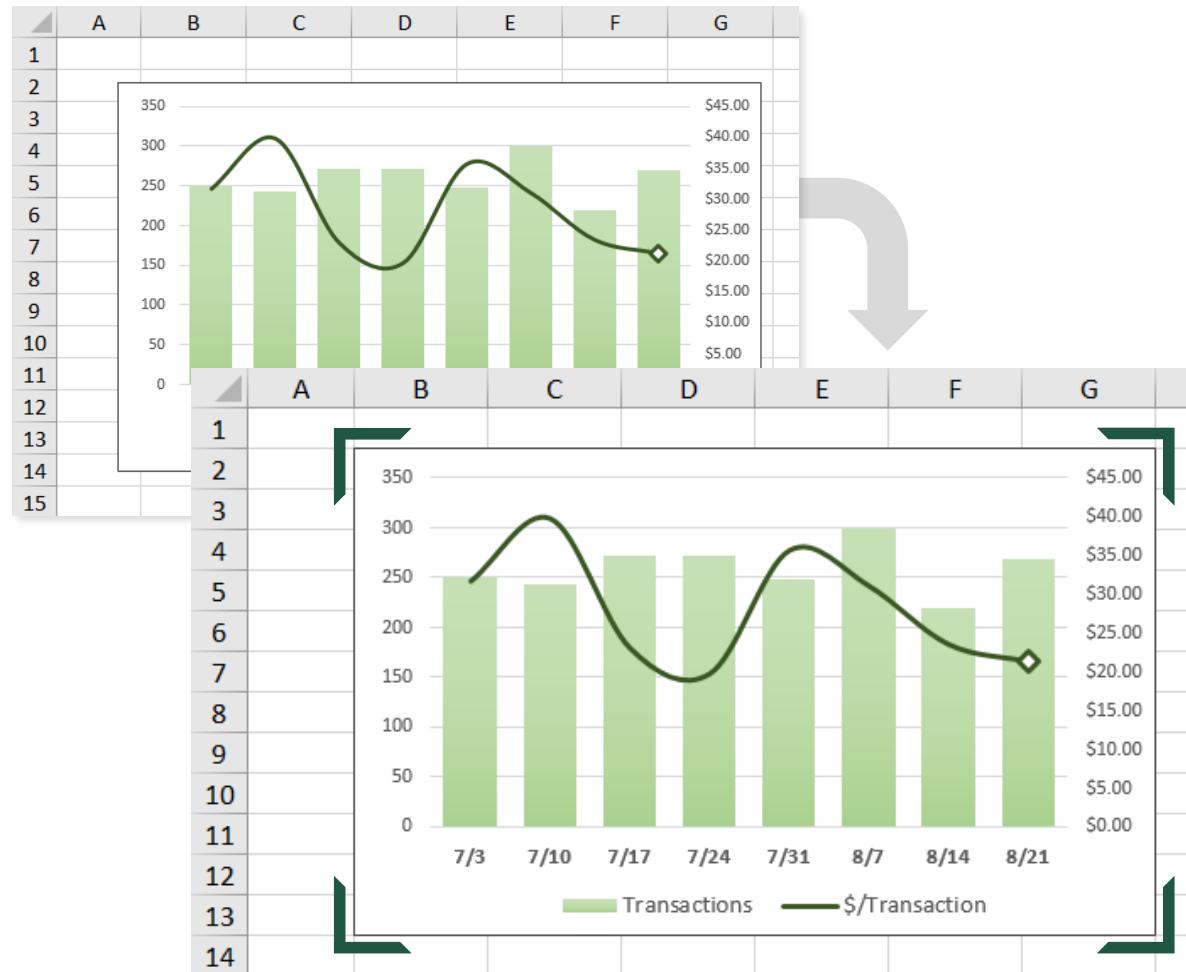
- Hold the **ALT key** as you drag or resize objects to “snap” them to cell borders
- **BONUS TIPS:**
 - Hold **CTRL** as you drag to create a copy of the object at the same time
 - Hold **SHIFT** as you drag to limit movement to the horizontal or vertical plane



FORMATTING



1 STAR (VERY BASIC)



COMMON USE CASES:

- Ensuring that all worksheet objects are aligned to a common grid
- Designing clean and polished user-facing tools or dashboards

PRO TIP

HIDE WORKBOOK ELEMENTS TO REDUCE CLUTTER

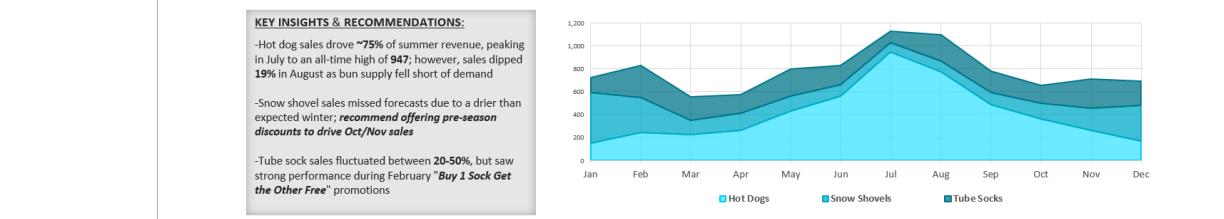
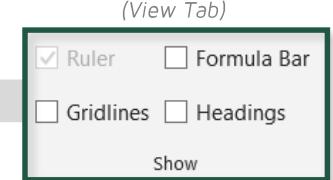
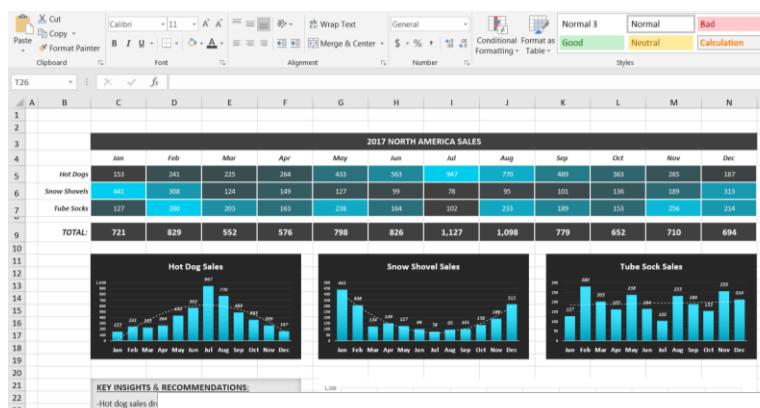
- Use the **View > Show** checkboxes to hide workbook elements from view, including **Gridlines**, **Headings**, or the **Formula Bar**
- To collapse the ribbon from view, click the **caret icon (^)** in the lower right corner
 - To anchor the ribbon, select a tab and click the “pin” icon (where the caret used to be)
- **NOTE:** Gridlines and headings are specific to individual sheets, but formula bar and ribbon settings impact the entire workbook



FORMATTING



1 STAR (VERY BASIC)



COMMON USE CASES:

- Creating clean and polished “dashboard-style” views
- Preventing users from modifying rows, columns, or formulas

PRO TIP

REPLICATE FORMATS WITH THE FORMAT PAINTER

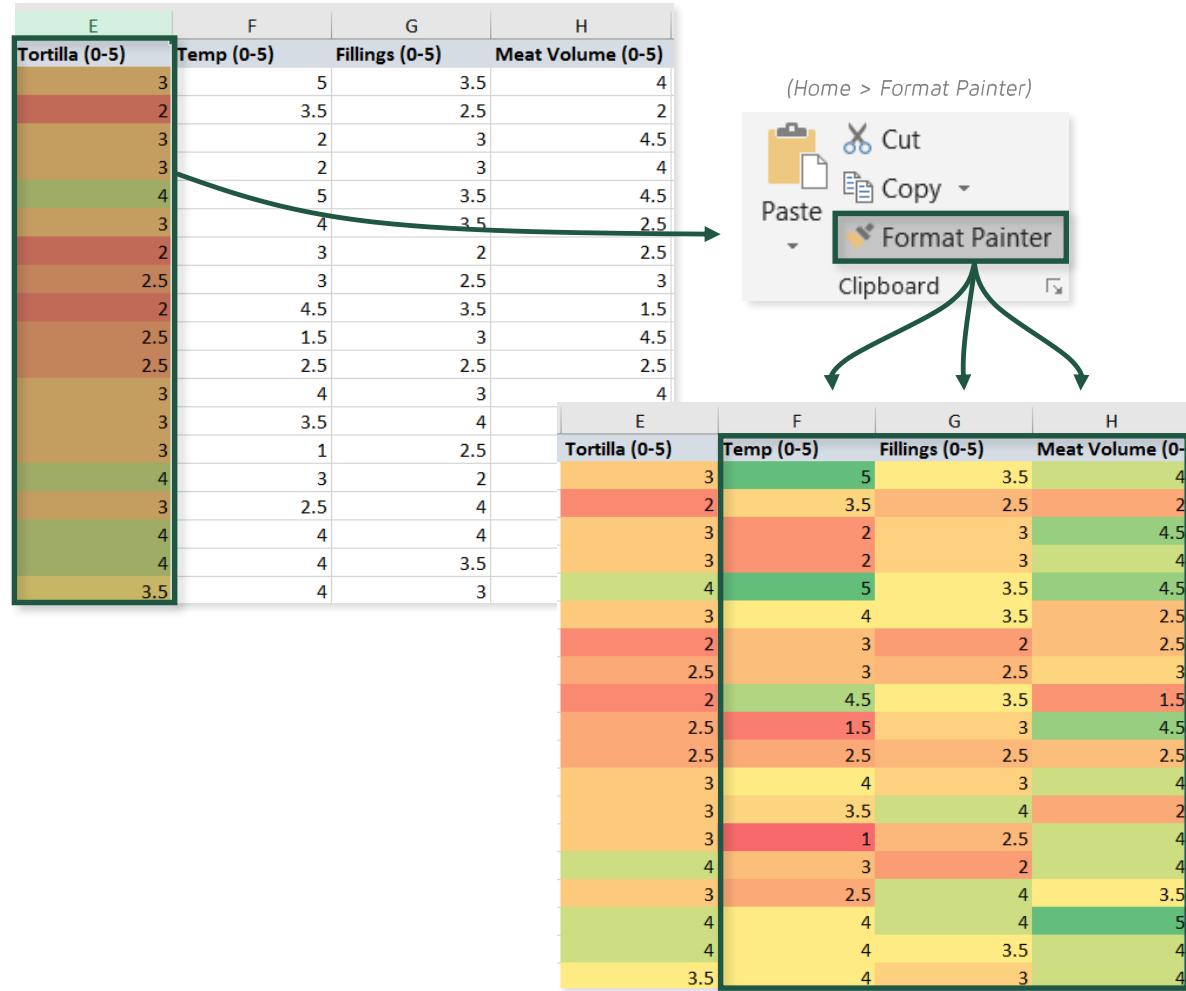
- Use the **Format Painter** to copy all formatting settings (*fill, number format, borders, font styles, alignment, etc.*) from one cell or range of cells to another
- Click the format painter once to copy formats one time; **double click** if you want to copy formats multiple times (*until you click the format painter again to deactivate*)



FORMATTING



1 STAR (VERY BASIC)



COMMON USE CASES:

- Quickly applying formats across multiple columns without having to manually replicate each setting
- Ensuring that cell formats are exactly the same (borders, fill, number format, etc.)

PRO TIP

USE COLOR & BORDERS TO CREATE POLISHED REPORTS

- **Fill colors** and **borders** aren't just stylistic tools; they can be used strategically to improve readability, create spacing, and draw attention to key metrics or trends
- Hide worksheet gridlines and add **white borders** to create a clean and polished look
 - Under the border options in the *Home* tab, use **Line Color** to set the border color and **Line Style** to determine the thickness



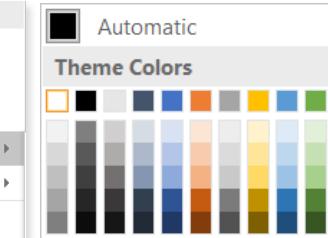
FORMATTING



1 STAR (VERY BASIC)

Week Start	TRAFFIC						LEADS					
	Spend	Impressions	Clicks	\$/Click	Click %	Lead A	Lead B	Lead C	Lead D	Total Leads	\$/Lead	Lead %
7/1/18	\$7,761	29,005	2,986	\$2.60	10.3%	319	194	336	267	1,116	\$6.95	37.4%
7/25/18	\$9,748	25,647	1,307	\$7.46	5.1%	177	210	177	287	851	\$11.45	65.1%
8/1/18	\$6,482	22,026	2,548	\$2.54	11.6%	292	314	219	155	980	\$6.61	38.5%
8/8/18	\$5,463	28,726	2,227	\$2.45	7.8%	244	243	306	259	1,052	\$5.19	47.2%
8/15/18	\$9,907	24,595	2,952	\$3.36	12.0%	288	270	298	237	1,093	\$9.06	37.0%
8/22/18	\$5,504	28,700	1,343	\$4.10	4.7%	314	155	216	310	995	\$5.53	74.1%
8/29/18	\$5,632	27,690	1,327	\$4.24	4.8%	220	236	306	229	991	\$5.68	74.7%
9/5/18	\$9,201	22,969	1,567	\$5.87	6.8%	256	283	202	155	896	\$10.27	57.2%
9/12/18	\$5,567	23,096	1,033	\$5.39	4.5%	251	340	306	264	1,161	\$4.80	112.4%
9/19/18	\$6,399	25,640	2,141	\$2.99	8.4%	272	196	342	159	969	\$6.60	45.3%
9/26/18	\$9,730	15,279	2,879	\$3.38	18.8%	231	315	275	256	1,077	\$9.03	37.4%
10/3/18	\$5,301	29,993	1,255	\$4.22	4.2%	168	350	309	333	1,160	\$4.57	92.4%
10/10/18	\$9,778	19,627	2,218	\$4.41	11.3%	301	183	325	325	1,134	\$8.62	51.1%

(Home Tab)



Week Start	TRAFFIC						LEADS					
	Spend	Impressions	Clicks	\$/Click	Click %	Lead A	Lead B	Lead C	Lead D	Total Leads	\$/Lead	Lead %
6/30/18	\$7,761	29,005	2,986	\$2.60	10.3%	319	194	336	267	1,116	\$6.95	37.4%
7/7/18	\$9,748	25,647	1,307	\$7.46	5.1%	177	210	177	287	851	\$11.45	65.1%
7/14/18	\$6,482	22,026	2,548	\$2.54	11.6%	292	314	219	155	980	\$6.61	38.5%
7/21/18	\$5,463	28,726	2,227	\$2.45	7.8%	244	243	306	259	1,052	\$5.19	47.2%
7/28/18	\$9,907	24,595	2,952	\$3.36	12.0%	288	270	298	237	1,093	\$9.06	37.0%
8/4/18	\$5,504	28,700	1,343	\$4.10	4.7%	314	155	216	310	995	\$5.53	74.1%
8/11/18	\$5,632	27,690	1,327	\$4.24	4.8%	220	236	306	229	991	\$5.68	74.7%
8/18/18	\$9,201	22,969	1,567	\$5.87	6.8%	256	283	202	155	896	\$10.27	57.2%
8/25/18	\$5,567	23,096	1,033	\$5.39	4.5%	251	340	306	264	1,161	\$4.80	112.4%
9/1/18	\$6,399	25,640	2,141	\$2.99	8.4%	272	196	342	159	969	\$6.60	45.3%
9/8/18	\$9,730	15,279	2,879	\$3.38	18.8%	231	315	275	256	1,077	\$9.03	37.4%
9/15/18	\$5,301	29,993	1,255	\$4.22	4.2%	168	350	309	333	1,160	\$4.57	92.4%
9/22/18	\$9,778	19,627	2,218	\$4.41	11.3%	301	183	325	325	1,134	\$8.62	51.1%

COMMON USE CASES:

- Designing tools or dashboards that don't have a "spreadsheet" feel
- Creating separation between values without adding extra rows or columns

PRO TIP

FREEZE PANES TO KEEP ROWS & COLUMNS IN VIEW

- **Freeze Panes** is commonly used to “freeze” or fix the first row or column in place while allowing the rest of the sheet to scroll:
 - **Freeze Top Row**: Freezes the first row in place (*usually the header row*)
 - **Freeze First Column**: Freezes the first column in place
 - **Freeze Panes**: Freezes all cells *above and to the left of* the selected cell
- **NOTE:** Use the **Freeze Panes** option when you want to fix both rows and columns



FORMATTING



2 STARS (BASIC)

A	B	C	D	
1	Title	Release Date	Release Year	Release Month
2	Over the Hill to the Poorhouse	9/15/1920	1920	9
3	Metropolis	1/26/1927	1927	1
4	The Broadway Melody	11/11/1929	1929	11
5	42nd Street	8/29/1933	1933	8
6	Top Hat	4/15/1935	1935	4
7	Modern Times	10/7/1936	1936	10
8	Snow White and the Seven Dwarfs	2/2/1937	1937	2
9	Gone with the Wind	11/12/1939	1939	11
10	The Wizard of Oz	4/9/1939	1939	4
11	Fantasia	5/18/1940	1940	5
12	Pinocchio	10/12/1940	1940	10
13	Duel in the Sun	6/7/1946	1946	6

(View > Freeze Panes)

Freeze Panes

Keep rows and columns visible while the rest of the worksheet scrolls (based on current selection).

Freeze Top Row

Keep the top row visible while scrolling through the rest of the worksheet.

Freeze First Column

Keep the first column visible while scrolling through the rest of the worksheet.

A	P	Q	R	S	
1	Title	Lead Actor FB Likes	Cast FB Likes	Director FB Likes	Movie FB Likes
32	A Fistful of Dollars	16000	16534	0	0
33	A Hard Day's Night	785	2538	44	0
34	Goldfinger	387	1198	82	0
35	Mary Poppins	382	2045	55	0
36	My Fair Lady	453	1164	165	0
37	Nothing But a Man	581	835	0	363
38	Doctor Zhivago	597	1966	767	7000
39	Major Dundee	773	2888	541	251
40	The Greatest Story Ever Told	940	1934	126	1000
41	The Sound of Music	354	1495	338	15000
42	Thunderball	244	1164	92	0
43	The Good, the Bad and the Ugly	16000	16089	0	20000
44	You Only Live Twice	742	2127	43	0
45	2001: A Space Odyssey	273	727	0	24000
46	Oliver!	695	1593	82	0
47	Butch Cassidy and the Sundance Kid	640	2169	131	0
48	Mississippi Mermaid	963	1694	0	278

COMMON USE CASES:

- Keeping the header row visible as you scroll through rows (**Note:** this happens by default if you format your range as a **table**)
- Freezing “key” columns when tables contain a large number of fields

PRO TIP

CENTER TEXT ACROSS A SELECTION OF CELLS

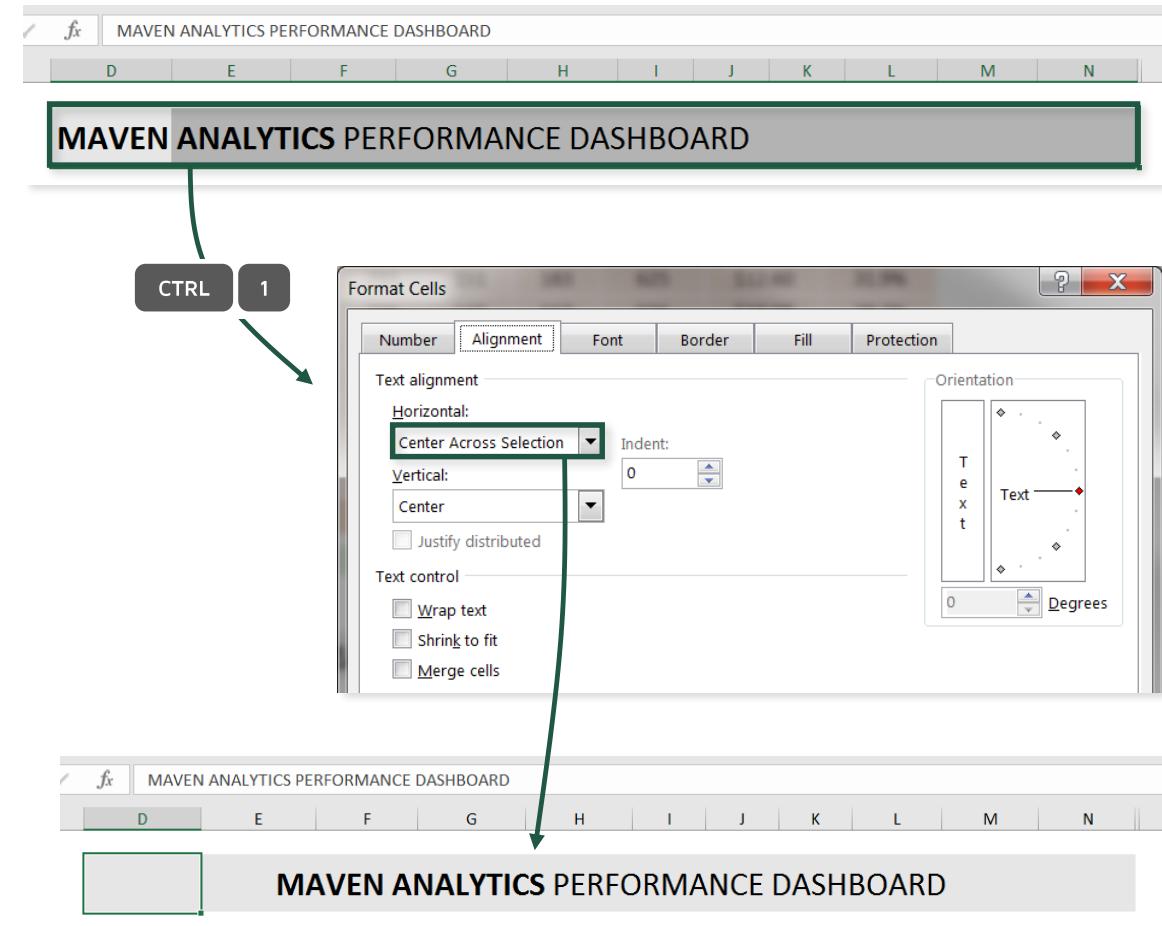
- Most users center text across cells by **merging** and then **aligning to center**; however, merged cells can cause issues if you need to modify other cells in the sheet
- Instead of merging, select a cell range, launch the **Format Cells** dialog box (**CTRL-1**), and choose **Center Across Selection** in the Alignment tab (*Horizontal options*)



FORMATTING



2 STARS (BASIC)



COMMON USE CASES:

- *Formatting text headers within reports or dashboards*
- *Customizing alignment in cases where merged cells cannot be used*

PRO TIP

USE CUSTOM FORMATTING TO MAKE TEXT INVISIBLE

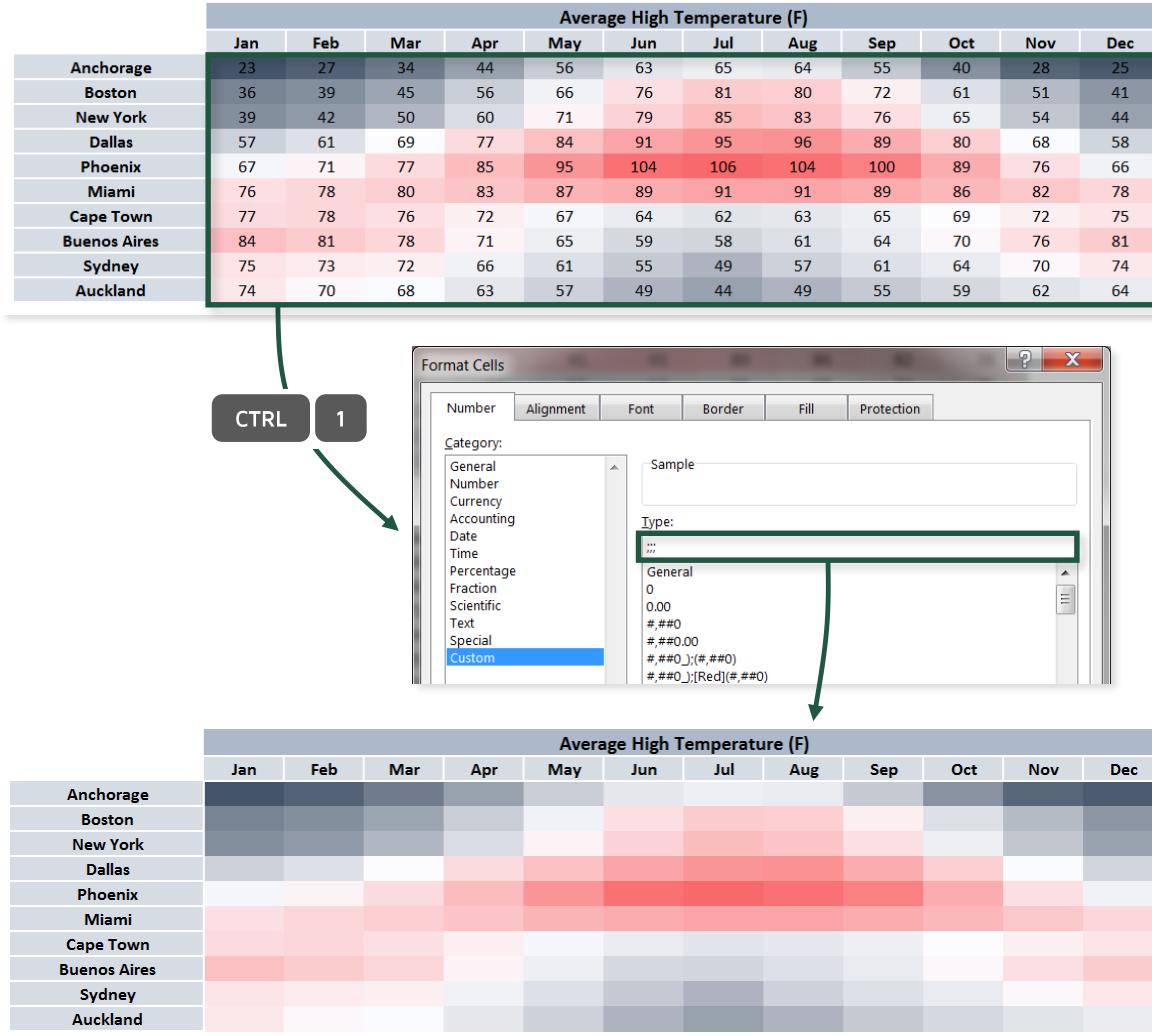
- Use a **custom number format** with type “;;;” (three consecutive semi-colons) to make text invisible
- **NOTE:** This does *not* delete the underlying values, it simply prevents them from displaying within cells



FORMATTING



2 STARS (BASIC)



COMMON USE CASES:

- Creating heatmaps to visualize data while obscuring underlying values
- Transforming a column of values into **data bars** or **icon sets** to visualize high-level patterns or trends

PRO TIP

PROPERLY FORMAT ZIP CODES & PHONE NUMBERS

- Zip codes and phone numbers can be difficult to work with, since Excel often converts them to numerical fields by default
- Most versions of Excel include a **Special** formatting category for dealing with these specific types of values (as well as SS#)
 - **NOTE:** You can also use text functions like **TEXT(A1,"0#####")** to format zip codes or **LEFT/MID/RIGHT** to format phone numbers



FORMATTING



2 STARS (BASIC)

D	E
Zip Code	Telephone
62031	6183763064
95936	5302893807
7040	9082641670
22448	5406447658
70815	2252744802
97205	5034022075
78749	5126337667
36083	3347257343
11101	3476260700
12207	5184317602
77803	9798141664
75247	2544883212
2905	4012
8232	6094
54620	6082
48607	9896

D	E
Zip Code	Telephone
62031	(618) 376-3064
95936	(530) 289-3807
07040	(908) 264-1670
22448	(540) 644-7658
70815	(225) 274-4802
97205	(503) 402-2075
78749	(512) 633-7667
36083	(334) 725-7343
11101	(347) 626-0700
12207	(518) 431-7602
77803	(979) 814-1664
75247	(254) 488-3212
	(401) 222-2097
	(609) 412-4268
	(608) 272-8021
	(989) 669-4705

COMMON USE CASES:

- Reformatting zip codes or phone numbers that have automatically been converted into numerical values (you'll never add two zip codes!)
- Adding leading zeros to force zip codes into a consistent 5-digit format

PRO TIP

GROUP COLUMNS OR ROWS TO SIMPLIFY REPORTS

- Use the **Group** option (*Data > Group*) to hide selected rows or columns from view
- Excel automatically generates toggles (+/-) to show or hide individual groups, as well as buttons to show or hide *all* rows or columns with one click (labeled "1" and "2")



FORMATTING



2 STARS (BASIC)

The screenshot shows a complex Excel dashboard titled 'MAVEN ANALYTICS PERFORMANCE DASHBOARD'. It contains several data tables: 'TRAFFIC', 'LEADS', 'TRANSACTIONS', 'SEGMENT BREAKDOWN', 'CHANNEL BREAKDOWN', and 'W-o-W'. Each table has multiple rows and columns of data. The 'Data' tab is selected in the ribbon. A green arrow points from the 'Data > Group' option in the ribbon to the 'Group...' button in the 'Outline' tab of the ribbon. Another green arrow points from the 'Group' button to the 'Group' icon in the 'Outline' tab.

COMMON USE CASES:

- Designing reports that contain a large amount of data, but only display the most important information by default
- Enabling users to quickly toggle views without manually unhiding rows and columns

PRO TIP

REFORMAT ERRORS WITH IFERROR FUNCTIONS

- Wrap formulas with an **IFERROR** statement to customize how errors will be displayed (*i.e. “-” instead of #DIV/0!*)
- NOTE:** Use this tip carefully, and only when you understand the source of the error; **IFERROR** should be used for cosmetics, not to “fix” broken formulas or mislead users



FORMATTING



3 STARS (MODERATE)

Select Player: Victor Martinez

	AB	H	Avg	R	HR	RBI	SB	CS	SB%	K/BB
2010	493	149	0.302	64	20	79	1	0	100%	1.3
2011	540	178	0.330	76	12	103	1	0	100%	1.1
2012	0	0	#DIV/0!	0	0	0	0	0	#DIV/0!	#DIV/0!
2013	605	182	0.301	68	14	83	0	2	0%	1.1
2014	561	188	0.335	87	32	103	3	2	60%	0.6
2015	440	108	0.245	39	11	64	0	0	#DIV/0!	1.7
Total:	2,639	805	0.305	334	89	432	5	4	56%	1.1

X ✓ fx =IFERROR(AB5/(AB5+AC5),"-")

Select Player: Victor Martinez

	AB	H	Avg	R	HR	RBI	SB	CS	SB%	K/BB
2010	493	149	0.302	64	20	79	1	0	100%	1.3
2011	540	178	0.330	76	12	103	1	0	100%	1.1
2012	0	0	-	0	0	0	0	0	-	-
2013	605	182	0.301	68	14	83	0	2	0%	1.1
2014	561	188	0.335	87	32	103	3	2	60%	0.6
2015	440	108	0.245	39	11	64	0	0	-	1.7
Total:	2,639	805	0.305	334	89	432	5	4	56%	1.1

COMMON USE CASES:

- Cleaning up a user-facing report or dashboard where occasional errors are expected (*i.e. dividing by zero*)
- Writing formulas that produce different outputs based on whether or not a conditional test yields an error

PRO TIP

CONVERT TEXT STRINGS INTO DATE VALUES

- **Dates** are one of the most challenging data types to work with, as formats tend to vary considerably (i.e. **MM/DD/YYYY** vs. **DD/MM/YYYY** vs. **MMDDYYYY**)
 - Excel understands a wide range of date formats specific to your regional settings; however, unusual or non-local formats may be recognized as **text**, not dates
- Use text functions (**LEFT/MID/RIGHT/&**) to rearrange date components from a string, and **DATEVALUE** to convert the result



FORMATTING



4 STARS (ADVANCED)

	A	B	C
1	Date	Type	Country
2	19000128	Unprovoked	Australia
3	19000701	Provoked	USA
4	19000714	Invalid	USA
5	19000731	Unprovoked	Croatia
6	19000821	Unprovoked	USA
7	19000905	Unprovoked	USA
8	19000913	Unprovoked	USA

=DATEVALUE(MID(A2,5,2)"/"&RIGHT(A2,2)"/"&LEFT(A2,4))

	A	B	C	D
1	Date	New Date	Type	Country
2	19000128	1/28/1900	Unprovoked	Australia
3	19000701	7/1/1900	Provoked	USA
4	19000714	7/14/1900	Invalid	USA
5	19000731	7/31/1900	Unprovoked	Croatia
6	19000821	8/21/1900	Unprovoked	USA
7	19000905	9/5/1900	Unprovoked	USA
8	19000913	9/13/1900	Unprovoked	USA

COMMON USE CASES:

- Reformattting fields that Excel doesn't recognize as common date types
- Converting dates from text to date values, in order to use them for date/time or time-series analysis

PRO TIP

DEFINE YOUR OWN FORMULA-DRIVEN FORMATS

- Use **formula rules** to format cells using custom or complex logic that standard conditional formatting tools can't handle
 - **For example:** formatting an entire row in a table or range based on the values in one column, or applying formats to cells that meet multiple, formula-based criteria
- **NOTE:** Intellisense is not available within the conditional formatting dialog box, so make sure you know your formula syntax!



FORMATTING



5 STARS (EXPERT)

The screenshot shows a Microsoft Excel spreadsheet titled "TO-DO LIST". The table has columns: A (TASK), B (CATEGORY), C (PRIORITY (1-3)), D (DUE DATE), and E (STATUS (0/1)). Rows 2 through 24 contain various tasks like "Pay condo fees", "Buy snow shovels and salt", etc., with their respective details. A green box highlights the first few rows of the table.

To the right of the table, the "Conditional Formatting" ribbon tab is selected. A context menu is open over the first row of the table, with "New Rule..." highlighted. A callout arrow points from this menu to the "New Rule..." button in the "Formatting Rule" dialog box.

The "Formatting Rule" dialog box is displayed. It shows the formula `=AND($D3<TODAY(),$E3=0)` in the "Format values where this formula is true:" input field. A preview window shows the first row of the table with a red background color. Buttons for "OK" and "Cancel" are at the bottom right.

A large green arrow points from the formula in the dialog box back to the formula in the "Format values where this formula is true:" field, indicating they are the same.

A	B	C	D	E	
			TO-DO LIST		
1					
2	TASK	CATEGORY	PRIORITY (1-3)	DUE DATE	STATUS (0/1)
3	Pay condo fees	Personal	1	8/21/2018	✓
4	Clean out fridge	Personal	2	8/22/2018	✓
5	Buy snow shovels and salt	Personal	3	8/24/2018	✓
6	Coordinate interviews	Work	1	8/28/2018	✓
7	Schedule eye exam	Personal	2	9/1/2018	✓
8	Design new website template	Work	3	9/4/2018	
9	Pick up card for Lisa's birthday	Personal	1	9/5/2018	✓
10	Update weekly reports	Work	1	9/10/2018	✓
11	Send invites to company outing	Work	1	9/11/2018	
12	Schedule car maintenance	Personal	3	9/16/2018	
13	Submit feedback for sales team	Work	1	9/26/2018	✓
14	Order new office supplies	Work	3	9/27/2018	✓
15	Process expense reports	Work	2	9/28/2018	
16	Contact IT for password change	Work	1	9/29/2018	✓
17	Restock fish food	Personal	1	10/7/2018	✓
18	E-mail meeting recaps to Dave	Work	2	10/11/2018	
19	Pay utility bills	Personal	1	10/12/2018	✓
20	Book travel for November	Personal	2	10/12/2018	✓
21	Finish Excel Maven training	Work	1	10/13/2018	
22	Repaint closet wall	Personal	3	10/17/2018	
23	Schedule meeting with Andy	Work	1	10/19/2018	
24	Edit presentation slides	Work	2	10/25/2018	✓

COMMON USE CASES:

- Applying custom or complex formats beyond the standard options
- Highlighting cells which meet a specific set of criteria (i.e. rows where **Due Date** has passed, **Category** = "Work" and **Priority** = 1)

PRO TIP

APPLY ADVANCED CUSTOM NUMBER FORMATS

- Use **Custom** formatting options to select more complex formats, or define your own using Excel's custom formatting syntax
- Custom formats contain up to 4 conditions, separated by semicolons (**A;B;C;D**)
 - **A:** Format for **positive** numbers
 - **B:** Format for **negative** numbers
 - **C:** Format for **zeros**
 - **D:** Format for **text**
- **LEARN MORE:** <http://bit.ly/2A1JFUD>



FORMATTING



5 STARS (EXPERT)

The screenshot illustrates the process of applying custom number formats in Excel. At the top, a table shows raw data with columns: Gross Revenue, Budget, and Profit. The Profit column contains both positive and negative values. A green arrow points from this table to the 'Number' tab of the 'Format Cells' dialog box. In this dialog, the 'Category' dropdown is set to 'Custom'. The 'Type' dropdown shows the formula: '\$#,##0.00;[Red](\$#,##0)'. Below this, the 'Sample' section shows the formatted 'Budget' column, where values like 1,000,000 and 2,000,000 are shown in black, while 300,000 is shown in red. Another green arrow points from the 'Type' dropdown to the 'Format Cells' dialog for the 'Profit' column. This second dialog also has 'Category: Custom' selected, with the 'Type' dropdown showing the same formula: '\$#,##0.00;[Red](\$#,##0)'. The 'Sample' section shows the formatted 'Profit' column, where positive values like 2,900,000 are in black and negative values like -597,356 are in red. A final green arrow points from the 'Format Cells' dialog to the bottom right, where the final formatted table is displayed. The table uses M\$ abbreviations for millions and includes conditional formatting for negative values.

Gross Revenue	Budget	Profit
3000000	1000000	2900000
26435	6000000	-5973565
2808000	379000	2429000
2300000	439000	1861000
3000000	609000	2391000
163245	1500000	-1336755
184925485	2000000	182925485
198655278	3977000	194678278
22202612	2800000	19402612

Gross Revenue	Budget	Profit
\$3.00 M	\$0.10 M	\$2,900,000
\$0.03 M	\$6.00 M	(-\$5,973,565)
\$2.81 M	\$0.38 M	\$2,429,000
\$2.30 M	\$0.44 M	\$1,861,000
\$3.00 M	\$0.61 M	\$2,391,000
\$0.16 M	\$1.50 M	(-\$1,336,755)
\$184.93 M	\$2.00 M	\$182,925,485
\$198.66 M	\$3.98 M	\$194,678,278
\$22.20 M	\$2.80 M	\$19,402,612

COMMON USE CASES:

- Applying *custom formats* to *positive vs. negative values* to draw attention to important patterns or trends
- Abbreviating large values with "**K**" or "**M**" labels (no formulas required)

FORMULA TIPS

PRO TIP

CHANGE FORMULA CALCULATION MODES

- Excel has two primary **calculation modes**: **Automatic** (default) and **Manual**
 - Automatic** allows formulas to calculate automatically with any workbook change
 - Manual** freezes all formula calculations until the **Calculate Now (F9)** option is selected
- NOTE:** If you see a worksheet formula producing duplicate values, check that you are not in **Manual** calculation mode

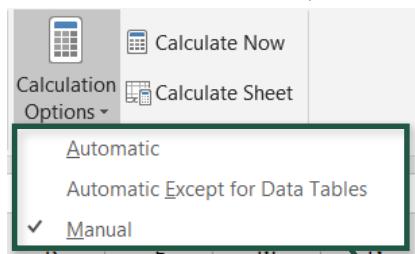


FORMULAS

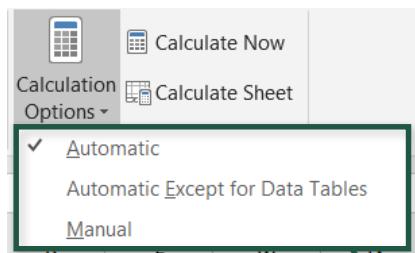


1 STAR (VERY BASIC)

(Formulas > Calculation Options)



B	C	D	E
Quantity	Retail Price	Unit Cost	Sales Profit
53,847	\$0.32	\$0.10	\$12,058.25
47,363	\$2.47	\$0.74	\$12,058.25
36,381	\$1.72	\$0.86	\$12,058.25
36,334	\$1.01	\$0.10	\$12,058.25
36,039	\$0.76	\$0.38	\$12,058.25
35,317	\$3.20	\$0.32	\$12,058.25
30,680	\$2.38	\$0.95	\$12,058.25
26,437	\$0.78	\$0.31	\$12,058.25
26,315	\$0.45	\$0.09	\$12,058.25
24,753	\$0.74	\$0.22	\$12,058.25
23,854	\$1.65	\$0.66	\$12,058.25



B	C	D	E
Quantity	Retail Price	Unit Cost	Sales Profit
53,847	\$0.32	\$0.10	\$12,058.25
47,363	\$2.47	\$0.74	\$81,899.38
36,381	\$1.72	\$0.86	\$31,324.62
36,334	\$1.01	\$0.10	\$33,059.74
36,039	\$0.76	\$0.38	\$13,622.48
35,317	\$3.20	\$0.32	\$101,848.07
30,680	\$2.38	\$0.95	\$43,726.09
26,437	\$0.78	\$0.31	\$12,397.33
26,315	\$0.45	\$0.09	\$9,390.94
24,753	\$0.74	\$0.22	\$12,843.13
23,854	\$1.65	\$0.66	\$23,634.29

COMMON USE CASES:

- Switching large, formula-heavy files to manual mode while editing to prevent automatic recalculation
- Allowing formulas to calculate automatically with the exception of data tables, which typically iterate a large number of times

PRO TIP

USE FORMULA LINE BREAKS TO IMPROVE READABILITY

- While typing or editing in the formula bar, press **ALT-ENTER** to create a line break
- **Line breaks** are a great way to improve readability and provide transparency into formula logic, particularly for complex nested or conditional (IF) functions



FORMULAS



1 STAR (VERY BASIC)

The screenshot illustrates the use of the **ALT-ENTER** key combination to insert line breaks in a formula. At the top, a formula bar contains the formula: `=IF(G2>35000,"Very Large", IF(G2>30000,"Large",IF(G2>25000,"Medium",IF(G2>20000,"Small","Other"))))`. A green arrow points from this formula bar down to a second formula bar below it, which shows the formula broken into multiple lines: `=IF(G2>35000,"Very Large",
IF(G2>30000,"Large",
IF(G2>25000,"Medium",
IF(G2>20000,"Small",
"Other"))))`. This visual demonstrates how line breaks can make complex nested formulas more readable. Below the formula bars are two tables. The top table shows data with a formula in column H: `=IF(G2>35000,"Very Large", IF(G2>30000,"Large",IF(G2>25000,"Medium",IF(G2>20000,"Small","Other"))))`. The bottom table shows the same data with the formula simplified across multiple lines.

B	C	D	E	F	G	H
ion_id	store_type	store_city	store_state	store_country	total_sqft	store_size
28	Supermarket	Acapulco	Guerrero	Mexico	23,593	Small
78	Small Grocery	Bellingham	WA	USA	28,206	Medium
76	Supermarket	Bremerton	WA	USA	39,696	Very Large

B	C	D	E	F	G	H
ion_id	store_type	store_city	store_state	store_country	total_sqft	store_size
28	Supermarket	Acapulco	Guerrero	Mexico	23,593	"Other"))))
78	Small Grocery	Bellingham	WA	USA	28,206	Medium
76	Supermarket	Bremerton	WA	USA	39,696	Very Large

COMMON USE CASES:

- *Breaking conditional functions into multiple lines to isolate each criteria*
- *Making complex nested formulas easier to interpret by introducing each component function on a new line*

PRO TIP

CHANGE MEASUREMENT UNITS WITH CONVERT

- Use the **CONVERT** function to change values from one unit of measurement to another (*lbs to kg, celcius to fahrenheit, minutes to seconds, etc.*)
- **NOTE:** Some unit types may not be listed in the formula dialog box, but can be accessed by typing them directly (i.e. “cm” for centimeters or “kg” for kilograms)



FORMULAS



1 STAR (VERY BASIC)

B	C	D	E
Average Monthly Temperature			
Month	Temp_f	Temp_c	
1/1/2010	41.7	=CONVERT(C3,"F","	
2/1/2010	43.1	CONVERT(number,from unit,to unit)	
3/1/2010	47.6		
4/1/2010	56.3		
5/1/2010	59.8		
6/1/2010	69.4		
7/1/2010	80.7		



B	C	D
Average Monthly Temperature		
Month	Temp_f	Temp_c
1/1/2010	41.7	5.3870968
2/1/2010	43.1	6.1428571
3/1/2010	47.6	8.6774194
4/1/2010	56.3	13.5
5/1/2010	59.8	15.419355
6/1/2010	69.4	20.8
7/1/2010	80.7	27.032258

COMMON USE CASES:

- Quickly converting measurements without needing conversion rates or calculators
- Converting date or time values without the use of formula constants

PRO TIP

ADD REAL-TIME FORMULAS WITH TODAY & NOW

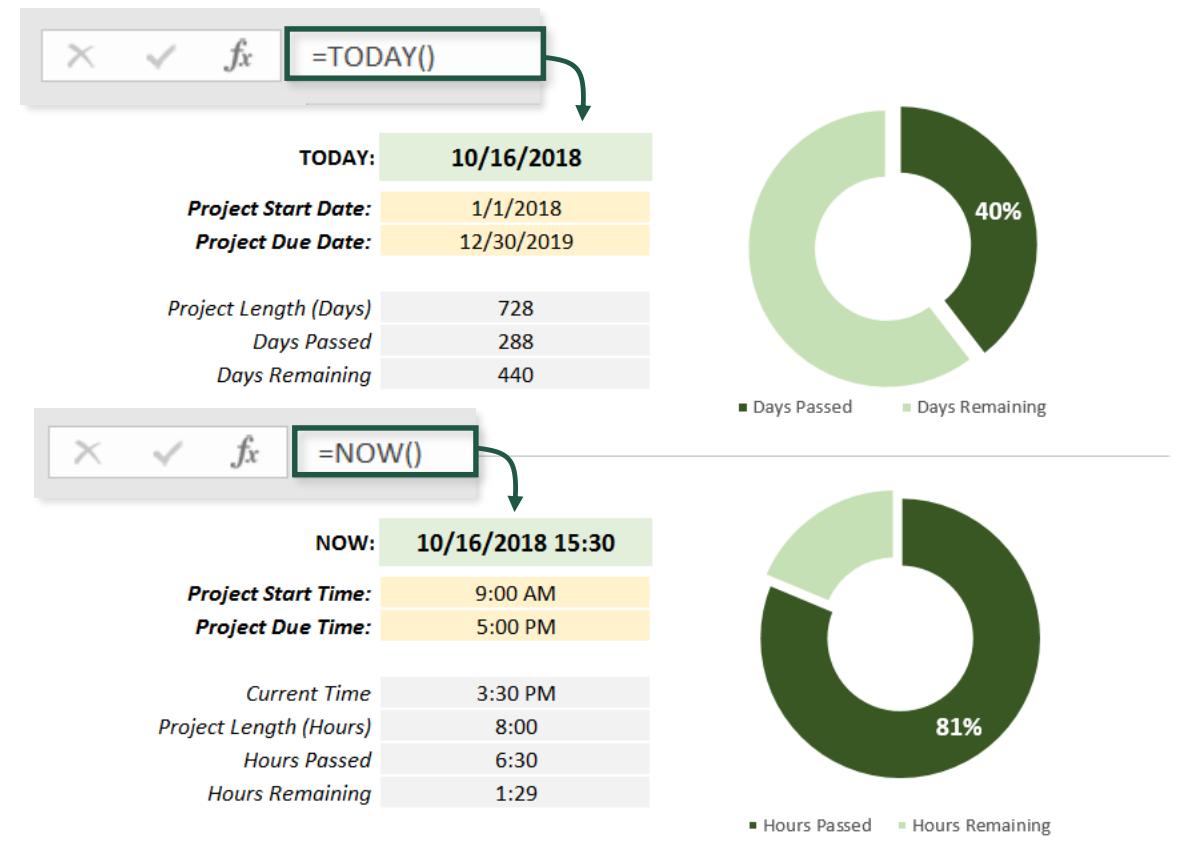
- Use **TODAY()** and **NOW()** functions to return the current date or time
- **NOTE:** These are **volatile** functions, meaning that they automatically recalculate with *any* workbook change
 - Use the **CTRL-;** shortcut to return the current day as a hard-coded value, or **CTRL-SHIFT-;** to return the current time



FORMULAS



2 STARS (BASIC)



COMMON USE CASES:

- Displaying the current date or time in a worksheet cell
- Creating scheduling or timeline tools that update with any workbook change

PRO TIP

FIND & FIX ERRORS USING FORMULA AUDITING TOOLS

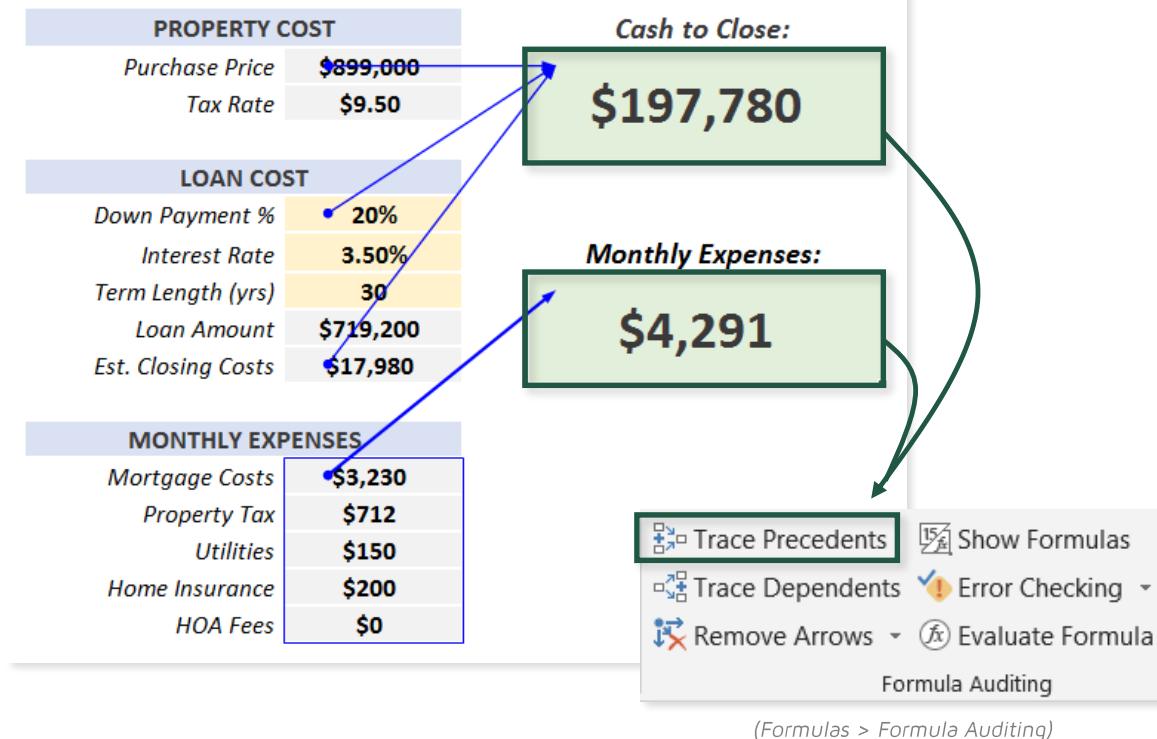
- Use **Formula Auditing** to trace references, evaluate calculations, and diagnose errors:
 - **Trace Precedents:** Draws arrows to any cells that *impact* the selected value
 - **Trace Dependents:** Draws arrows to any cells *impacted by* the selected value
 - **Show Formulas:** Temporarily displays all formulas within the worksheet
 - **Error Checking:** Scans the sheet for errors and traces the source to precedent cells
 - **Evaluate Formula:** Evaluates each component of a formula step-by-step



FORMULAS



3 STARS (MODERATE)



COMMON USE CASES:

- Understanding how complex formulas and functions operate
- Visualizing which cells factor into a certain formula output
- Tracing and diagnosing the source of an error

PRO TIP

USE STATS FUNCTIONS FOR PIVOT-STYLE REPORTS

- **Conditional stats functions (SUMIFS, COUNTIFS, AVERAGEIFS)** can be used to generate filtered values just like PivotTables
- While pivots are ideal for unstructured analysis, **stats functions** are a great tool for building custom reports and dashboards



FORMULAS



3 STARS (MODERATE)

The diagram illustrates the process of generating a pivot-style report using three Excel functions: COUNTIFS, SUMIFS, and AVERAGEIFS. It starts with a large table of raw data (A1:L30) containing columns for Title, Genre, Country, IMDb Score, Revenue, and Action. A PivotTable is then created (H1:L1) with 'Genre' as the Row Labels, 'Action' as the Column Labels, and three summary statistics: 'Count of Title', 'Sum of Revenue', and 'Average IMDb Score'. Below this, a second PivotTable (K1:L1) is shown with 'Country' as the Row Labels, 'Title Count' as the Column Labels, and 'Revenue' and 'Avg. IMDb Score' as the data fields. Arrows point from the labels 'COUNTIFS', 'SUMIFS', and 'AVERAGEIFS' to the respective columns in the raw data table, indicating that these functions are used to calculate the values displayed in the PivotTables.

A	B	D	E	F	H	I	J	K	L
1	Title	Genre	Country	IMDb Score	Revenue	Genre	Action		
2	Over the Hill tc Crime	USA	4.8	3000000					
3	Metropolis	Drama	Germany	8.3	26435				
4	The Broadway Musical	USA	6.3	2808000					
5	42nd Street	Comedy	USA	7.7	2300000				
6	Top Hat	Comedy	USA	7.8	3000000				
7	Modern Times	Comedy	USA	8.6	163245				
8	Snow White ar Animation	USA	7.7	184925485					
9	Gone with the Drama	USA	8.2	198655278					
10	The Wizard of Adventure	USA	8.1	22202612					
11	Fantasia	Animation	USA	7.8	76400000				
12	Pinocchio	Animation	USA	7.5	84300000				
13	Duel in the Sur	Drama	USA	6.9	20400000				
14	The Best Years	Drama	USA	8.1	23650000				
15	The Lady from Crime	USA	7.7	7927					
16	The Pirate	Adventure	USA	7.1	2956000				
17	Annie Get You	Biography	USA	7	8000000				
18	The Greatest S	Drama	USA	6.7	36000000				
19	The Beast frn Adventure	USA	6.7	5000000					
20	The Robe	Drama	USA	6.8	36000000				
21	On the Waterf Crime	USA	8.2	9600000					
22	Seven Samurai	Action	Japan	8.7	269061				
23	The Bridge on	Adventure	UK	8.2	27200000				
24	Some Like It H	Comedy	USA	8.3	25000000				
25	Psycho	Horror	USA	8.5	32000000				
26	West Side Stor	Crime	USA	7.6	43650000				
27	Dr. No	Action	UK	7.3	16067035				
28	Lawrence of A	Adventure	UK	8.4	6000000				
29	Cleopatra	Biography	UK	7	57750000				
30	From Russia w	Action	UK	7.5	24800000				

COMMON USE CASES:

- Designing custom-formatted, dynamic reports without using PivotTables
- Filtering or segmenting raw data based on a given set of criteria

PRO TIP

COUNT WORDS IN A CELL USING TEXT FORMULAS

- **LEN** and **SUBSTITUTE** can be used to count the number of spaces (and therefore determine the number of words) in a string
 - *In this example, we're counting spaces by replacing them with blanks, and comparing the original string length to the new one*
- **NOTE:** Add a **TRIM** function to avoid counting extra (leading or trailing) spaces



FORMULAS



3 STARS (MODERATE)

F	Description	G	Word Count
Berry and cherry aromas are surprisingly sturdy and clean. Freshness is maintained on the palate, which is honest enough to offer modest tannic bite. Lightly spiced plum and raspberry flavors change little on an easy finish.			36
Fruity, soft and rather sweet, this wine smells and tastes like apple and pear juice. It has low acidity, medium body and a sugary finish.			25
Crimson in color but also translucent, with a candied, slightly green nose. Overall this is a simple quaffer with no excess weight and reasonably good flavors of berry and plum. Bland on the finish, but for \$4 who's caring about finish?			41
Sweet and fruity, this canned wine feels soft and syrupy, with sugary pear as the primary flavor on the palate. It's a basic white wine in a convenient package.			29
This opens with standard cherry and berry aromas before transitioning to a juicy palate with red berry, plum, herb and grass notes. It finishes a little hot and aggressive, but for \$4 who's complaining?			34
Nice on the nose, this has a leafy note and a mellow red-berry aroma. Bouncy and rubbery feeling, it has easygoing flavors of raspberry and plum. It's candied and rubbery tasting on the finish, but good overall.			37

=LEN(TRIM(F2))-LEN(TRIM(SUBSTITUTE(F2, " ", "")))+1

COMMON USE CASES:

- Adding counters in cases where word counts are important
- Analyzing text fields (Tweets, Blogs, Ad Copy, etc.) based on length

PRO TIP

CREATE DEPENDENT DROP-DOWNS WITH INDIRECT

- Use **INDIRECT** and **Data Validation** to create drop-down lists that update based on user selections:
 - **STEP 1:** Create individual lists containing all sets of possible selections
 - **STEP 2:** Turn each list into a named range using the Name Manager or Name Box (be *consistent with your names!*)
 - **STEP 3:** Create a second drop-down, and configure the list source to reference the first drop-down cell, wrapped in **INDIRECT**



FORMULAS



4 STARS (ADVANCED)

(Summer Named Range)

Summer		
L	M	N
1	Season	Summer Sports
2	Summer	Archery
3	Winter	Athletics
4		Badminton
5		Baseball
6		Basketball
7		Beach Volleyball
8		Boxing
9		Canoeing
10		Cycling
11		Diving
12		Equestrianism
		Winter Sports
		Alpine Skiing
		Biathlon
		Bobsleigh
		Cross Country Skiing
		Curling
		Figure Skating
		Freestyle Skiing
		Ice Hockey
		Luge
		Nordic Combined
		Short Track Speed Skating

(Winter Named Range)

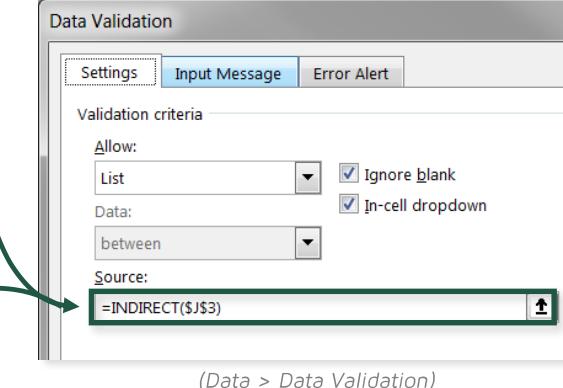
Winter		
L	M	N
1	Season	Summer Sports
2	Summer	Archery
3	Winter	Athletics
4		Badminton
5		Baseball
6		Basketball
7		Beach Volleyball
8		Boxing
9		Canoeing
10		Cycling
11		Diving
12		Equestrianism
		Winter Sports
		Alpine Skiing
		Biathlon
		Bobsleigh
		Cross Country Skiing
		Curling
		Figure Skating
		Freestyle Skiing
		Ice Hockey
		Luge
		Nordic Combined
		Short Track Speed Skating

Select Season: Summer

Select Sport: Archery

Select Season: Winter

Select Sport: Alpine Skiing



COMMON USE CASES:

- Creating dynamic reports with multiple user inputs
- Configuring drop-down lists to prevent users from selecting invalid combinations of options

PRO TIP

CREATE DYNAMIC LINKS USING HYPERLINK

- Use **HYPERNLINK** to connect users straight to specific workbook locations
- Syntax is *extremely* specific; for example, the following would link to Sheet1, cell A1:
`=HYPERLINK("#'Sheet1'!A1","LinkName")`
- **NOTE:** You can replace a hard-coded sheet name with a cell reference, but you need to concatenate it with the hash, exclamation point, and quotation marks as shown



FORMULAS



4 STARS (ADVANCED)

The screenshot shows a Microsoft Excel spreadsheet with two main sections: "PRODUCTIVITY TIPS" and "FORMATTING TIPS". Both sections have columns for "Topic", "Level of Difficulty", and "Link". The "Link" column contains hyperlinks, which are highlighted with a green box and an arrow pointing to them from the formula bar at the top. The formula bar shows the formula: =HYPERLINK("#'"&B5&"'!A1","Link"). Below these sections is a smaller table with columns for "Product", "Size", and "Price". A green arrow points from the "Link" column in the Productivity section down to the "Price" cell in this smaller table, indicating how a hyperlink can be used to dynamically update a value based on user input.

COMMON USE CASES:

- Adding tools to help users navigate large or complex workbooks
- Creating reports with links to additional details or data sources

PRO TIP

FIND VALUE RANGES USING “FUZZY MATCH” VLOOKUPS

- **Approximate** (aka “Fuzzy”) **Match** can be used to determine where a specific lookup value falls within a given set of ranges
 - Instead of finding an *exact* match, this finds the closest match that is **equal to or less than** the lookup value
 - In the *[range_lookup]* argument of a VLOOKUP, use **TRUE** (or 1) for fuzzy match
- **NOTE:** Groups must be defined by the **minimum value**, and in **ascending order**



FORMULAS



4 STARS (ADVANCED)

Product	Quantity	Retail Price	Discount
WORLD WAR 2 GLIDERS ASSTD DESIGNS	5	\$0.32	0%
JUMBO BAG RED RETROSPOT	25	\$2.47	15%
ASSORTED COLOUR BIRD ORNAMENT	75	\$1.72	20%
POPCORN HOLDER	6	\$1.01	5%
PACK OF 72 RETROSPOT CAKE CASES	10	\$0.76	5%
WHITE HANGING HEART T-LIGHT HOLDER	5	\$3.20	0%
RABBIT NIGHT LIGHT	100	\$2.38	20%
MINI PAINT SET VINTAGE	15	\$0.78	10%

=VLOOKUP(C2,\$H\$2:\$I\$6,2,TRUE)

TRUE - Approximate match
FALSE - Exact match

G	H	I
Order Volume	Order Minimum	Discount
0 - 5	0	0%
6 - 10	6	5%
11 - 20	11	10%
21 - 50	21	15%
51+	51	20%

COMMON USE CASES:

- Defining variable commission rates based on agent sales volume
- Calculating tiered discounts based on purchase quantity

PRO TIP

RANDOMIZE ITEMS WITH OFFSET & RANDBETWEEN

- Combine **OFFSET** with **RANDBETWEEN** to jump to random rows within a cell range
 - Since **RANDBETWEEN** is a **volatile** function, the result will automatically recalculate with *any* workbook change
- TIP:** Rather than hard-coding the max random value, use a **COUNTA** function to automatically count the length of the list



FORMULAS



4 STARS (ADVANCED)

	A	B
1	LIST A	LIST B
2	AQUATIC	AARDVAARKS
3	BALD	AIRBAGS
4	BELLIGERENT	ANGELS
5	CHUBBY	BANANAS
6	CLEAN	BEASTS
7	DAZZLING	BUBBLES
8	ELASTIC	CRICKETS
9	ELECTRIC	CROWS
10	ELEGANT	DAUGHTERS
11	FANCY	FISH
12	FLABBY	GHOSTS
13	FRIGID	GOGGLES
14	GLAMOROUS	KITTENS
15	GLISTENING	KNIVES
16	HANDSOME	MILKMEN
17	MAGNIFICENT	MONKEYS
18	MUSCULAR	MUSHROOMS
19	MYSTERIOUS	NECKTIES
20	PLUMP	PENGUINS
21	SALTY	
22	SCREECHING	
23	SCRUFFY	
24	SHAPELY	
25	SHORT	
26	SKINNY	
27	SLIPPERY	
28	UGLY	
29	UNDERCOVER	TODDLERS
30	WHIMSICLE	WEASELS
31	WHITE HOT	WHIPS



=OFFSET(A\$1,RANDBETWEEN(1,30),0)

=OFFSET(B\$1,RANDBETWEEN(1,30),0)

COMMON USE CASES:

- Creating models or scenarios with randomized inputs
- Building your own hilarious band name generator (because why not!)

PRO TIP

COMBINE INDEX & MATCH FOR A FLEXIBLE LOOKUP

- **INDEX & MATCH** offer several benefits over traditional VLOOKUP functions:
 - No hard-coded column index; MATCH can identify headers and automatically pull values from the correct columns
 - Lookup values **don't need to live in the first column** of the table array
 - **More flexibility** for custom or complex cases (like finding the 2nd or 3rd matches)



FORMULAS



4 STARS (ADVANCED)

The screenshot shows a Microsoft Excel interface with three tables. The top-left table (A1:C11) contains data for stores 1-10 with columns for Year, Store ID, and Revenue. The top-right table (D1:F11) contains city, state, and country information. The bottom table (H1:M10) contains store details like address and labels. Arrows point from the formula bar and specific cells in the first table to the corresponding columns in the other tables, illustrating how INDEX and MATCH are used to look up values from different tables based on matching criteria.

D4

=INDEX(\$H\$2:\$M\$11,MATCH(\$B4,\$I\$2:\$I\$11,0),MATCH(D\$1,\$H\$1:\$M\$1,0))

A	B	C	D	E	F	
1	Year	Store ID	Revenue	City	State	Country
2	2016	1	\$631,303	Acapulco	Guerrero	Mexico
3	2016	2	\$542,738	Bellingham	WA	USA
4	2016	3	\$653,469	Bremerton	WA	USA
5	2016	4	\$178,607	Camacho	Zacatecas	Mexico
6	2016	5	\$463,379	Spokane	WA	USA
7	2016	6	\$717,386	Beverly Hills	CA	USA
8	2016	7	\$517,508	Los Angeles	CA	USA
9	2016	8	\$122,819	Merida	Yucatan	Mexico
10	2016	9	\$379,994	Mexico City	DF	Mexico
11	2016	10	\$714,400	Orizaba	Veracruz	Mexico

=MATCH(\$B4,\$I\$2:\$I\$11,0)

=MATCH(D\$1,\$H\$1:\$M\$1,0)

H	I	J	K	L	M
Store Label	Store ID	Address	City	State	Country
Store 1	1	2853 Bailey Rd	Acapulco	Guerrero	Mexico
Store 2	2	5203 Catanzaro Way	Bellingham	WA	USA
Store 3	3	1501 Ramsey Circle	Bremerton	WA	USA
Store 4	4	433 St George Dr	Camacho	Zacatecas	Mexico
Store 5	5	5922 La Salle Ct	Spokane	WA	USA
Store 6	6	5495 Mitchell Canyon Road	Beverly Hills	CA	USA
Store 7	7	1077 Wharf Drive	Los Angeles	CA	USA
Store 8	8	3173 Buena Vista Ave	Merida	Yucatan	Mexico
Store 9	9	1872 El Pintado Road	Mexico City	DF	Mexico
Store 10	10	7894 Rotherham Dr	Orizaba	Veracruz	Mexico

COMMON USE CASES:

- Populating many lookup columns without having to manually update formulas
- Working with more complex scenarios (like lookups with multiple matches)

PRO TIP

COUNT MATCHING ITEMS BETWEEN TWO LISTS

- Combine **SUMPRODUCT** with **COUNTIF** to return the number of matching values across multiple lists
- SUMPRODUCT** acts like an array formula, iterating through each row of one list to search for matches in the other
 - COUNTIF** assigns each row as a **1** (if a match exists) or a **0**, and **SUMPRODUCT** sums the resulting array of values
- NOTE:** Either list can be used as the basis

fx

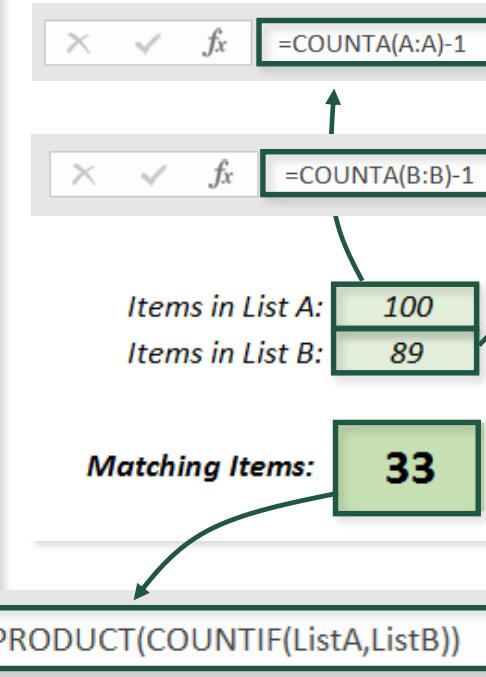
FORMULAS



5 STARS (EXPERT)

	A	B
1	Product List A	Product List B
2	Racing Socks, L	Touring-1000 Blue, 50
3	HL Touring Frame - Blue, 46	Mountain-100 Black, 48
4	Taillights - Battery-Powered	Touring Tire Tube
5	Mountain-100 Black, 48	ML Road Pedal
6	Rear Derailleur	Mountain-500 Silver, 42
7	Touring-1000 Blue, 46	HL Mountain Frame - Silver, 48
8	HL Fork	ML Road Frame-W - Yellow, 48
9	Long-Sleeve Logo Jersey, L	HL Touring Frame - Yellow, 46
10	Road-550-W Yellow, 42	Road-650 Red, 60
11	Road-550-W Yellow, 44	Mountain-200 Silver, 46
12	Sport-100 Helmet, Red	Short-Sleeve Classic Jersey, S
13	HL Road Tire	LL Road Frame - Red, 62
14	Road-250 Black, 48	Mountain-500 Black, 40
15	Touring-1000 Blue, 50	Road-250 Black, 58
16	Mountain-100 Silver, 42	Road-750 Black, 58
17	Touring-2000 Blue, 50	Road-450 Red, 44
18	LL Road Frame - Red, 44	Mountain-500 Silver, 40
19	LL Touring Frame - Yellow, 50	Mountain-500 Black, 44
20	HL Touring Frame - Blue, 50	Mountain Tire Tube
21	LL Mountain Seat/Saddle	ML Mountain Frame-W - Silver, 42
22	ML Road Frame-W - Yellow, 48	Road-650 Black, 44
23	HL Road Frame - Red, 48	Mountain-500 Silver, 44
24	Touring-2000 Blue, 54	ML Mountain Tire
25	Road-250 Black, 44	MI Mountain Rear Wheel
26	Road-650 Black, 44	
27	ML Road Frame - Re	
28	Men's Bib-Shorts,	
29	HL Road Frame - Red, 52	Road-550-W Yellow, 40
30	Headlights - Dual-Beam	ML Touring Seat/Saddle
31	Road-250 Red, 44	Road-650 Red, 48

(ListA = A2:A101, ListB = B2:B90)



COMMON USE CASES:

- Calculating the overlap between two lists
- Confirming that lists are unique to avoid double-counting errors

PRO TIP

COUNT DUPLICATE OR UNIQUE ROWS IN A LIST

- Counting duplicates and uniques with cell formulas alone can be deceptively tricky
 - **NOTE:** Tools like Pivots or Power Query (which *includes* a “Count Distinct” option) often offer simpler alternatives
- One option is to use **SUMPRODUCT** and **COUNTIF** to count *unique* values, and then subtract from the total count to identify the number of *duplicate* values



FORMULAS



5 STARS (EXPERT)

A	B	C	D	E
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				

Grocery List

Green Ribbon Canned Peaches
Washington Cranberry Juice
Jeffers Oatmeal
Blue Label Canned Tuna in Water
Queen City Map
Washington Orange Juice
Washington Mango Drink
Blue Label Canned Yams
Blue Label Fancy Canned Anchovies
Blue Label Large Canned Shrimp
Blue Label Noodle Soup
Washington Mango Drink
Blue Label Chicken Soup
Club Sour Cream
Washington Cola
Green Ribbon Canned Mixed Fruit
Blue Label Beef Soup

Total Items: 49

Unique Items: 47

Duplicates: 2

=COUNTA(Groceries)

=E3-E5

=SUMPRODUCT(1/COUNTIF(Groceries,Groceries))

(Groceries = B4:B52)

COMMON USE CASES:

- Calculating the number of unique or distinct products ordered
- Error-checking to avoid inflation caused by duplicate records

PRO TIP

USE COUNTIF TO HANDLE MANY-TO-MANY LOOKUPS

- Excel lookup formulas are designed to work with **1-to-1** or **1-to-Many** relationships (*only one instance of each primary key*)
- If you have a **Many-to-Many relationship** (multiple matches), you can use **COUNTIF**, **INDEX** and **MATCH** formulas to return values from subsequent matches
- NOTE:** Make sure to understand why there are multiple instances of your key, and confirm that they are valid records



FORMULAS



5 STARS (EXPERT)

The diagram illustrates the use of COUNTIF, INDEX, and MATCH formulas to handle many-to-many lookups. The main table (A1:D8) contains OrderID, Store ID, # Instances, and Revenue. The secondary table (G2:I13) contains Store ID and Address. A COUNTIF formula (=COUNTIF(\$G\$2:\$G\$13,B4)) is used to find the count of instances for a given store ID. An INDEX formula (=INDEX(G2:G13,MATCH(B6,\$G\$2:\$G\$13,0)+1)) is used to find the address corresponding to the store ID.

	A	B	C	D	E
1	OrderID	Store ID	# Instances	Revenue	Address
2	87696	2	1	\$631,303	5203 Catanzaro Way
3	69581	6	1	\$542,738	5495 Mitchell Canyon Road
4	66216	8	2	\$653,469	6764 Glen Road
5	70863	1	1	\$178,607	2853 Bailey Rd
6	22797	5	2	\$463,379	490 Risdon Road
7	49585	5	2	\$717,386	490 Risdon Road
8	23289	10	1	\$517,508	7894 Rotherham Dr

G	H
Store ID	Address
1	2853 Bailey Rd
2	5203 Catanzaro Way
3	1501 Ramsey Circle
4	433 St George Dr
5	5922 La Salle Ct
5	490 Risdon Road
6	5495 Mitchell Canyon Road
7	1077 Wharf Drive
8	3173 Buena Vista Ave
8	6764 Glen Road
9	1872 El Pintado Road
10	7894 Rotherham Dr

(Stores = G2:I13)

COMMON USE CASES:

- Tracking historical changes within an existing lookup table (i.e. product prices or store addresses that may have changed at one point in time)

VISUALIZATION TIPS

PRO TIP

PREVENT CHARTS FROM MOVING OR SIZING

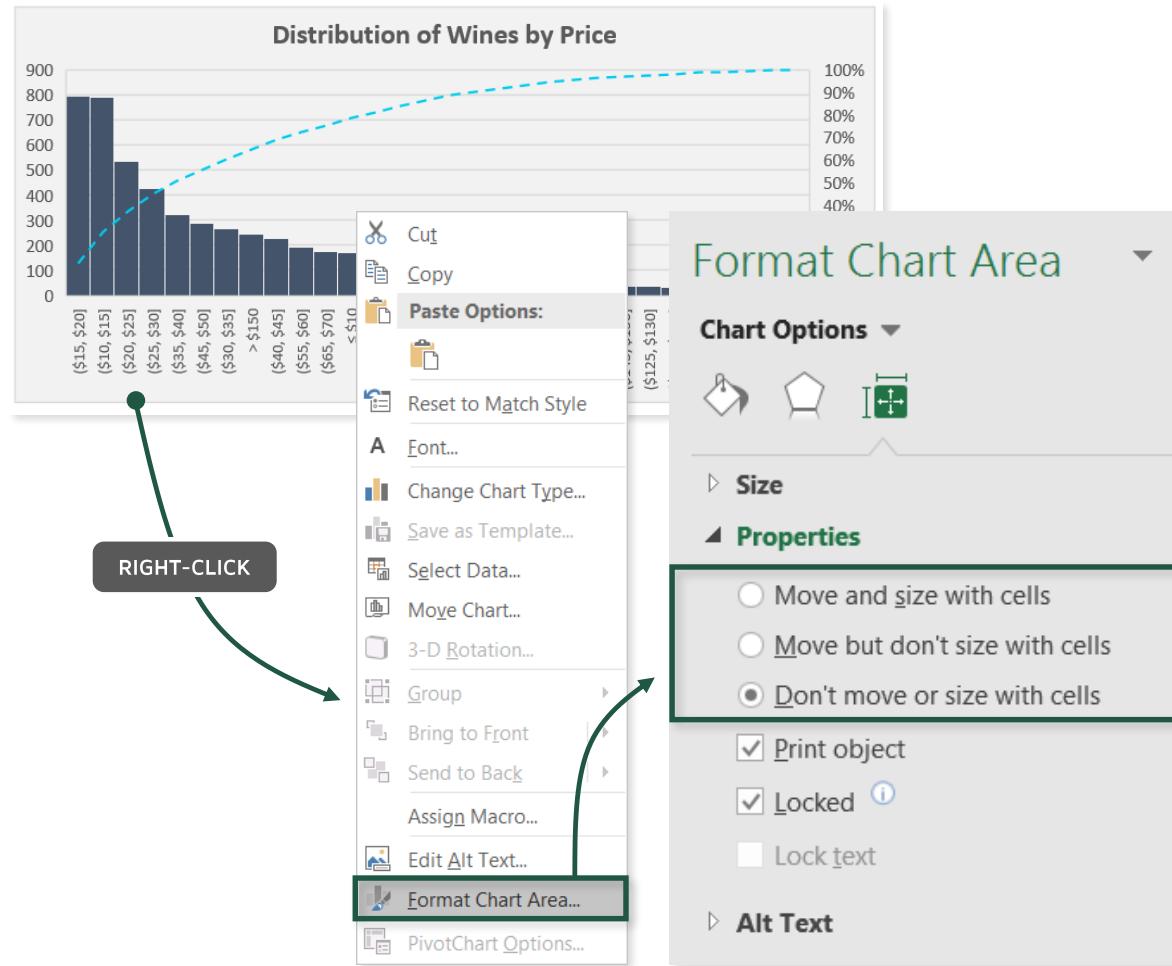
- By default, charts **move** and **size** with cells, stretching and shifting as underlying rows or columns are resized
- Change chart behavior using the **Format Chart Area** options, under **Properties**:
 - **Move and Size**: Allows charts to move and stretch with columns or rows
 - **Move but don't Size**: Allows charts to move but not stretch or distort
 - **Don't move or Size**: Fixes chart position in place, regardless of how cells change



DATA VIZ



1 STAR (VERY BASIC)



COMMON USE CASES:

- Locking in chart positions within reports or dashboards to prevent them from distorting if underlying rows or columns are modified
- Allowing charts to move (but not stretch) if rows are filtered or sorted

PRO TIP

ALLOW CHARTS TO REFERENCE HIDDEN DATA

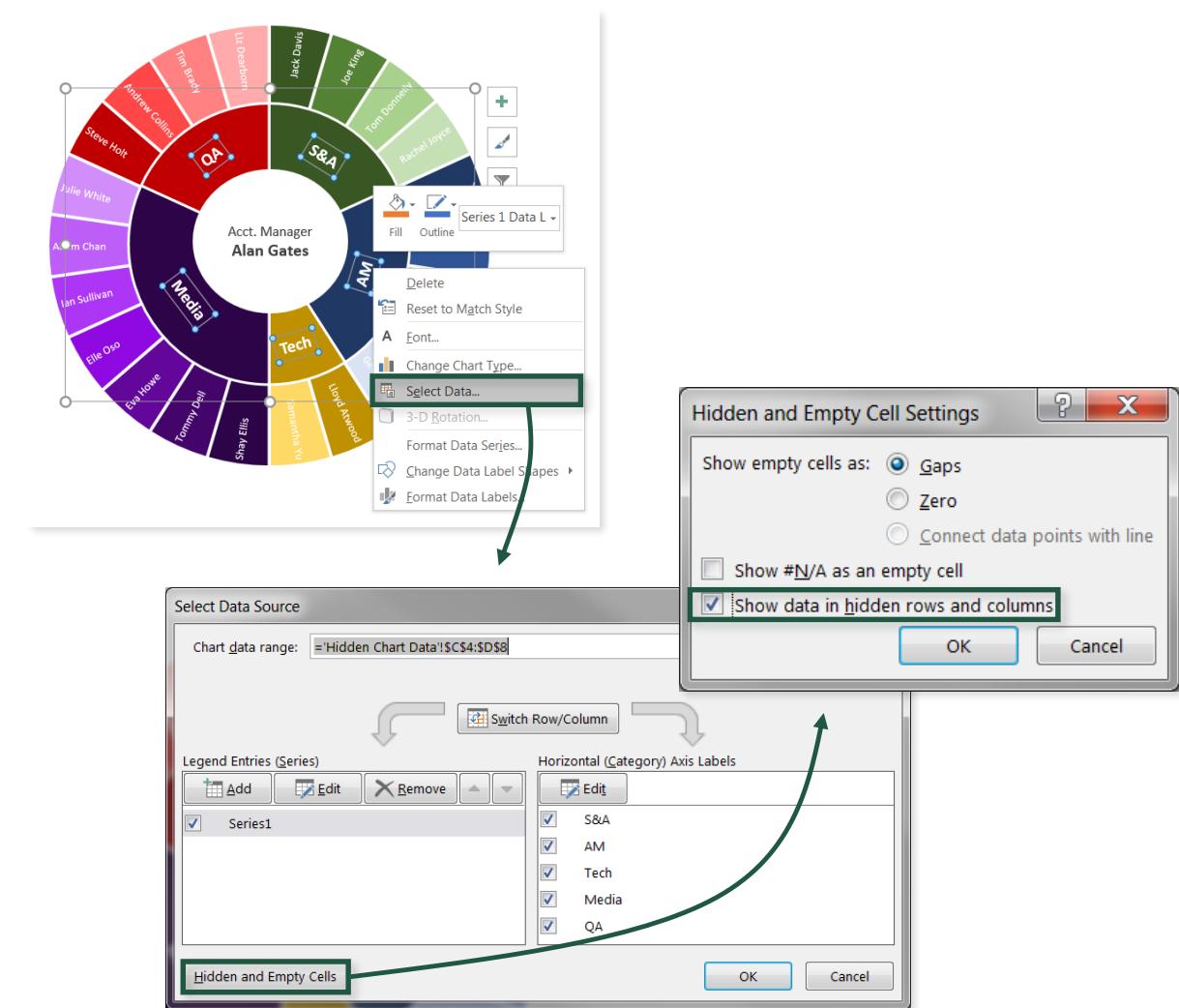
- By default, Excel charts will not display source data in **hidden rows or columns**
- To allow charts to display hidden data, right-click, **Select Data**, click **Hidden and Empty Cells**, and activate the “*Show data in hidden rows and columns*” checkbox



DATA VIZ



1 STAR (VERY BASIC)



COMMON USE CASES:

- Designing reports with the source data and visuals on the same tab
- Preventing users from accessing or modifying a chart's raw source data

PRO TIP

USE FILLED MAPS FOR GEOSPATIAL ANALYSIS

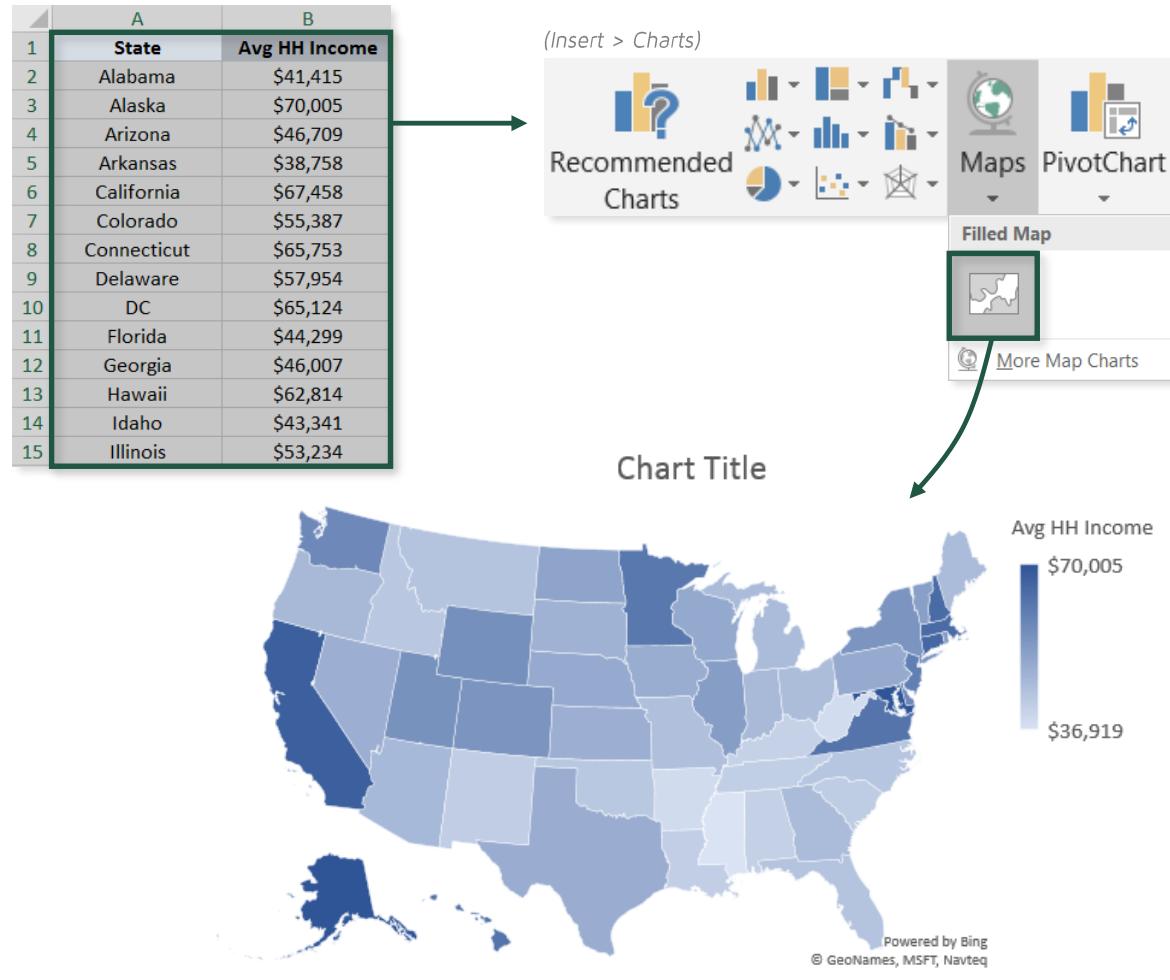
- Recent versions of Excel (2016/365) include a **Filled Map** visual to plot geospatial data
 - Like dates, Excel automatically recognizes many types of geospatial information (*states, countries, zip codes, lat/long, etc.*)
 - If some values aren't recognized, you may see a warning icon with a statement like "*We plotted 80% of the locations from your data with high confidence*"
- NOTE:** Filled maps are currently unavailable in older versions of Excel (pre-2016)



DATA VIZ



1 STAR (VERY BASIC)



COMMON USE CASES:

- Quickly visualizing regional patterns or trends
- Comparing census information like population, GDP, household income, or birth rates across countries

PRO TIP

CUSTOMIZE YOUR CHARTS TO TELL A STORY

- Don't settle for boring, default formats; use **chart titles** and **formatting tools** to add insight and bring your data to life
 - **Tell a story** in the chart title or subtitle rather than making the user interpret it
 - Add **individual labels or markers** to draw attention to key points
 - **Use colors** consistently and deliberately
- **TIP:** Add text or shapes while the chart is selected to automatically group the objects



DATA VIZ

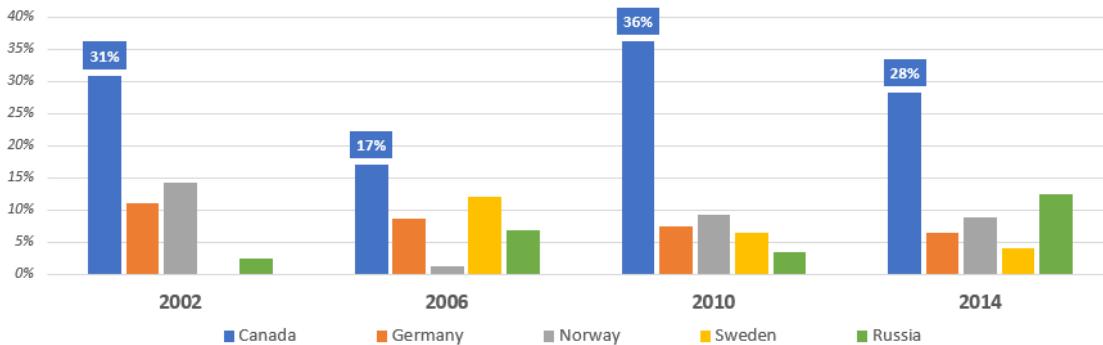


2 STARS (BASIC)

	% of Winter Olympic Gold Medals (Top 5 Countries)			
	2002	2006	2010	2014
Canada	31%	17%	36%	28%
Germany	11%	9%	7%	6%
Norway	14%	1%	9%	9%
Sweden	0%	12%	6%	4%
Russia	2%	7%	3%	12%

Share of Winter Olympic Gold Medals (Top 5 Countries)

Canada dominated the Winter Games from 2002-2014, capturing an unprecedented 36% of all gold medals in 2010



COMMON USE CASES:

- Preparing visuals for use in presentations, where comprehension is key
- Reducing the chance of users misinterpreting the story that a chart or graph is designed to communicate

PRO TIP

QUICKLY VISUALIZE TRENDS WITH SPARKLINES

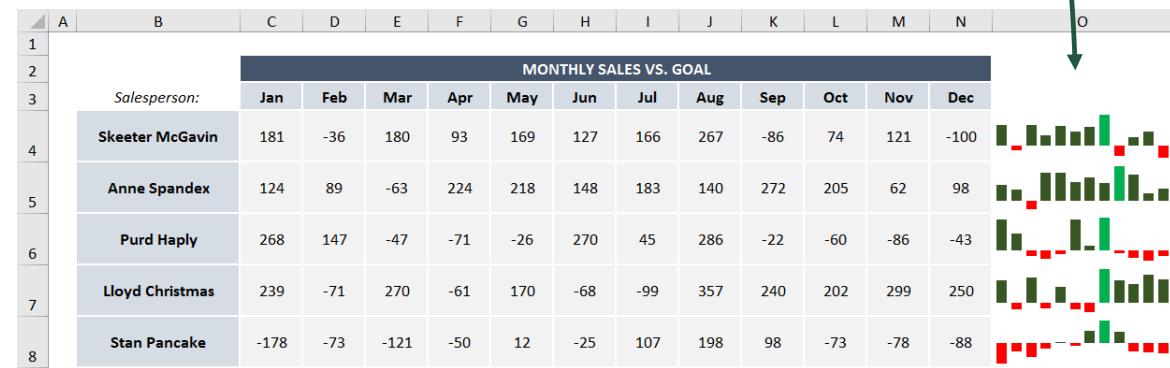
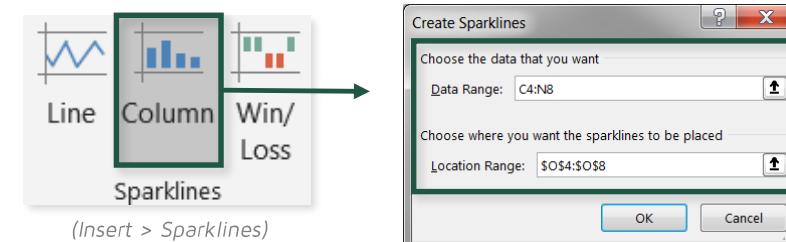
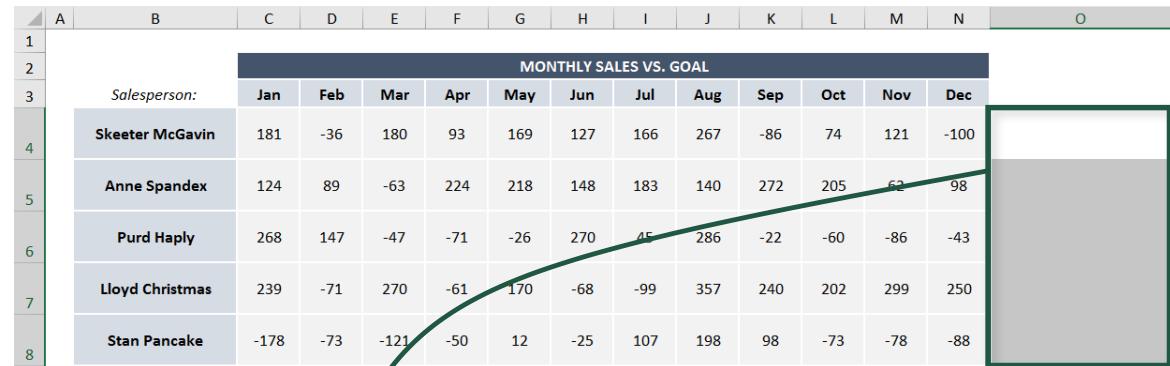
- **Sparklines** are basically tiny charts that live within the confines of a single cell
- While formatting options are somewhat limited, sparklines can be a great way to quickly (*and subtly*) visualize patterns
 - Use the **Sparkline Tools** ribbon to change chart types, highlight specific points (*high/low, first/last, +/-*), and adjust colors, markers, or axis options



DATA VIZ



2 STARS (BASIC)



COMMON USE CASES:

- Embedding a simple line or column sparkline to show trends at a glance
- Creating KPI cells to show key metrics with sparklines in the background

PRO TIP

DESIGN & APPLY CUSTOM CHART TEMPLATES

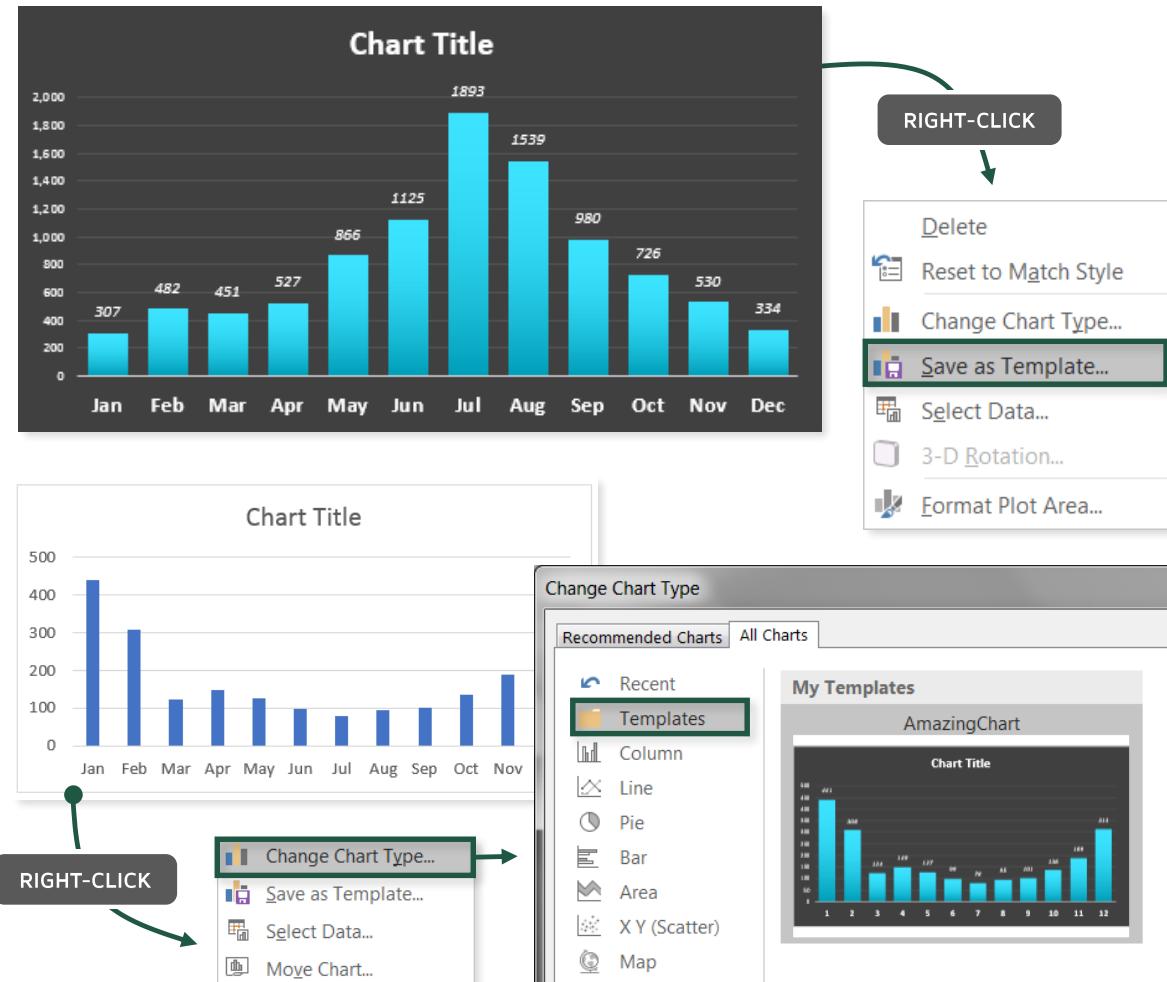
- To apply a specific set of formatting rules across multiple charts, you can create your own **custom chart templates**
 - Once you've applied the formatting you'd like to replicate, **right-click** the chart and select **Save As Template**
 - To apply the template to a new chart, navigate to the **Templates** folder within the **Change Chart Type** dialog box



DATA VIZ



2 STARS (BASIC)



COMMON USE CASES:

- Saving specific formats for future use in other workbooks
- Ensuring consistent formatting across all visuals in a report

PRO TIP

DESIGN YOUR OWN CONDITIONAL HEAT MAPS

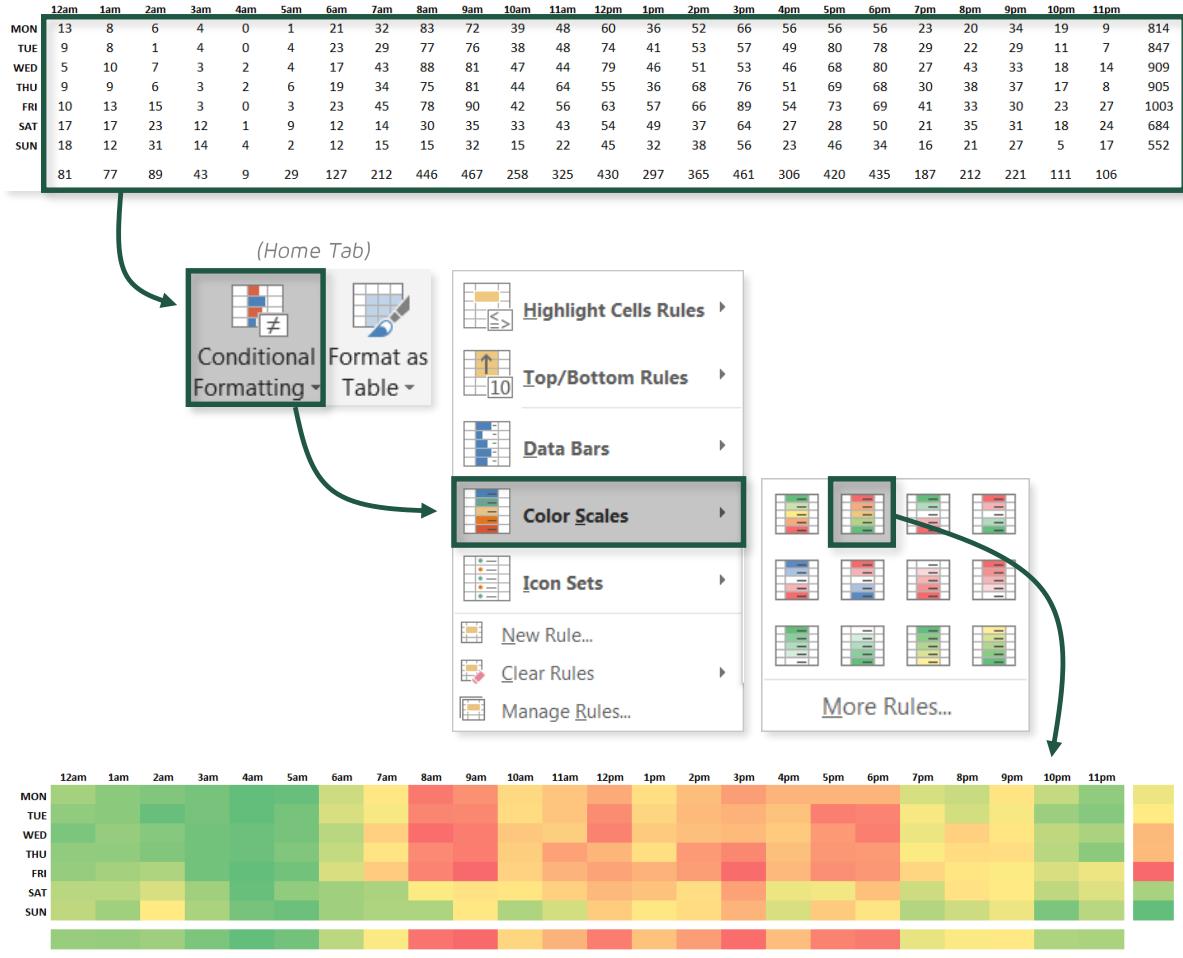
- One of the most effective visualizations in Excel isn't a chart at all, but a **heat map** created with **conditional formatting**
 - Select your source data and navigate to **Home > Conditional Formatting > Color Scales** to format cells based on their values
- **BONUS:** To hide text, apply a **Custom** number format and set the **Type** to “;;”



DATA VIZ



2 STARS (BASIC)



COMMON USE CASES:

- Quickly identifying patterns or trends in the underlying values using common color scales (red to green, white to red, etc)
- Highlighting “hot spots” or outliers based on the colors alone

ANALYZE DISTRIBUTIONS WITH HISTOGRAMS

- Histograms** are a great tool to understand and visualize how data is distributed
 - Unlike traditional column charts, Histograms show the **frequency** of observations that fall within given ranges of values (aka “**bins**”)
- NOTE:** Histograms are currently unavailable in older versions of Excel (pre-2016)

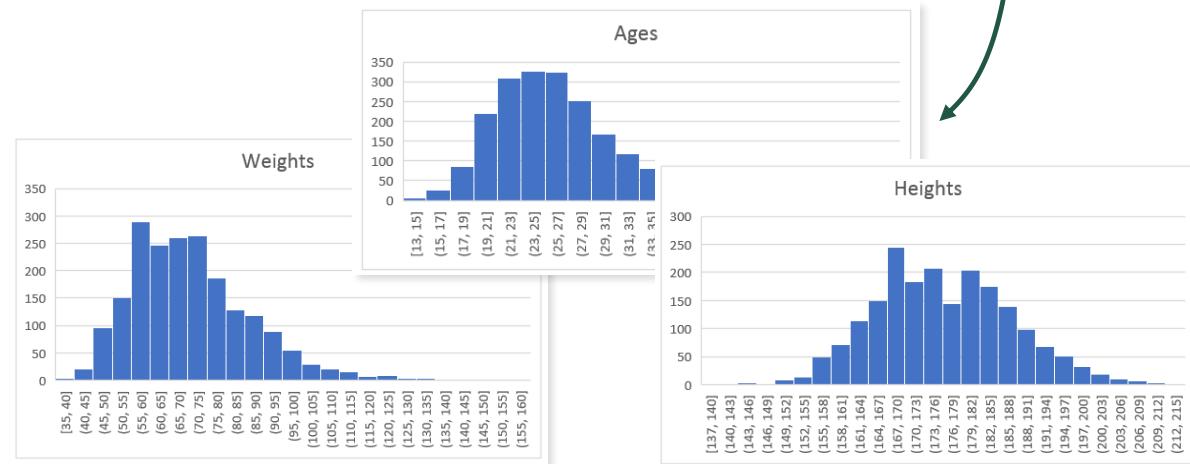
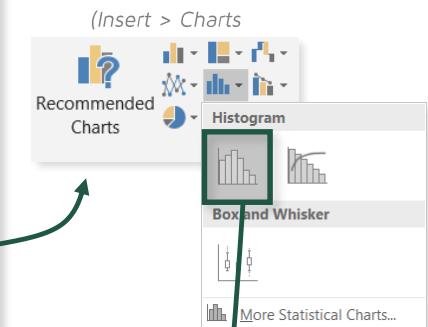


DATA VIZ



3 STARS (MODERATE)

A	B	C	D	E	F
Name	Gender	Sport	Age	Height_cm	Weight_kg
1 Aaron Arthur Cook	M	Taekwondo	25	183	80
2 Aaron Brown	M	Athletics	24	198	79
3 Aaron Gate	M	Cycling	25	181	71
4 Aaron John Royle	M	Triathlon	26	180	67
5 Aaron Russell	M	Volleyball	23	206	93
7 Aaron Younger	M	Water Polo	24	193	100
8 Aauri Lorena Bokesa Abia	F	Athletics	27	180	62
9 aba Silai	M	Swimming	25	185	77
10 Ababel Yeshaneh Birhane	F	Athletics	25	165	54
11 Abadi Hadis Embaye	M	Athletics	18	170	63
12 Abbas Qali	M	Swimming	23	178	77
13 Abbey Weitzel	F	Swimming	19	178	68
14 Abbas Rakhmonov	M	Wrestling	18	161	57
15 Abbubaker Mobra	M	Football	22	175	64
16 Abby May Ercog	F	Football	26	177	68
17 Abdalelah Haroun Hassan	M	Athletics	19	185	80
18 Abdalla Yousie	M	Athletics	19	177	65
19 Abdel Aziz Mehelba	M	Shooting	27	176	80
19 Abdel Aziz Merzougui Noureddine	M	Athletics	24	175	67
21 Abdel Rahman Salah Orabi Abdalgawwad	M	Boxing	28	185	81



COMMON USE CASES:

- Visualizing population demographics (height, weight, income, age, etc.)
- Identifying the most and least common values in a sample

PRO TIP

TURN DONUTS INTO CUSTOM GAUGE CHARTS

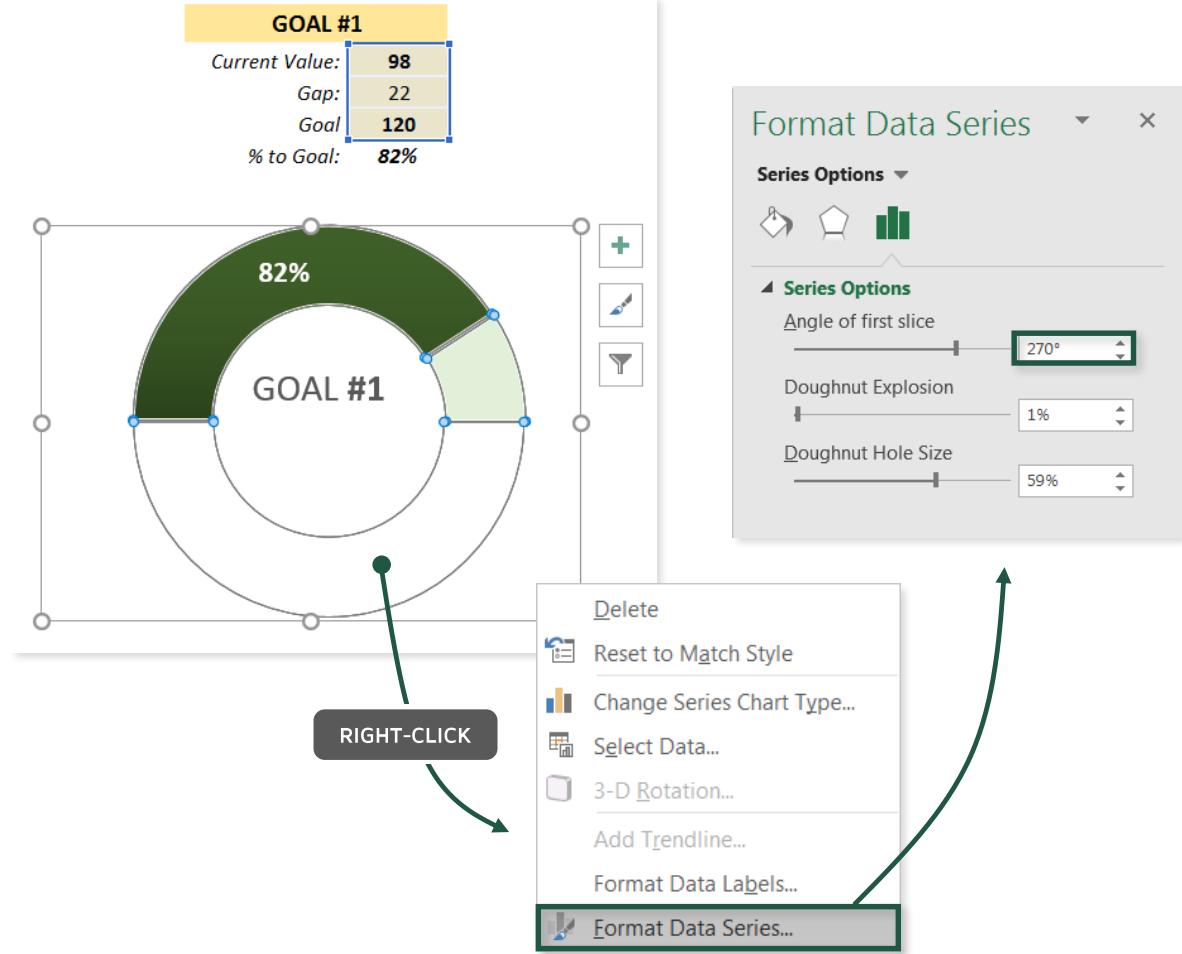
- To show progress towards a goal, create a custom **Gauge Chart** by formatting a standard **Pie or Donut Chart**:
 - STEP 1:** Create cells with 3 values: **Current Value**, **Gap**, and **Goal** (*in that order*)
 - STEP 2:** Insert a **Donut or Pie Chart**, and format the **Goal** series with no fill or border
 - STEP 3:** Format the data series, and change the *Angle of First Slice* to **270 degrees**
- TIP:** Add a "% to Goal" calculation, and insert a data label linked to that cell value



DATA VIZ



3 STARS (MODERATE)



COMMON USE CASES:

- Tracking performance against benchmarks or goals
- Designing executive scorecards to visualize key metrics at a glance

PRO TIP

USE COMBO CHARTS TO HIGHLIGHT DATE RANGES

- Use **Combo Charts** to visually highlight specific time periods within a line chart:
 - **STEP 1:** Add a new column and “flag” key rows with a “1” (leave others **blank** or **0**)
 - **STEP 2:** Add the new series, change the type to **Combo**, and plot it as a **100% Stacked Column**, on the **Secondary Axis**
 - **STEP 3:** Right-click to format the new series and change the **Gap Width** to **0%**
- **TIP:** Apply a custom number format (;;;) to the secondary axis to hide the labels



DATA VIZ



4 STARS (ADVANCED)

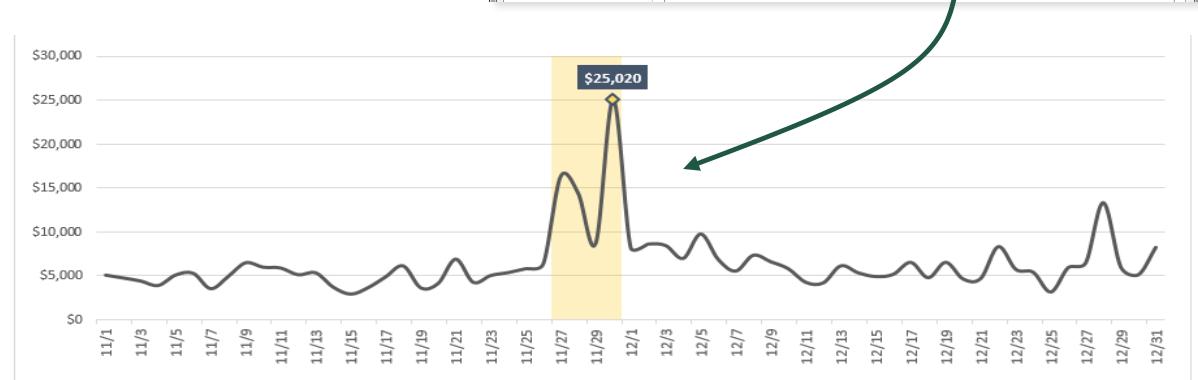
A	B	C	
1	Date	Revenue	Sale?
17	11/16/2015	\$3,598	
18	11/17/2015	\$4,830	
19	11/18/2015	\$6,077	
20	11/19/2015	\$3,572	
21	11/20/2015	\$4,077	
22	11/21/2015	\$6,842	
23	11/22/2015	\$4,201	
24	11/23/2015	\$4,976	
25	11/24/2015	\$5,309	
26	11/25/2015	\$5,749	
27	11/26/2015	\$6,278	
28	11/27/2015	\$16,279	1
29	11/28/2015	\$14,333	1
30	11/29/2015	\$8,638	1
31	11/30/2015	\$25,020	1
32	12/1/2015	\$8,142	
33	12/2/2015	\$8,561	
34	12/3/2015	\$8,390	
35	12/4/2015	\$6,925	
36	12/5/2015	\$9,707	

(Chart Tools > Type)

Daily Revenue Pacing (11/1 - 12/31)
Revenue volume spiked during the Black Friday/Cyber Monday sale, reaching a new YTD high of \$25,020 on Monday, 11/30.

Choose the chart type and axis for your data series:

Series Name	Chart Type	Secondary Axis
Revenue	Line	
Sale?	100% Stacked Column	<input checked="" type="checkbox"/>



COMMON USE CASES:

- Highlighting sales or promotional periods to add context to the chart
- Drawing attention to seasonal patterns or trends (peak vs. off-peak, weekdays vs. weekends, etc.)

PRO TIP

CREATE DYNAMIC SOURCE DATA WITH NAMED RANGES

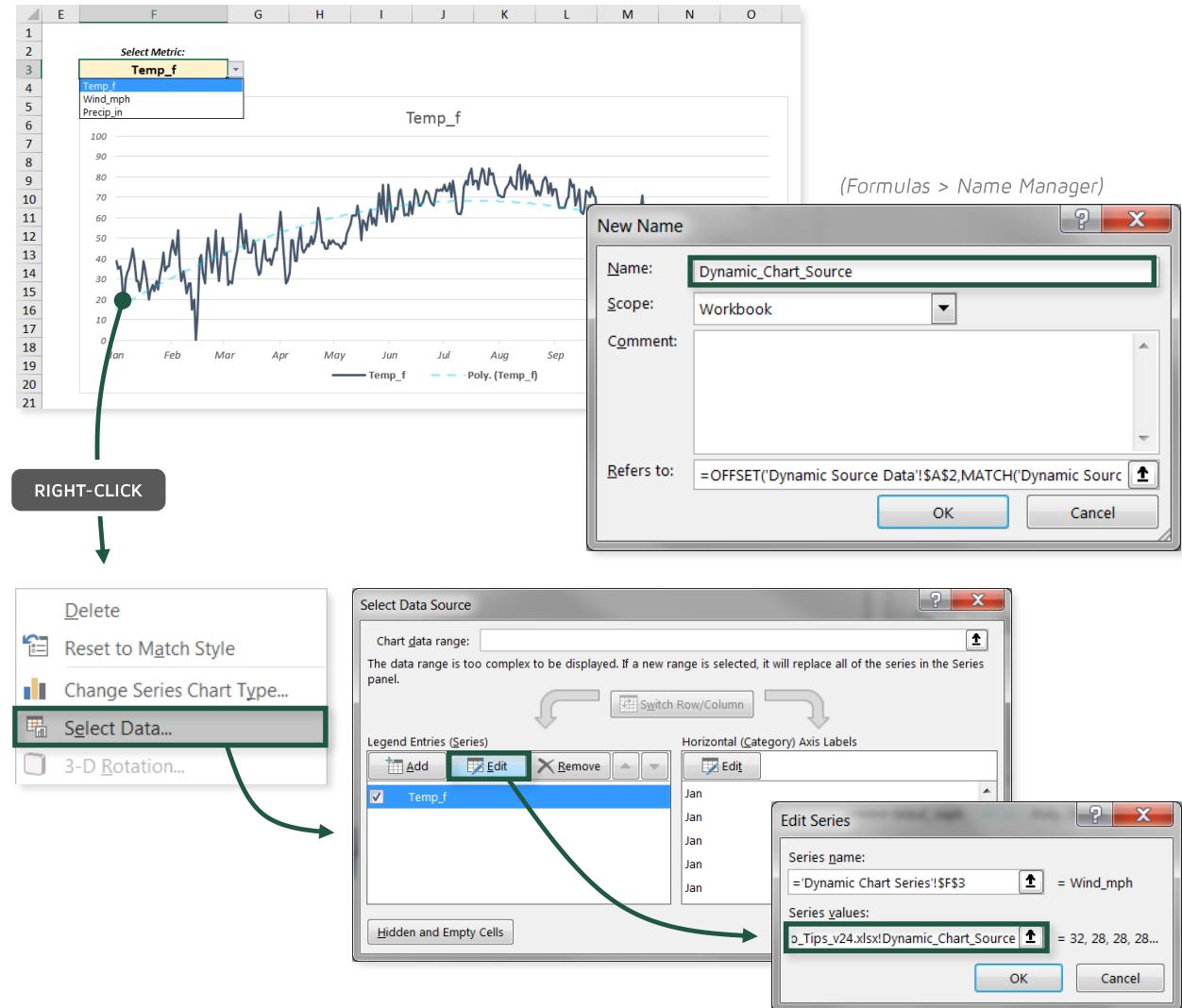
- **Named Ranges** allow you to define dynamic cell references and charts using functions like **OFFSET** and **MATCH**:
 - **STEP 1:** Create a **data validation** list containing each column header
 - **STEP 2:** Add a named range using **OFFSET**, **MATCH** and **COUNTA** to dynamically reference the column selected from the list
 - **STEP 3:** Insert a new chart, edit the data source, and reference the named range in **Series Values** (after the workbook name)



DATA VIZ



5 STARS (EXPERT)



COMMON USE CASES:

- Creating interactive dashboards with user-controlled charts and graphs
- Consolidating multiple visuals into a single chart template

PRO TIP

ADD FORM CONTROLS FOR INTERACTIVE VISUALS

- Use **Form Controls** to create interactive charts based on lists, buttons or scroll bars:
 - **STEP 1:** Insert a **List Box**, with an *Input Range* referencing a unique list of options and a *Cell Link* to store the selected value
 - **STEP 2:** Use cell functions (**INDEX**, **MATCH**, **VLOOKUP**, etc.) to create the chart source data, based on the list box selection
- **NOTE:** If you don't see the **Developer** tab, check **File > Options > Customize Ribbon**

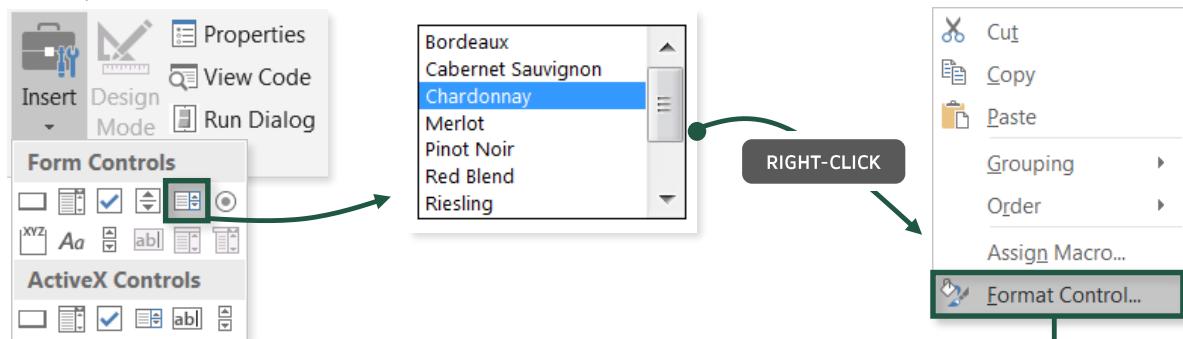


DATA VIZ

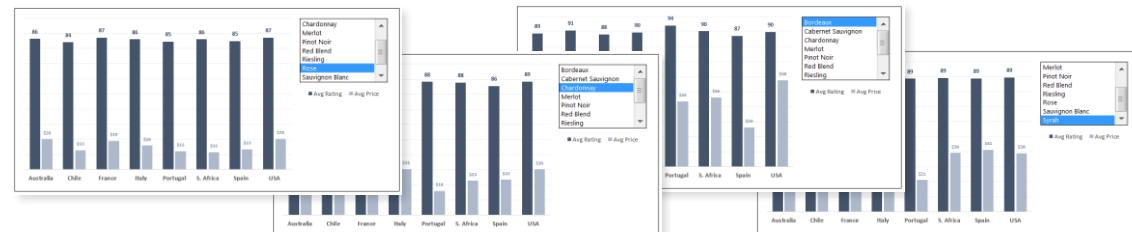


5 STARS (EXPERT)

(Developer > Controls)



	Avg Rating	Avg Price
Australia	89.16	\$22.02
Chile	85.63	\$16.25
France	90.78	\$32.24
Italy	88.25	\$24.50
Portugal	86.50	\$18.00
S. Africa	87.00	\$18.50
Spain	82.00	\$20.00
USA	87.91	\$19.28



COMMON USE CASES:

- Integrating user controls into a dynamic report or dashboard
- Consolidating multiple visuals into a single chart template

PIVOT TABLE TIPS

PRO TIP

USE FIELD LIST OPTIONS TO STAY ORGANIZED

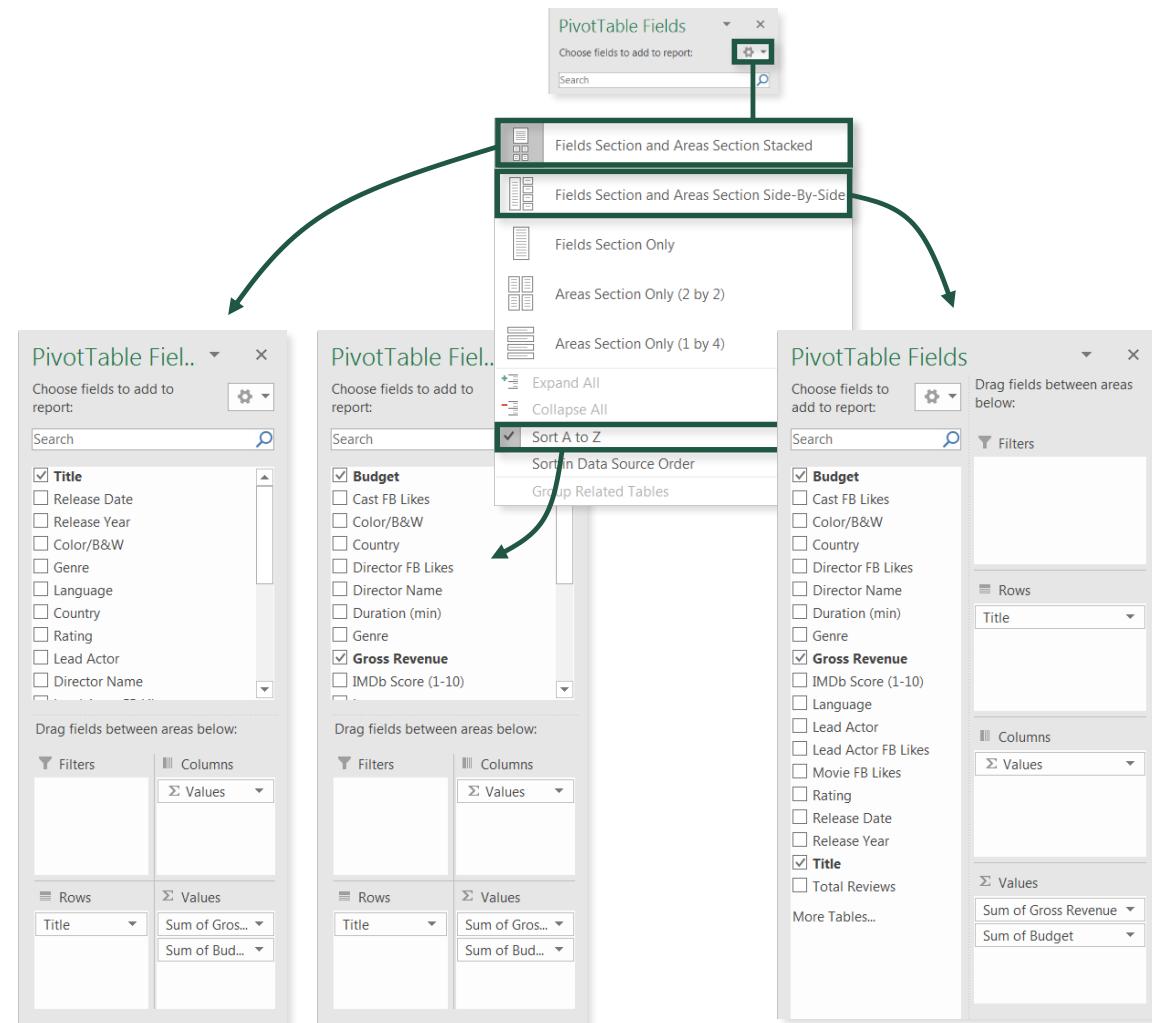
- The **Field List** is typically “stacked” by default, and sorted in **Data Source** order
- If you have a large number of source tables or fields, you may want to adjust settings:
 - Fields & Areas Side-by-Side**: Displays all tables and fields in one vertical pane, next to the Filter/Rows/Columns/Values options
 - Sort A to Z**: Sorts column names in alphabetical order, rather than source order (*note that you can search for fields as well*)



PIVOT TABLES



1 STAR (VERY BASIC)



COMMON USE CASES:

- Updating the layout to show all tables and fields in one vertical pane for easy access (especially for Power Pivot views with many tables)
- Sorting fields alphabetically when the source order isn't meaningful

PRO TIP

PREVENT COLUMNS FROM AUTOFITTING WIDTH

- By default, pivots will **adjust column width** to accommodate the longest value in a field
 - This can be helpful, but inconvenient when working with long, text-based fields
- To prevent automatic resizing, uncheck the “**Autofit Columns Widths**” box in the PivotTable options (**Layout & Format** tab)
- **TIP:** Use the **wrap text** option to make text fields more readable within the pivot



PIVOT TABLES



1 STAR (VERY BASIC)

The screenshot shows a Microsoft Excel interface with a PivotTable named "PivotTable2". The "Analyze" tab is selected in the ribbon. A green arrow points from the "Options" button in the ribbon down to the "PivotTable Options" dialog box. Another green arrow points from the "Wrap Text" button in the ribbon down to the "Wrap Text" checkbox in the "Layout & Format" tab of the dialog box. The dialog box also has a checked "Preserve cell formatting on update" checkbox. The main worksheet shows a table with two rows of data: "Taster Name" and "Description". The "Description" column contains long text entries. The ribbon also shows the "Home" tab with the "Wrap Text" button highlighted.

(PivotTable Tools > Options)

(Home > Wrap Text)

COMMON USE CASES:

- Working with text fields like survey results or social media posts
- Forcing the PivotTable column widths to remain fixed, regardless of how the table layout changes

PRO TIP

SHOW PIVOTS IN OUTLINE OR TABULAR FORM

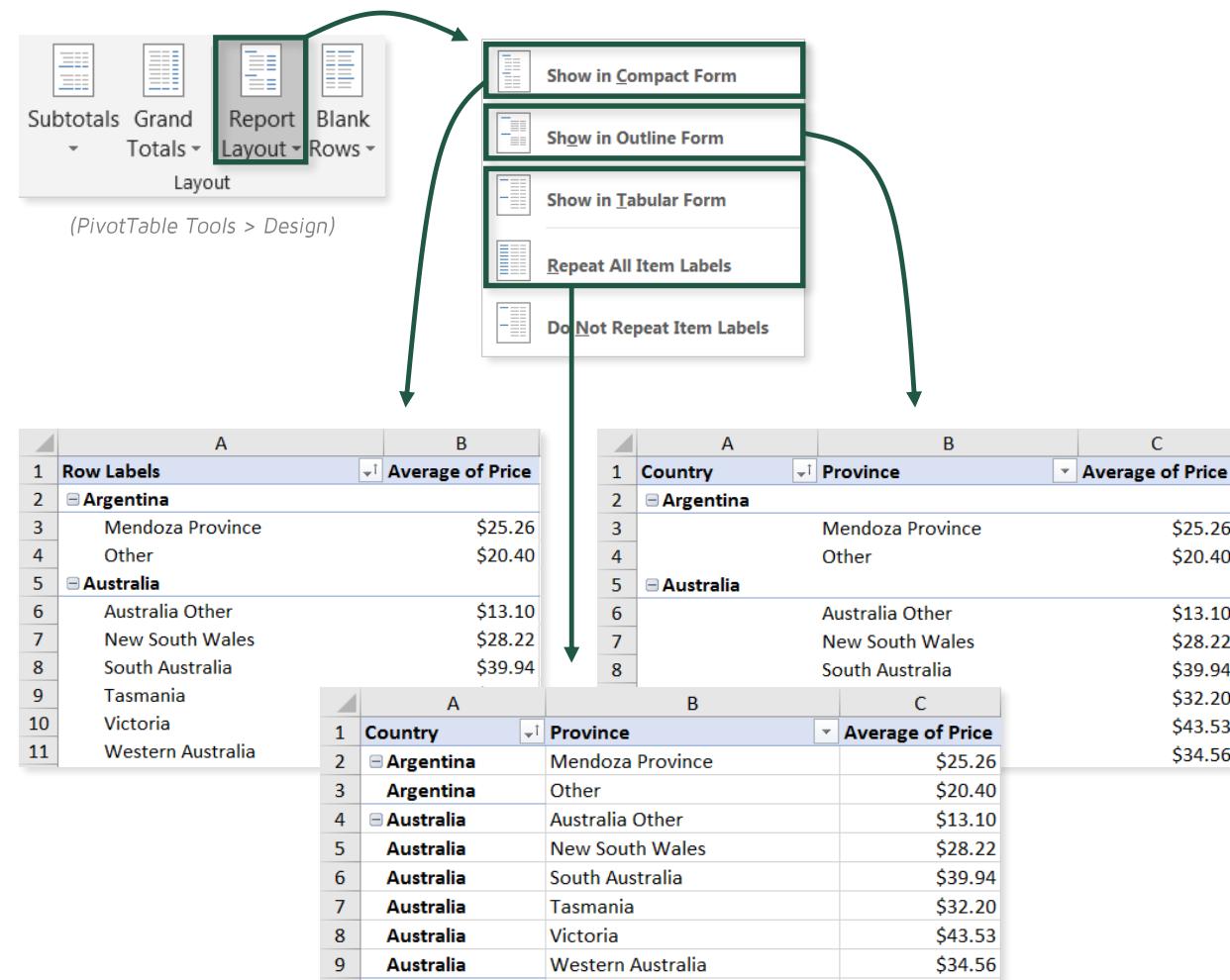
- Pivots typically default to **Compact Form**, grouping all row labels into a single column
- You can change the layout using **PivotTable Tools > Design > Report Layout**:
 - Outline Form**: Splits row labels into separate columns, to sort/filter individually
 - Tabular Form**: Formats the pivot like a table, without extra spacing rows
- NOTE:** Head to **File > Options > Data > Edit Default Layout** to change your default



PIVOT TABLES



1 STAR (VERY BASIC)



COMMON USE CASES:

- Using **Outline Form** to sort and filter multiple fields individually
- Using **Tabular Form** with repeating item labels and no grand totals or subtotals to create new source data for further analysis

PRO TIP

USE PIVOT TABLES TO COUNT TEXT FIELDS

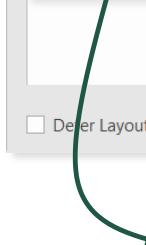
- While the **Values** pane is typically for numerical fields, it can be used to analyze the **count or frequency of text fields**
 - Since you can't aggregate non-numerical fields, use **Count Of** summarization to display frequencies for text-based values
- NOTE:** If a *numerical* field defaults to a count, it typically indicates values formatted as text or blank rows in the source data



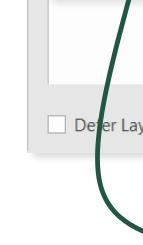
PIVOT TABLES



1 STAR (VERY BASIC)



Genre	Count of Genre
Action	900
Adventure	362
Animation	45
Biography	204
Comedy	1,016
Crime	252
Documentary	43
Drama	672
Family	3
Fantasy	35
Horror	151
Musical	2
Mystery	23
Romance	3
Sci-Fi	8
Thriller	3
Western	3
Grand Total	3,725



Rating	Count of Rating
Approved	17
G	91
GP	1
M	2
NC-17	6
Not Rated	43
Passed	3
PG	553
PG-13	1,248
R	1,679
Unrated	24
X	9
(blank)	
Grand Total	3,676

COMMON USE CASES:

- Analyzing the number of rows or observations that fall into specific categories (i.e. movie titles by genre, products by category, etc.)
- Generating source data for statistical charts like histograms/pareto charts

PRO TIP

GROUP DATES USING PIVOTS OR SOURCE DATA

- PivotTables include standard tools to **group date fields** into months, years, etc.
 - NOTE:** Head to *Options > Data > Data Options* to check whether or not automatic date/time grouping is enabled
- Grouping creates new fields that *only exist in the pivot*, but can be used like any other
- NOTE:** An alternative (*and often more flexible*) approach is to create new fields in the source data using date & time functions



PIVOT TABLES



2 STARS (BASIC)

A screenshot of Microsoft Excel illustrating how to group dates. On the left, a table of 'Release Date' values from 1920 to 1957 is shown. A context menu is open over the 15th row (12/7/1947), with the 'Group...' option highlighted. A callout bubble points to the 'RIGHT-CLICK' action. To the right, a 'Group' dialog box shows 'Auto' settings for 'Starting at: 9/15/1920' and 'Ending at: 12/30/2015', and a list of groupings: Seconds, Minutes, Hours, Days, Months, Quarters, Years. Below the dialog is a PivotTable with columns for 'Years', 'Quarters', and 'Release Date'. The 'Years' column shows 1920, 1927, 1929, 1933, 1935, 1936, 1937, 1939, 1940, 1940, 1946, 1946, 1947, 1948, 1950, 1952, 1953, 1953, 1954, 1954, 1957. The 'Quarters' column shows Qtr3, Qtr1, and Qtr4. The 'Release Date' column shows specific dates like Sep, Jan, and Nov.

COMMON USE CASES:

- Rolling up daily data to analyze trends by month or quarter
- Creating high-level summary tables or charts from granular source data

PRO TIP

APPLY MULTIPLE FILTERS TO A SINGLE PIVOT FIELD

- By default, you can apply **label filters** or **value filters** to a single field, *but not both*
 - To change this, head to **PivotTable Options** and check the "**Allow Multiple Filters Per Field**" box in the **Totals & Filters** tab
- This will allow you to filter PivotTable fields based on both **text** and **value** attributes



PIVOT TABLES



2 STARS (BASIC)

(PivotTable Tools > Options)

PivotTable Options

PivotTable Name: PivotTable9

Printing Data Alt Text

Layout & Format Totals & Filters Display

Grand Totals

Show grand totals for rows (checked)

Show grand totals for columns (checked)

Filters

Subtotal filtered page items (unchecked)

Allow multiple filters per field (checked)

Sorting

Use Custom Lists when sorting (checked)

A 1 Title B Sum of Gross Revenue

2 Shrek 2 436,471,036

3 Spider-Man 2 373,377,893

4 Despicable Me 2 368,049,635

5 Iron Man 2 312,057,433

6 The Twilight Saga: Breaking Dawn - Part 2 292,298,923

7 The Hunger Games: Mockingjay - Part 2 281,666,058

8 Toy Story 2 245,823,397

9 Rush Hour 2 226,138,454

10 X-Men 2 214,948,780

11 The Amazing Spider-Man 2 202,853,933

12 Cars 2 191,450,875

13 Pitch Perfect 2 183,436,380

14 How to Train Your Dragon 2 176,997,107

15 Hotel Transylvania 2 169,692,572

16 2012 166,112,167

17 Kung Fu Panda 2 165,230,261

18 American Pie 2 145,096,820

19 Taken 2 139,852,971

20 The Santa Clause 2 139,225,854

21 Grown Ups 2 133,668,525

22 Rio 2 131,536,019

A 2 Sort A to Z

A 3 Sort Z to A

A 4 More Sort Options...

A 5 Clear Filter From "Title"

B 1 Label Filters

B 2 Value Filters

B 3 Search

B 4 OK Cancel

MAVEN ANALYTICS

Titles that end with "2" AND drove \$100,000,000+ in Gross Revenue

COMMON USE CASES:

- Applying more complex or custom filters that incorporate both text and value-based criteria

PRO TIP

USE PIVOT TABLES TO GROUP NUMERICAL VALUES

- Just like text, you can **group numerical fields** into custom buckets
 - Pull a numerical field into rows, right-click and select **Group**, and specify a **start value**, **end value**, and **group size**
 - To undo, right-click and select **Ungroup**
- Value grouping is a great way to analyze data distribution, or create bins as source data for a Histogram or Pareto Chart



PIVOT TABLES



2 STARS (BASIC)

The screenshot illustrates the steps to group numerical values into bins. On the left, a table of numerical values (Price) from 1 to 25 is shown. A callout points to the 'RIGHT-CLICK' action on cell A15, which opens a context menu. In the menu, an arrow points to the 'Group...' option under the 'Subtotal "Release Date"' section. This leads to a 'Grouping' dialog box on the right, where the 'Starting at' value is set to 0, the 'Ending at' value is set to 1000, and the 'By:' value is set to 100. The 'OK' button is highlighted. Below the dialog, the final grouped data table is shown, with the first column labeled 'Price' and the second column labeled 'Count of Wine Name'. The grouped data shows the count of wine names for price ranges: 0-99 (48,383), 100-199 (1,282), 200-299 (185), 300-399 (62), 400-499 (40), 500-599 (20), 600-699 (7), 700-799 (9), 800-899 (6), 900-1000 (3), and >1000 (3). The total count is 50,000.

A	B
Price	Count of Wine Name
0-99	48,383
100-199	1,282
200-299	185
300-399	62
400-499	40
500-599	20
600-699	7
700-799	9
800-899	6
900-1000	3
>1000	3
Grand Total	50,000

COMMON USE CASES:

- Analyzing the count or frequency of observations that fall into specific groups or "bins" of values
- Creating high-level summary tables or charts from granular data

PRO TIP

ANALYZE DATA USING VALUE CALCULATIONS

- **Value Calculations** allow you to display values from several different angles:
 - **% of Column/Row**: Displays values as a percentage of the row or column total
 - **% of Parent**: Displays values as a percentage of a given “parent” category
 - **Difference From**: Displays values in terms of the difference from a given base item
 - **Running Total**: Displays values as a cumulative total within a given base field
 - **Rank**: Displays values as a rank based on volume (*low to high or high to low*)



PIVOT TABLES

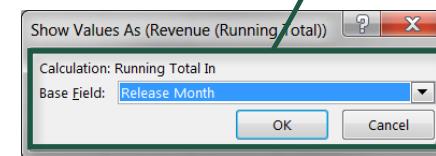
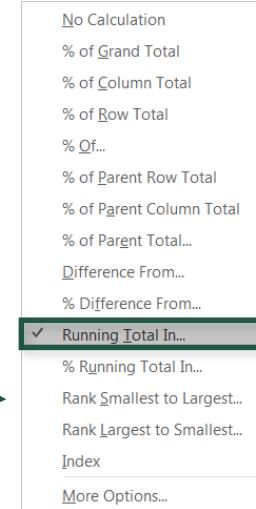
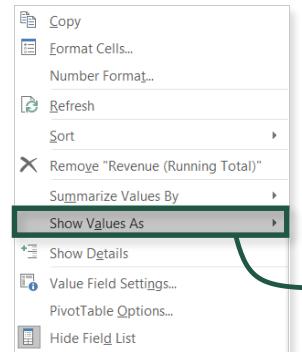


3 STARS (MODERATE)

TIP: Drag in multiple copies of the field to keep an original

3	Release Month	Gross Revenue	Revenue (% of Column)	Revenue (Rank)	Revenue (Running Total)
4	1	\$1,241,690,062	14.57%	2	\$1,241,690,062
5	2	\$1,080,470,947	12.68%	3	\$2,322,161,009
6	3	\$739,670,617	8.68%	6	\$3,061,831,626
7	4	\$1,258,644,348	14.77%	1	\$4,320,475,974
8	5	\$487,598,739	5.72%	8	\$4,808,074,713
9	6	\$928,755,990	10.90%	4	\$5,736,830,703
10	7	\$783,958,882	9.20%	5	\$6,520,789,585
11	8	\$591,889,024	6.94%	7	\$7,112,678,609
12	9	\$214,029,146	2.51%	12	\$7,326,707,755

RIGHT-CLICK



COMMON USE CASES:

- Analyzing time-series data as a running total by day, month or year
- Exploring the composition of values in terms of percent share by category

PRO TIP

CUSTOMIZE ERRORS & BLANKS WITHIN A PIVOT

- By default, pivots won't display row labels where values don't exist; however, you can choose to **show items with no data**
 - Right-click the header, select **Field Settings**, and check the "**Show items with no data**" box in the **Layout & Print** tab
- **TIP:** To customize how **empty values** and **errors** are displayed, go to the **Layout & Format** tab in the **Options** menu



PIVOT TABLES



3 STARS (MODERATE)

The screenshot shows a Microsoft Excel PivotTable with three columns: Country, Genre, and Sum of Gross Revenue. The data includes rows for Afghanistan, Argentina, Aruba, and Australia, with various movie genres and their revenue. A context menu is open over the 'Genre' header in the second row. The menu options include Sort, Filter, Subtotal "Genre", Expand/Collapse, Group..., Ungroup..., Move, Remove "Genre", Field Settings... (which is highlighted with a red box), PivotTable Options..., and Hide Field List. A callout bubble points to the 'Field Settings...' option with the text 'RIGHT-CLICK'. To the right of the table is a 'Layout & Print' dialog box. Under the 'Layout' tab, the 'Show item labels in outline form' radio button is selected. Within this group, the 'Show items with no data' checkbox is checked and highlighted with a red box. Another callout bubble points to this checkbox with the text 'Show items with no data'.

A	B	C	
1	Country	Genre	Sum of Gross Revenue
2	Afghanistan	Drama	\$1,127,331
3		Crime	\$1,127,331
4	Argentina	Drama	\$21,692,809
5		Crime	\$1,221,261
6	Aruba	Action	\$20,471,548
7		Comedy	\$10,076,136
8	Australia	Action	\$1,506,979,847
9		Adventure	\$843,261,855
10		Animation	\$274,765,505
11		Biography	\$63,992,328
12		Comedy	\$40,246,592
13		Crime	\$77,873,417
14		Drama	
15		Horror	
16		Mystery	
17			
18			

Source Name: Genre			
Custom Name: Genre			
Subtotals & Filters		Layout & Print	
<input checked="" type="radio"/> Show item labels in outline form			
<input type="checkbox"/> Display labels from the next field in the same column (compact form)			
<input checked="" type="checkbox"/> Display subtotals at the top of each group			
<input type="radio"/> Show item labels in tabular form			
<input type="checkbox"/> Repeat item labels			
<input type="checkbox"/> Insert blank line after each item label			
<input checked="" type="checkbox"/> Show items with no data			

A	B	C	
1	Country	Genre	Sum of Gross Revenue
2	Afghanistan		\$1,127,331
3		Action	\$0
4		Adventure	\$0
5		Animation	\$0
6		Biography	\$0
7		Comedy	\$0
8		Crime	\$0
9		Documentary	\$0
10		Drama	\$1,127,331
11		Family	\$0
12		Fantasy	\$0
13		Horror	\$0
14		Musical	\$0
15		Mystery	\$0
16		Romance	\$0
17		Sci-Fi	\$0
18		Thriller	\$0
19		Western	\$0
20	Argentina		\$21,692,809
21		Action	\$0
22		Adventure	\$0
23		Animation	\$0
24		Biography	\$0
25		Comedy	\$0
26		Crime	\$1,221,261

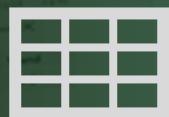
COMMON USE CASES:

- Displaying all possible items within the PivotTable (even for blanks), to create a consistent layout or template
- Reformatting blanks or errors to clean up user-facing reports or dashboards

PRO TIP

ADD VISUAL FILTERS WITH SLICERS & TIMELINES

- **Slicers** are essentially interactive versions of filters, and **Timelines** are slicers designed to work specifically with dates
- Use the **Report Connections** option to link slicers to multiple PivotTables (assuming they share the same source data)
- **NOTE:** It typically makes sense to hide or indicate options with no data (via **Slicer Settings**), but note that this may cause slow performance for very large tables



PIVOT TABLES



3 STARS (MODERATE)

The screenshot illustrates the process of creating a visual filter using a Slicer in Microsoft Power BI.

PivotTable Fields pane:

- Choose fields to add to report: Search
- Athlete Name
- Gender
- Age
- Height
- Weight
- Team
- Year
- Season
- City
- Sport
- Event
- Medal
- More Tables...

A context menu is open over the "Sport" checkbox, with the "Add as Slicer" option highlighted. A callout bubble says "RIGHT-CLICK".

Sport Slicer:

- Alpine Skiing
- Biathlon
- Bobsleigh
- Cross Country Skiing
- Curling
- Figure Skating
- Freestyle Skiing
- Ice Hockey

(Slicer Tools) pane:

- Slicer Caption: Sport
- Slicer Settings
- Slicer

Event PivotTable:

Event	Medal Count
Cross Country Skiing Men's 15 kilometres	285
Cross Country Skiing Men's Sprint	228
Cross Country Skiing Women's 10 kilometres	225
Cross Country Skiing Men's 30 km Skiathlon	208
Cross Country Skiing Men's 50 kilometres	196
Cross Country Skiing Women's 15 km Skiathlon	194
Cross Country Skiing Women's 4 x 5 kilometres Relay	188
Cross Country Skiing Women's Sprint	187
Cross Country Skiing Men's 4 x 10 kilometres Relay	184
Cross Country Skiing Women's 30 kilometres	171
Cross Country Skiing Men's Team Sprint	136
Cross Country Skiing Women's Team Sprint	100
Grand Total	2302

Athlete Name PivotTable:

Athlete Name	Medal Count
Yelena Vladimirovna Kolomina	16
Marit Bjørgen	16
Aino-Kaisa Saarinen	15
Justyna Kowalczyk	14
Li Hongxue	13
Sami Olavi Jauhojoki	12
Valentyna Yevhenivna Shevchenko	12
Stefanie Böhler	12
Kateryna Vasylivna Hryhorenko	12
Aivar Rehemaa	12
Devon Kershaw	12
Kikkan Lewis Randall (-Ellis)	12
Grand Total	158

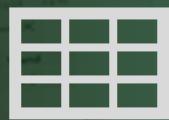
COMMON USE CASES:

- Adding user-friendly, visual filters to reports built from PivotTables
- Using slicers to clearly and visually indicate how a table is being filtered

PRO TIP

BRING PIVOTS TO LIFE WITH CONDITIONAL FORMATTING

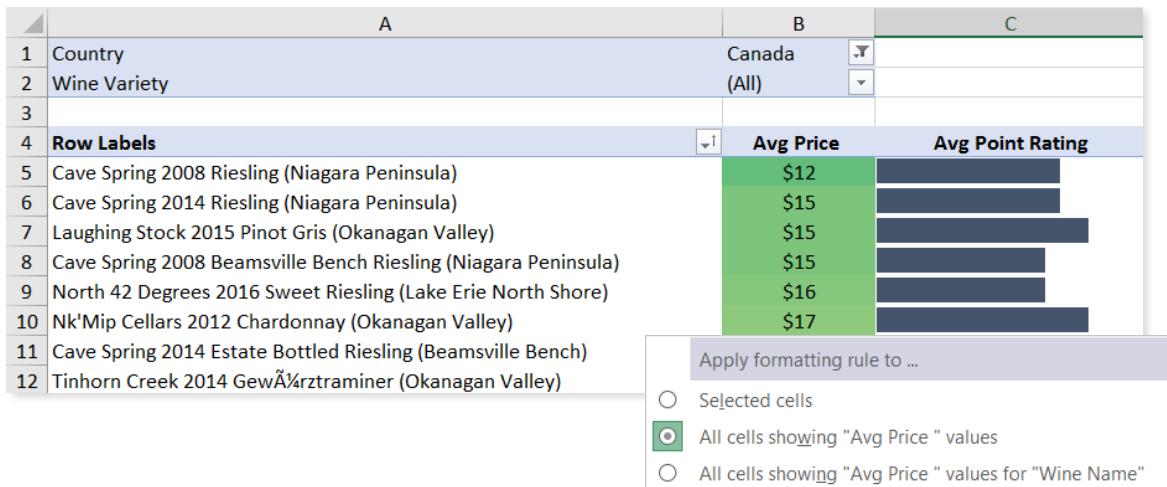
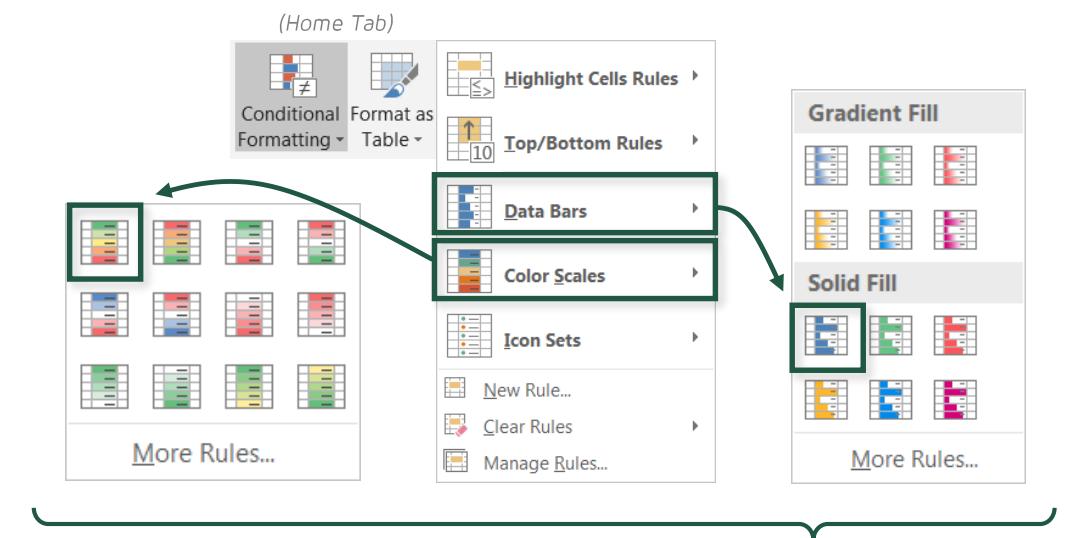
- Add **conditional formatting rules** (*data bars, color scales, icon sets, etc.*) to highlight patterns or trends in the pivot
- Unlike traditional cell formatting, you can specify how PivotTable formats react to changes in the table layout
 - **TIP:** Use “*All cells showing [X] values*” to apply the same rule to different layouts



PIVOT TABLES



4 STARS (ADVANCED)



COMMON USE CASES:

- Using color scales to draw attention to patterns or trends in the data
- Applying formatting rules that “stick” regardless of how the pivot layout changes

PRO TIP

REMOVE & REVIVE PIVOT TABLE DATA FROM CACHE

- When a new PivotTable is created, a **Pivot Cache** is generated as well, which is a compressed duplicate of the source data
 - The cache allows you to **delete the original source data** without impacting the pivot, which can significantly reduce file size
- To **revive the source data** from cache, double-click an unfiltered, Grand Total cell in the pivot (**NOTE:** make sure "Show Details" is enabled from the Options menu)



PIVOT TABLES



4 STARS (ADVANCED)

A screenshot of a Microsoft Excel PivotTable showing the following data:

A	B
1 Year	Average of Base Pay
2 2011	\$65,045
3 2012	\$65,938
4 Grand Total	\$65,496

A green arrow points from the "Grand Total" cell down to a callout box labeled "DOUBLE-CLICK". This callout box points to the "Data" tab of the "PivotTable Options" dialog box. The dialog box shows the following settings:

- PivotTable Name: PivotTable1
- Layout & Format, Totals & Filters, Display tabs are visible.
- Data tab is selected.
- PivotTable Data section:
 - Save source data with file
 - Enable show details
 - Refresh data when opening the file
- Retain items deleted from the data source: Number of items to retain per field: None
- What-if Analysis: Enable cell editing in the values area (unchecked)

A	B	C	D	E	
1	Employee Name	Year	Job Title	Base Pay	Overtime Pay
2	A Bernard Fatooh	2011	Sheriff'S Property Keeper	19969.37	0
3	Aaric Pingree	2011	Carpenter	0	0
4	Aaron Richmond	2011	Public Svc Aide-Public Works	2175.41	0
5	Aaron A Hipolito	2011	Museum Guard	10954.9	0
6	Aaron C Ballonado	2011	Police Officer 3	123471.15	8199.27
7	Aaron D Lynch	2011	Deputy Sheriff	87296.9	3265.58
8	Aaron Del Tredici	2011	Physician Specialist	124568.92	0
9	Aaron E Vurek	2011	Roofer	79136.84	883.8
10	Aaron Hipolito	2011	Museum Guard	10233.46	70.35
11	Aaron M Del Tredici	2011	Physician Specialist	129528.39	0
12	Aaron Patterson	2011	Ps Aide Health Services	15131.57	0
13	Aaron S Duran	2011	Automotive Mechanic	73376.2	568.85
14	Aaron Sher	2011	Public Service Aide-Assistant To Professionals	4666.32	0

COMMON USE CASES:

- Removing static source data to reduce file size or increase processing speed
- Limiting accessibility in order to prevent users from changing the raw data

PRO TIP

ORGANIZE FIELDS USING CUSTOM SORT LISTS

- Excel has several built-in **sort lists** to help organize fields such as **weekdays** or **month names** (which use non-standard sort rules)
- To add your own **custom sort lists**, head to **File > Options > Advanced** and click the **Edit Custom Lists** option
 - Once a list is defined, A-Z sorting will default to the custom list, rather than standard alphabetical order



PIVOT TABLES



5 STARS (EXPERT)

A	B	C	
1	Sport	Medal	Count of Medal
2	Alpine Skiing	Bronze	31
		Gold	31
		NA	1,900
		Silver	29
7	Archery		594
8		Bronze	24
9		Gold	24
10		NA	522
11		Silver	24
12	Athletics		7,030
13		Bronze	184
14		Gold	193
15		NA	6,461
16		Silver	192

(File > Options > Advanced)

General

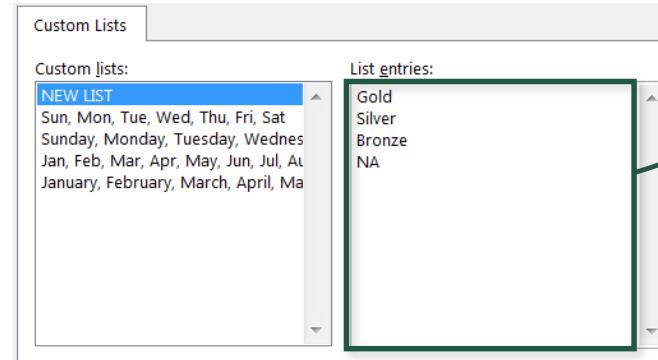
- Ignore other applications that use Dynamic Data Exchange (DDE)
- Ask to update automatic links
- Show add-in user interface errors
- Scale content for A4 or 8.5 x 11" paper sizes

At startup, open all files in:

Web Options...

- Enable multi-threaded processing

Create lists for use in sorts and fill sequences: **Edit Custom Lists...**



A	B	C	
1	Sport	Medal	Count of Medal
2	Alpine Skiing	Gold	31
		Silver	29
		Bronze	31
		NA	1,900
7	Archery		594
8		Gold	24
9		Silver	24
10		Bronze	24
11	Athletics	NA	522
12		Gold	193
13		Silver	192
14		Bronze	184
15		NA	6,461
16			

COMMON USE CASES:

- Organizing fields which can't be sorted using standard tools, such as apparel sizes (S, M, L) or Olympic medals (Gold, Silver, Bronze)
- Creating custom **fiscal calendars** to override standard month sorting

PRO TIP

CHANGE THE SOLVE ORDER FOR PIVOT CALCULATIONS

- If your pivot contains multiple calculated items and fields which could overlap, use the **Solve Order** to determine priority
 - In the **Solve Order** dialog box, the *last* formula in the list overrides those above
- **NOTE:** The **List Formulas** option generates a new tab documenting all calculated items and fields, as well as the sort order



PIVOT TABLES



5 STARS (EXPERT)

(PivotTable Tools)

Fields, Items, OLAP Relationships & Sets Tools

Calculated Field...

Calculated Item...

Solve Order...

List Formulas

Calculated Item Solve Order

Solve order:
'% English Titles' = English/(English+Spanish)
'North America' = Canada+USA
'Central America' = Mexico
'South America' = Argentina+Chile+Colombia+Peru

If the value in a PivotTable cell is affected by two or more calculated items, the value is determined by the last formula in the solve order.

Move Up Move Down Delete Close

A	B	C
1 Calculated Field		
2 Solve Order	Field	Formula
3 1	Profit	=Gross Revenue'-Budget
4 2	ROI	=Gross Revenue'/Budget
5 3	Total FB Likes	=Lead Actor FB Likes'+Cast FB Likes'+Director FB Likes'+Movie FB Likes'
6 4	Lead Actor Popularity	=Lead Actor FB Likes'/Total FB Likes'
8 Calculated Item		
9 Solve Order	Item	Formula
10 1	'% English Titles'	=English/(English+Spanish)
11 2	'North America'	=Canada+USA
12 3	'Central America'	=Mexico
13 4	'South America'	=Argentina+Chile+Colombia+Peru
16 Note:	When a cell is updated by more than one formula, the value is set by the formula with the last solve order.	
17		
18		
19	To change the solve order for multiple calculated items or fields, on the Options tab, in the Calculations group, click Fields, Items, & Sets, and then click Solve Order.	
20		
21		

COMMON USE CASES:

- Determining which calculations should take priority in conflicting cases
- Producing documentation for complex PivotTables containing a large number of calculated items and fields

ANALYTICS TIPS

PRO TIP

EXPLORE YOUR DATA WITH QUICK ANALYSIS TOOLS

- Select a cell range and click the pop-up (or **CTRL-Q**) to access **Quick Analysis** tools
 - These tools allow you to quickly add **conditional formats, charts, calculated rows & columns, tables & sparklines** to help explore and analyze your data
- **NOTE:** Options may be unavailable if they aren't compatible with the selected data

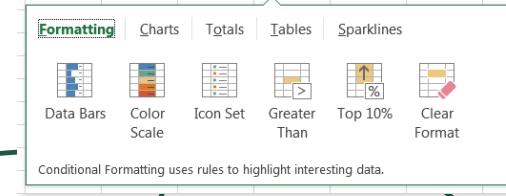


ANALYTICS



1 STAR (VERY BASIC)

	A	B	C	D	E	F
1						
2						
3						
4						
5						
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12						
13						



Conditional Formatting uses rules to highlight interesting data.

A	B	C	D	E	F	G	H	I	J
1									
2									
3	Action	6.26	6.35	6.56	6.45	6.41			
4	Adventure	6.40	6.76	6.60	6.81	6.86	6.69		
5	Animation	5.35	7.33	7.00	7.20	7.00	6.78		
6	Biography	6.81	7.19	7.49	6.86	7.22			
7	Comedy	6.25	6.15	6.21	6.13	6.32	6.21		
8	Crime	6.94	6.53	6.75	6.86	6.78	6.77		
9	Documentary	6.15	6.80	5.75	6.95	7.19	6.55		
10	Drama	6.66	6.84	6.66	6.54	6.51	6.61		
11	Fantasy	5.40	7.00	6.27	4.70	6.10	5.89		
12	Horror	5.43	5.24	6.08	5.72	5.35	5.57		
13									

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2									
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13									

A	B	C	D	E	F	G	H	I	J
1									
2									

<tbl_r cells="10" ix="4" maxcspan="1" max

PRO TIP

COMPARE OUTPUTS WITH THE SCENARIO MANAGER

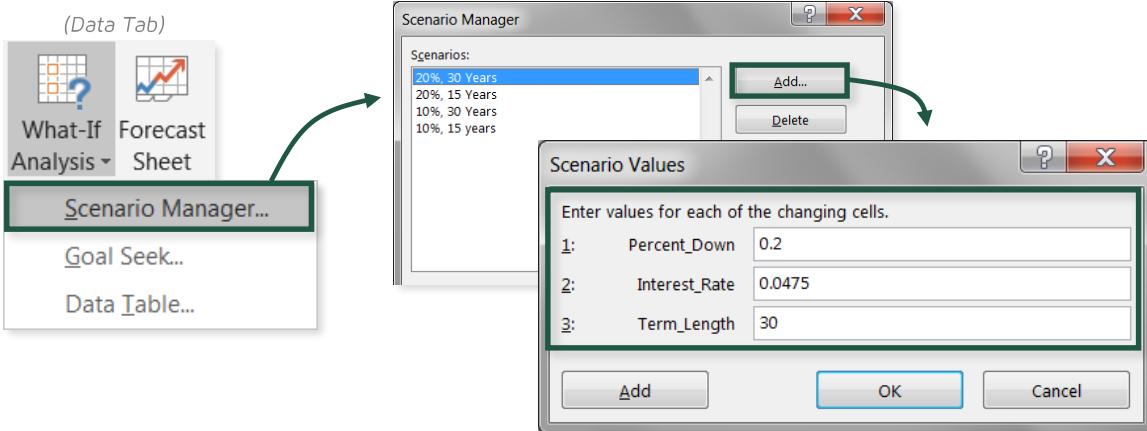
- Use the **Scenario Manager** to save and access specific combinations of cell values (*Data > What-If Analysis > Scenario Manager*)
 - This is often used for modeling exercises, allowing you to fix combinations of *inputs* in order to evaluate a calculated *output*
- **TIP:** Give your input cells meaningful names (i.e. "*Interest_Rate*" vs. *\$A\$1*)



ANALYTICS



2 STARS (BASIC)



Scenario #1

PROPERTY COST	
Purchase Price	\$899,000
Tax Rate	\$9.50

LOAN COST	
Down Payment %	20%
Interest Rate	4.75%
Term Length (yrs)	30
Loan Amount	\$719,200
Est. Closing Costs	\$17,980

Cash to Close:
\$197,780

Monthly Expenses:
\$4,813

Scenario #2

PROPERTY COST	
Purchase Price	\$899,000
Tax Rate	\$9.50

LOAN COST	
Down Payment %	20%
Interest Rate	4.00%
Term Length (yrs)	15
Loan Amount	\$719,200
Est. Closing Costs	\$17,980

Cash to Close:
\$197,780

Monthly Expenses:
\$6,382

Scenario #3

PROPERTY COST	
Purchase Price	\$899,000
Tax Rate	\$9.50

LOAN COST	
Down Payment %	10%
Interest Rate	5.75%
Term Length (yrs)	30
Loan Amount	\$809,100
Est. Closing Costs	\$17,980

Cash to Close:
\$107,880

Monthly Expenses:
\$5,783

Scenario #4

PROPERTY COST	
Purchase Price	\$899,000
Tax Rate	\$9.50

LOAN COST	
Down Payment %	10%
Interest Rate	5.00%
Term Length (yrs)	15
Loan Amount	\$809,100
Est. Closing Costs	\$17,980

Cash to Close:
\$107,880

Monthly Expenses:
\$7,460

COMMON USE CASES:

- Building forecasts based on several variables (seasonality, interest rate, etc.)
- Modeling several potential outcomes in cases where uncertainty is a factor (i.e. stock portfolio returns)

PRO TIP

SOLVE FOR INDIVIDUAL OUTPUTS WITH GOAL SEEK

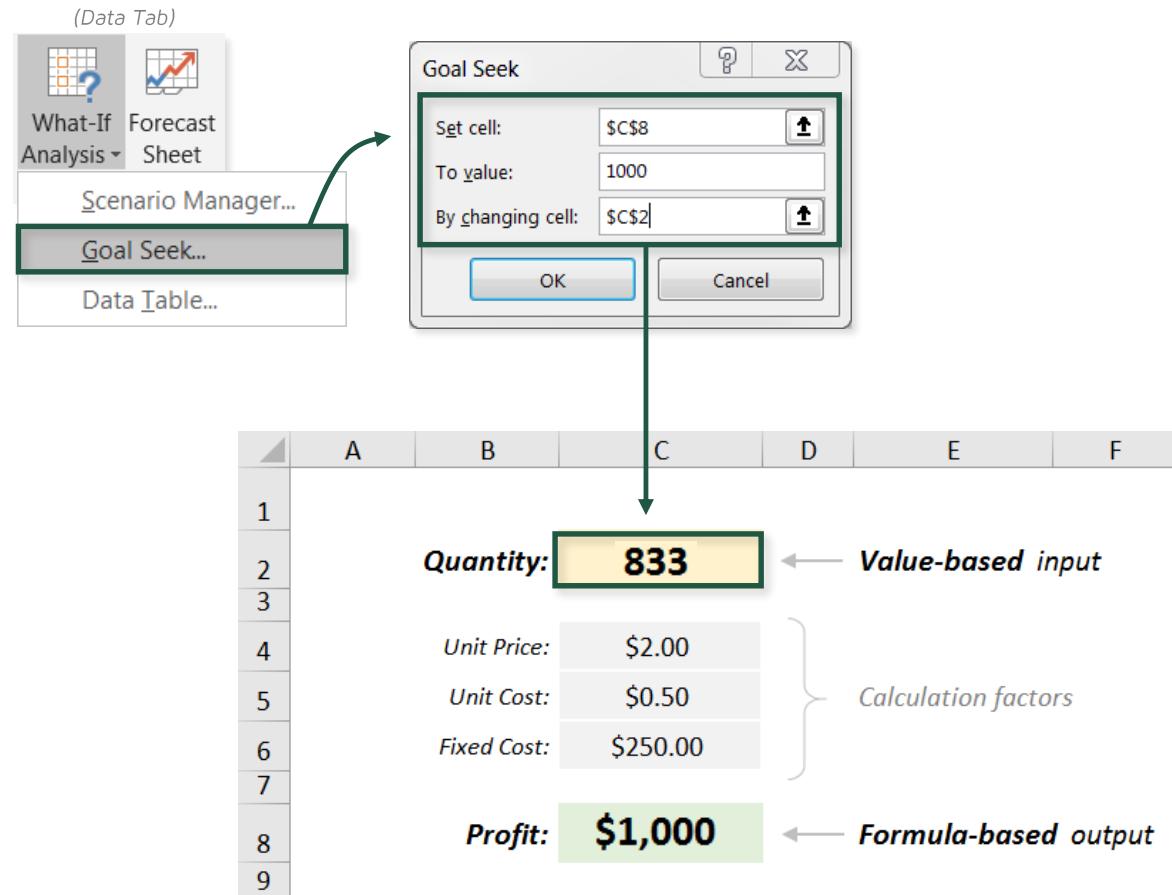
- Use **Goal Seek** to find the result you want by changing the value of a given input cell (*Data > What-If Analysis > Goal Seek*)
 - **Goal Seek** requires a single, hard-coded *input* cell and a single, formula-based *output* cell; you cannot test multiple inputs
- **TIP:** To evaluate multiple inputs, add constraints, or solve complex optimization problems, use Excel's **Solver** tool (*requires the Solver Add-In*)



ANALYTICS



2 STARS (BASIC)



COMMON USE CASES:

- Determining the ideal input required to produce a specific goal or target outcome (i.e. number of sales required to yield a positive profit)
- Solving simple optimization problems based on a single input variable

PRO TIP

CREATE FORECAST SHEETS FROM HISTORICAL DATA

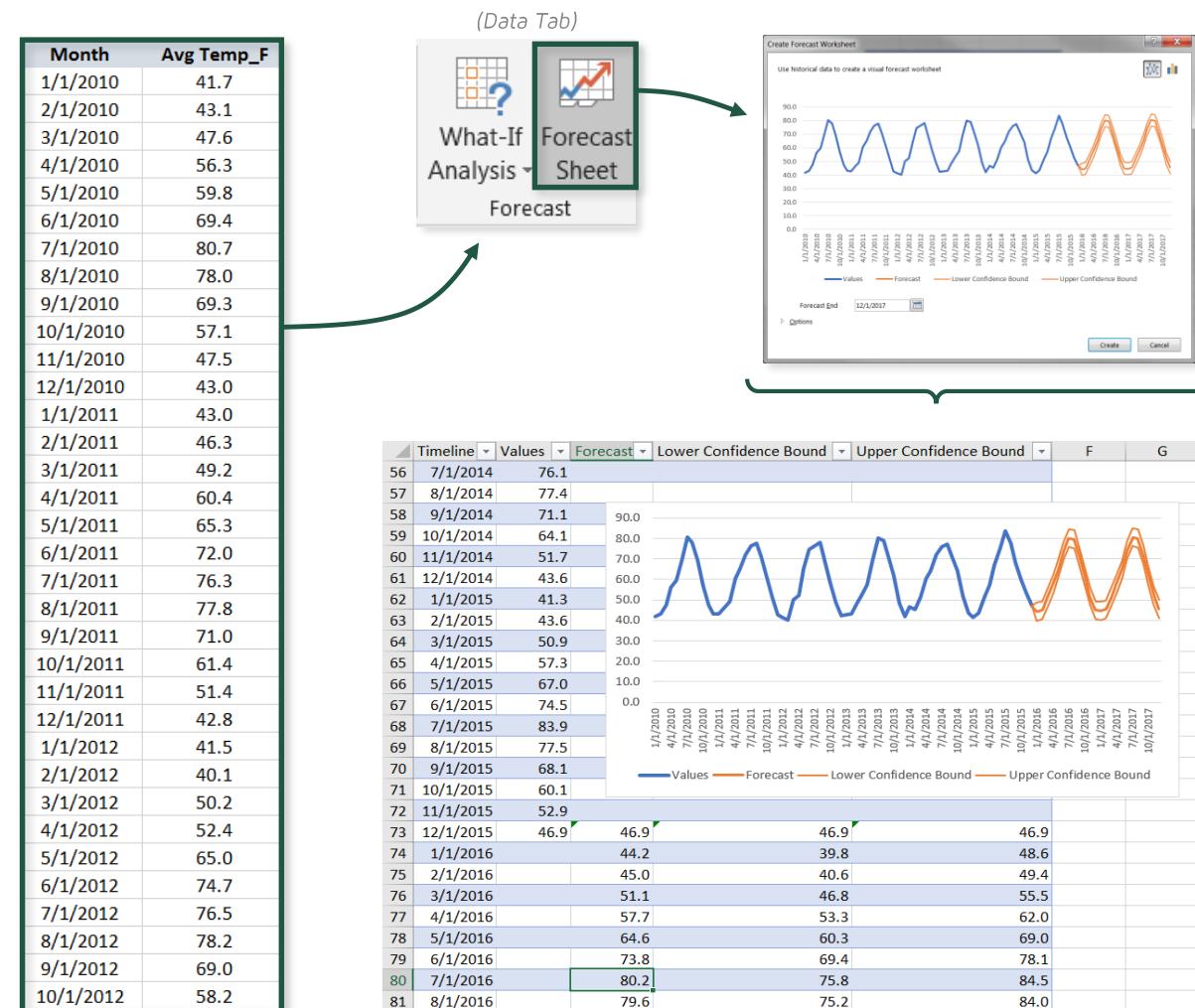
- Recent versions of Excel (2016/365) include a built-in **Forecast Sheet** tool to calculate forecasts based on given historical data
 - The **Forecast Sheet** dialog box allows you to set the **forecast length** and **confidence interval**, detect **seasonality**, and customize handling of **missing** or **duplicate** values
- NOTE:** Trendlines can be used for simple forecast exercises, but do not account for confidence or seasonality



ANALYTICS



3 STARS (MODERATE)



COMMON USE CASES:

- Predicting future values such as interest rates or stock returns
- Calculating an expected range of future outcomes based on a given level of confidence

PRO TIP

FIND OUTLIERS WITH STATS FUNCTIONS & FORMATTING

- Use functions like **MEDIAN** and **QUARTILE** to **calculate statistical outliers**, and **conditional formatting** to highlight them
 - Outliers are commonly defined using a “**fence**” based on how far a value falls outside of the **interquartile range (IQR)**
- **TIP:** For simple “**Top N**” or “**Top %**” calculations, use basic conditional formats

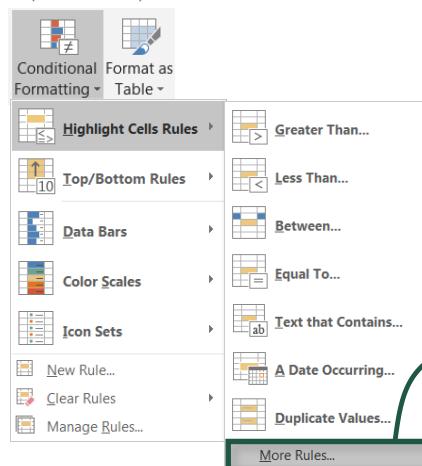


ANALYTICS



4 STARS (ADVANCED)

(Home Tab)



New Formatting Rule

Select a Rule Type:

- Format all cells based on their values
- Format only cells that contain
- Format only top or bottom ranked values
- Format only values that are above or below average
- Format only unique or duplicate values
- Use a formula to determine which cells to format

Edit the Rule Description:

Format only cells with:

Cell Value not between =F\$8 and =F\$11

Preview: AaBbCcYyZz

Format...

OK Cancel

	A	B	C	D	E	F
1	Player Name	Height (in)	Weight (lbs)		OUTLIER CALCULATIONS	
2	Jon Rauch	83	260		Median: 74	
3	Randy Johnson	82	231		1st quartile: 72	
4	Chris Young	82	250		3rd quartile: 75	
5	Andrew Sisco	81	260		IQR: 3	
6	Mark Hendrickson	81	230		Fence Multiplier: 1.5	
7	Kyle Snyder	80	220			
8	Richie Sexson	80	237		Inner Fence (lower): 67.5	
9	Scott Elarton	80	240			
10	Phil Stockman	80	240		Outer Fence (upper): 79.5	
11	Jason Hirsh	80	250			
12	Daniel Cabrera	79	230			
13	Jered Weaver	79	205			
14	C.C. Sabathia	79	290			

Outlier calculations

COMMON USE CASES:

- Identifying statistical anomalies in a dataset, based on custom criteria
- Finding and removing values that may have been incorrectly entered

PRO TIP

EVALUATE VARIABLE INPUTS WITH DATA TABLES

- **Data Tables** allow you to calculate an array of results based on a range of input values (*Data > What-If Analysis > Data Table*)
 - **Data Tables** can be used to evaluate formula results based on changes to either a *single* input variable or *multiple* variables
- **TIP:** Change the calculation mode to “Automatic Except for Data Tables” to prevent them from constantly recalculating



ANALYTICS



4 STARS (ADVANCED)

A	B	C	D	E	F	G	H	I	J	K
1										
2										
3										
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11										
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15										
16										
17										
18										
19										

PROPERTY DETAILS



Address: 63 Evergreen Zip Code: 01730
MLS #: 72393006 Year Built: 2018
Beds/Baths: 3/2+ Listing Date: 9/1/2018
Sq Ft: 2,059 \$/Sq. Ft: \$436.62
Notes: Close to town center and schools, borders preservation land and walking trails

PROPERTY COST

Purchase Price	\$899,000
Tax Rate	\$9.50

LOAN COST

Down Payment %	20%
Interest Rate	3.00%
Term Length (yrs)	15
Loan Amount	\$719,200
Est. Closing Costs	\$17,980

MONTHLY EXPENSES

Mortgage Costs	\$4,967
Property Tax	\$712
Utilities	\$150
Home Insurance	\$200
HOA Fees	\$0

Interest Rate **Monthly Cost**

Selected	\$4,967
3.0%	\$4,967
3.5%	\$5,141
4.0%	\$5,320
4.5%	\$5,502
5.0%	\$5,687
5.5%	\$5,876
6.0%	\$6,069
6.5%	\$6,265
7.0%	\$6,464
7.5%	\$6,667
8.0%	\$6,873
8.5%	\$7,082
9.0%	\$7,295
9.5%	\$7,510
10.0%	\$7,729

(Data Tab)

What-If Analysis Forecast Sheet Forecast Scenario Manager... Goal Seek... Data Table...

Data Table

Row input cell: Column input cell: OK Cancel

Interest Rate Monthly Cost

Selected	\$4,967
3.0%	\$4,967
3.5%	\$5,141
4.0%	\$5,320
4.5%	\$5,502
5.0%	\$5,687
5.5%	\$5,876
6.0%	\$6,069
6.5%	\$6,265
7.0%	\$6,464
7.5%	\$6,667
8.0%	\$6,873
8.5%	\$7,082
9.0%	\$7,295
9.5%	\$7,510
10.0%	\$7,729

COMMON USE CASES:

- Calculating a matrix of results based on combinations of input values (i.e. monthly payments based interest rates and down payments)
- Identifying the optimal outcome given multiple variable inputs

PRO TIP

CONNECT & SHAPE DATA WITH POWER QUERY

- Power Query (aka “*Get Data*” or “*Get & Transform*”) is used to connect, transform, and load data from external sources
 - All operations are saved with the query as “**Applied Steps**”, and repeated each time the connection is refreshed (*like a macro*)
- Data can be loaded to worksheets or to the **Data Model**, where you can store much more data and build relational models to connect tables from multiple sources



ANALYTICS



4 STARS (ADVANCED)

The screenshot illustrates the Microsoft Power Query interface. At the top, the "Data Tab" shows options like "From Text/CSV", "Recent Sources", and "Existing Connections". Below this is the "Get & Transform Data" ribbon tab. The "Query Preview" window displays a table of data from "kickstarter_projects.csv", with an "Edit" button. The main workspace shows a table of Kickstarter project data with columns like "in_category", "deadline", "launched", "state", "backers", "country", "usd_pledged_real", and "usd_goal_real". The "Query Editing Tools" pane on the right details the "Applied Steps" taken to process the data, including "Changed Type1".

COMMON USE CASES:

- Connecting to flat files or database sources, and transforming or filtering the data before loading into Excel for further analysis
- Creating an automated ETL (**extract, transform, load**) process that can be refreshed as new data becomes available

PRO TIP

BUILD RELATIONAL DATA MODELS IN EXCEL

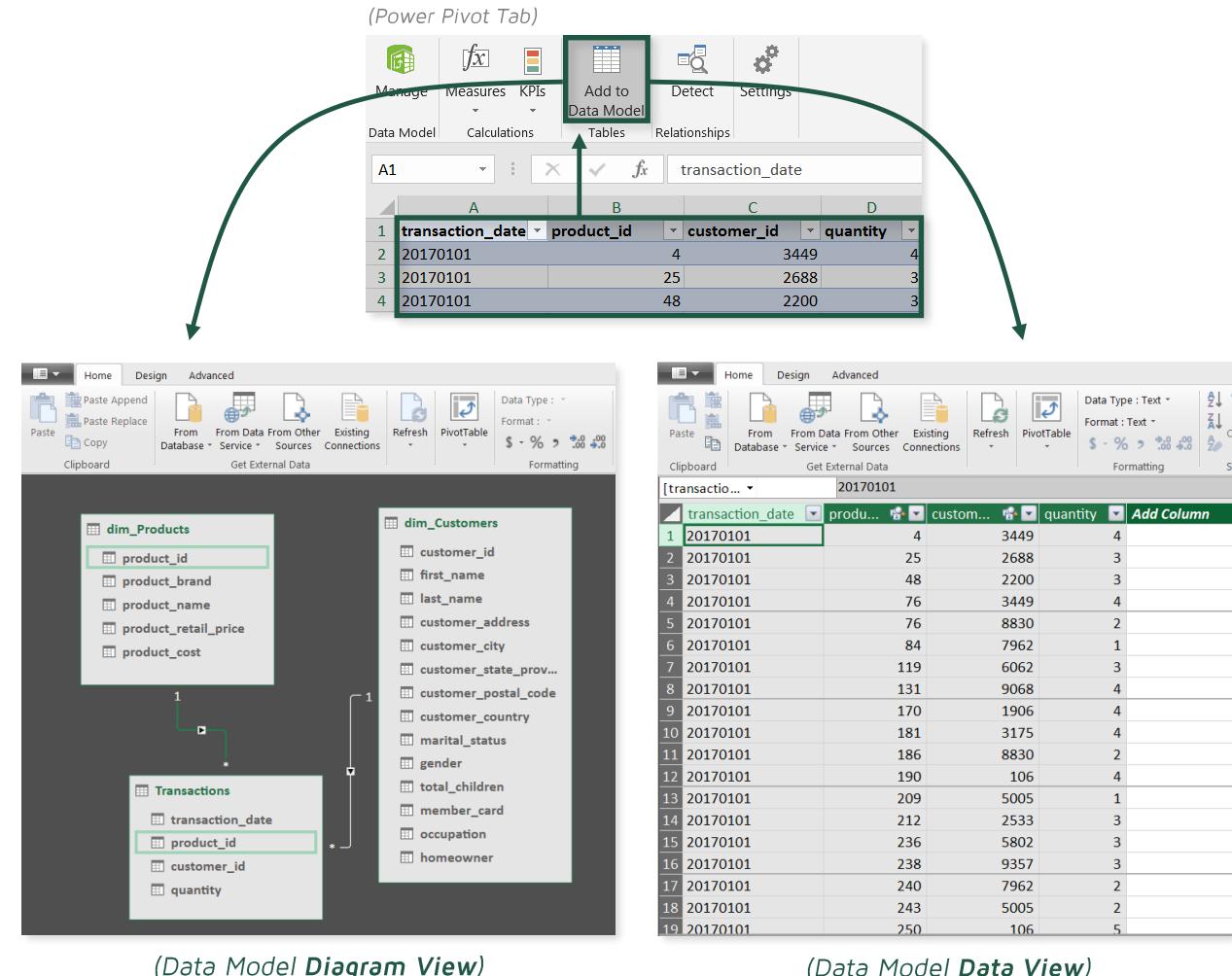
- Use Excel's **Data Model** to compress large amounts of data, create table relationships, and add calculated measures with DAX
 - Once table relationships are defined, use **Power Pivot** to explore and analyze data from multiple sources in a single view
- **NOTE:** Some versions of Excel may not have access to data modeling tools; if you don't see Power Pivot, check (**File > Options > Add-Ins > COM Add-Ins**)



ANALYTICS



4 STARS (ADVANCED)



(Data Model Diagram View)

(Data Model Data View)

COMMON USE CASES:

- Combining information from multiple sources without actually "stitching" the data together by merging or using LOOKUP/INDEX functions
- Building robust business intelligence solutions that integrate and blend data across many sources (sales, HR, finance, marketing, etc.)

PRO TIP

EXPLORE DATA MODELS WITH CUBE FUNCTIONS

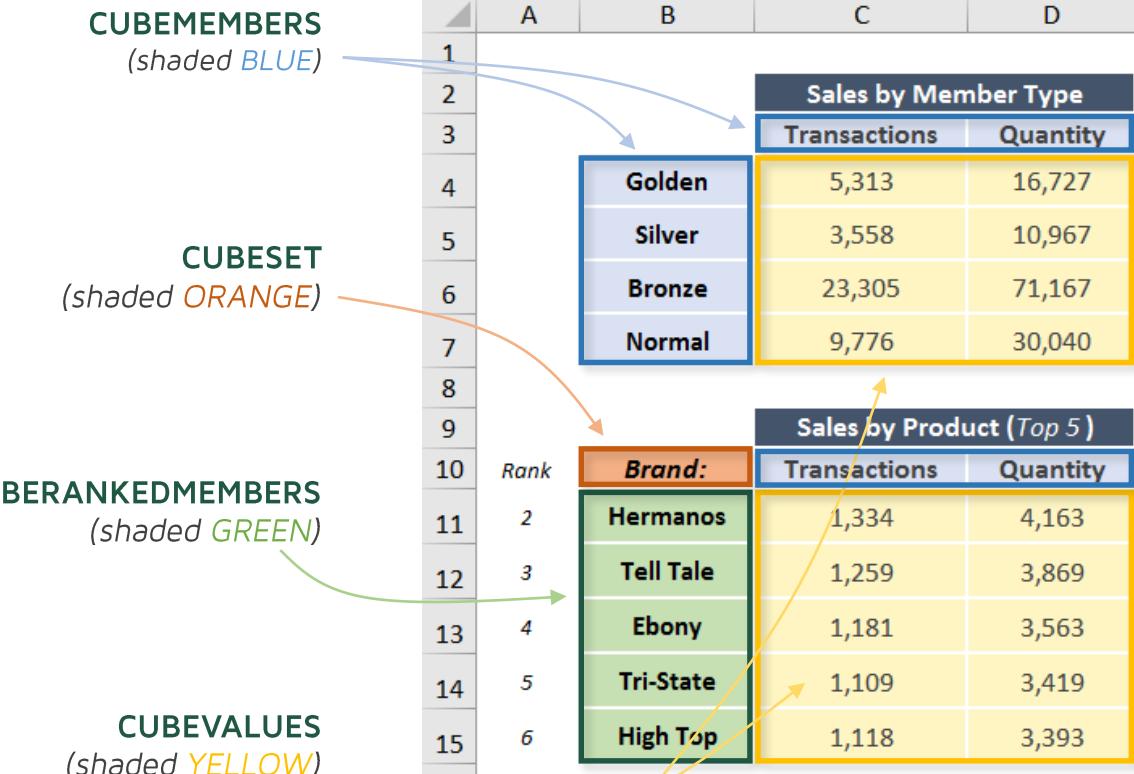
- Use **CUBE functions** (vs. Pivots) to pull values from a Data Model *directly into cells*:
 - **CUBESET**: A collection of items or members (*i.e. one column from a table in the model*)
 - **CUBEMEMBER**: A single item within a cubeset (*i.e. one item from a table column*)
 - **CUBERANKEDMEMBER**: A single item within a cubeset, based on an ordered rank
 - **CUBEVALUE**: An aggregated numerical value based on a set of member expressions
- **MORE INFO:** <http://bit.ly/2PYgdo0>



ANALYTICS



5 STARS (EXPERT)



COMMON USE CASES:

- Building spreadsheet-based reports or dashboards from data in the Data Model without relying on PivotTables
- Documenting all of the sets and members within a data model

PRO TIP

BUILD A MONTE CARLO SIMULATION MODEL

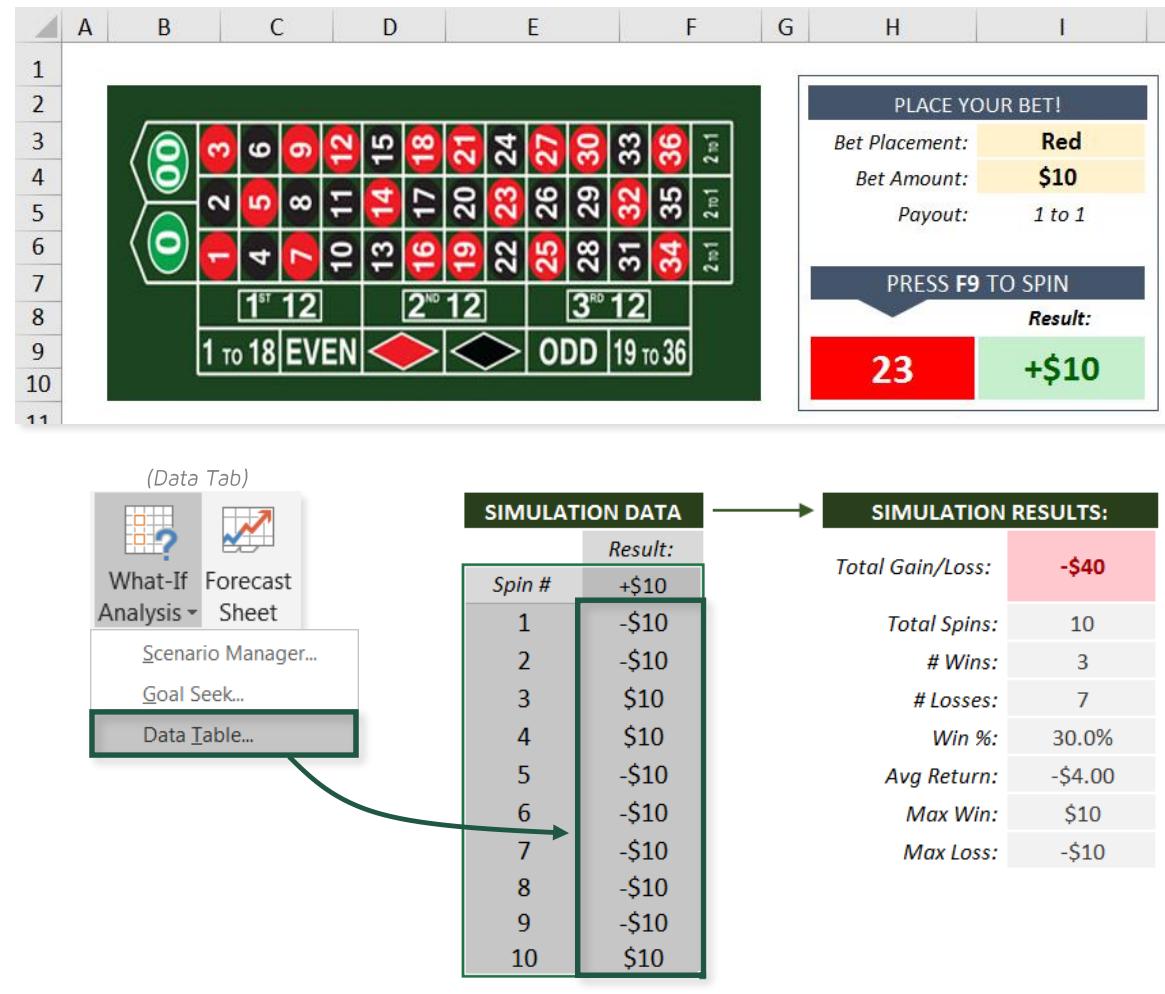
- Monte Carlo simulation is commonly used to predict the probability of given outcomes based on repeated random sampling
- In Excel, use RAND or RANDBETWEEN to randomize formula inputs, and Data Tables to generate an array of results
 - Based on the resulting array, you can use stats functions like FREQUENCY or COUNTIF to calculate outcome probabilities
 - TIP: Referencing a blank cell as the Data Table input allows each row to randomize



ANALYTICS



5 STARS (EXPERT)



COMMON USE CASES:

- Randomly simulating a model thousands of times in order to understand the probability of certain outcomes (i.e. probability of a profit vs. loss)
- Building predictive models that account for a given degree of uncertainty for one of more inputs (i.e. future interest rates, supply costs, etc.)

PRO TIP

OPTIMIZE COMPLEX MODELS WITH SOLVER

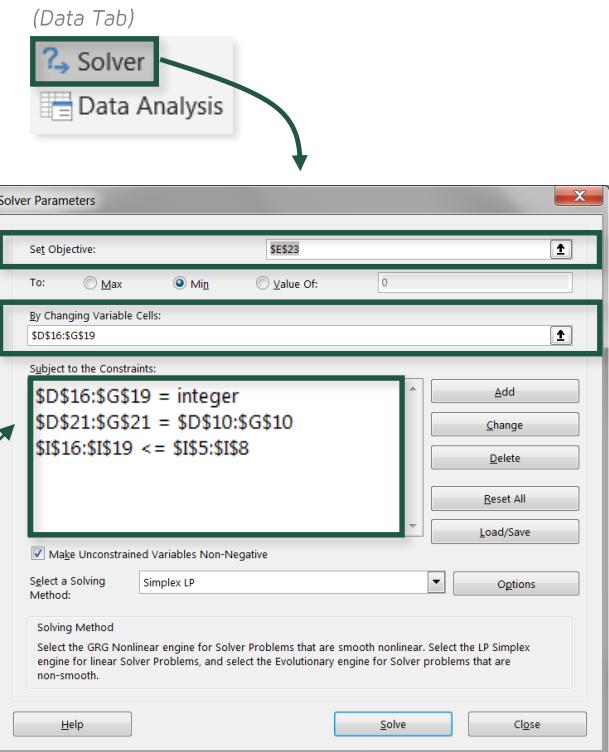
- Use **Solver** to solve complex optimization problems that require multiple decision variables and constraints
 - Unlike Goal Seek, **Solver** allows you to *minimize*, *maximize*, or *target* an objective value by changing multiple input cells, subject to given constraints
 - Select **Simplex LP** for linear optimizations, and **GRG** or **Evolutionary** for non-linear
 - **NOTE:** To use Solver, activate the plug-in (*File > Options > Add-Ins > Excel Add-Ins*)



ANALYTICS



5 STARS (EXPERT)



COMMON USE CASES:

- Determining optimal results subject to real-world constraints (i.e. limited inventory, price floors, integer values, etc.)

PRO TIP

EXPLORE DATA WITH THE ANALYSIS TOOLPAK

- **Analysis ToolPak** is a built-in Excel plug-in that supports a range of advanced **data analysis** and **statistical** methods (Anova, Covariance, Regression, T-Tests, etc.)
 - It can also be used to quickly generate key **descriptive statistics**, such as mean, mode, variance, range, count, skewness, etc.
- **NOTE:** You'll need to activate the plug-in (*File > Options > Add-Ins > Excel Add-Ins*)



ANALYTICS



5 STARS (EXPERT)

The diagram illustrates the use of the Analysis ToolPak. On the left, a table of athlete data is shown with columns for Athlete Name, Age, Height (cm), and Weight (kg). An arrow points from this table to the 'Data Analysis' button in the ribbon. Another arrow points from the 'Data Analysis' button to the 'Analysis Tools' dropdown menu. From the 'Analysis Tools' menu, an arrow points to the 'Descriptive Statistics' option, which is highlighted. The 'Descriptive Statistics' option is also connected to a table of descriptive statistics results on the right. This table includes rows for Mean, Standard Error, Median, Mode, Standard Deviation, Sample Variance, Kurtosis, Skewness, Range, Minimum, Maximum, Sum, Count, Largest(1), Smallest(1), and Confidence Level(95).

A	B	C	D
Athlete Name	Age	Height (cm)	Weight (kg)
Th Anh	20	165	58
Th Ngn Thng	23	147	47
Th Ngn Thng	19	147	47
A Lamusi	23	170	60
A. Joshua "Josh" West	31	207	105
Aadam Ismaael Khamis	19	172	67
Aarik Wilson	25	191	88
Aarn Sarmiento Padilla	25	180	72
Aarn Sarmiento Padilla	21	180	72
Aaron Arthur Cook	25	183	80
Aaron Arthur Cook	17	183	80
Aaron Blunck	17	180	78
Aaron Brown	24	198	79
Aaron Brown	20	198	79
Aaron Feltham	26	190	94
Aaron Gate	25	181	71
Aaron Gate	21	181	71
Aaron J. "AJ" Bear	29	170	82
Aaron James Ramsey	21	178	70
Aaron James Scott	22	177	72

(Data Tab)
Solver
Data Analysis

Analysis Tools
Anova: Single Factor
Anova: Two-Factor With Replication
Anova: Two-Factor Without Replication
Correlation
Covariance
Descriptive Statistics
Exponential Smoothing
F-Test Two-Sample for Variances
Fourier Analysis
Histogram

Age	Height	Weight			
Mean	26.17	Mean	176.621	Mean	72.29102
Standard Error	0.027019	Standard Error	0.054766	Standard Error	0.079224
Median	26	Median	176	Median	70
Mode	25	Mode	180	Mode	70
Standard Deviation	5.368748	Standard Deviation	10.88208	Standard Deviation	15.74192
Sample Variance	28.82346	Sample Variance	118.4196	Sample Variance	247.8081
Kurtosis	2.579227	Kurtosis	-0.07802	Kurtosis	1.991954
Skewness	1.019345	Skewness	0.168582	Skewness	0.954482
Range	59	Range	93	Range	186
Minimum	12	Minimum	133	Minimum	28
Maximum	71	Maximum	226	Maximum	214
Sum	1033244	Sum	6973350	Sum	2854194
Count	39482	Count	39482	Count	39482
Largest(1)	71	Largest(1)	226	Largest(1)	214
Smallest(1)	12	Smallest(1)	133	Smallest(1)	28
Confidence Level(95	0.052958	Confidence Level(95	0.107343	Confidence Level(95	0.155281

Age	Height	Weight	
Age	100%		
Height	11%	100%	
Weight	18%	78%	100%

COMMON USE CASES:

- Quickly generating descriptive statistics without using cell formulas
- Exploring or analyzing data using more advanced statistical methods or tools (analyzing variance, building predictive models, etc.)