

Mastering Essential Formulas: The LOOKUP





Why Use a LOOKUP?

LOOKUP formulas empower you to pull out just the data you care about from a massive source. Using LOOKUPS helps you avoid errors, and easily rearrange or update your data. When you use formulas that reference a cell's location (i.e. "B10"), sorting tables, or inserting rows can create issues. LOOKUPS allow you to get the data you want by matching the criteria you're looking for (i.e. "Alabama"), rather than the exact cell location ("B10").

Step-By-Step Instructions for Workshop Exercise

What follows is a set of step by step instructions for the workshop demonstration taking place November 30, 2016. We are using [FY13 State and Local Government Finance](#) as a practice dataset.

Helpful Tools for Setting up the Source Dataset and Final Table

- **Rename Tabs:** Rename the source tab "Source". Create a new tab "Table".
- **Add State Names to Each Individual Column in the Source:** Highlight Row 10. On the **Home** tab, click  Merge & Center to unmerge cells.
- **Select and Fill All Blank Cells at Once:** Highlight row 10. On the home tab, click and then 'Go to Special'. Click 'Blanks'. Click and hold **CTRL** while selecting cell D10. Then type "=C10". Click and hold **CTRL** while pressing enter. All the blank cells should fill with the appropriate state name. 
- **Create a Unique Name for Each Column with "&" or CONCAT:** Highlight row 10. Insert a row above. Select cell C10. Type =C11&C15. The cell should fill with "United States Total1". Drag this row horizontally. Now every column has a unique name. This will come in handy later.
- **Add a Helper Column:** Select cell C10. Type 1. Select cell C11 and type "=C10+1". Drag down. Now you have a helper column telling you what row each variable is in your array.
- **Paste Special & Removing Duplicates:** Select cell C11. Simultaneously press **CTRL, SHIFT** and **->** to select all the cells with data in them. Copy (**CTRL C**). Navigate to second tab "Table". Select cell C5. **Right click** to view paste special options (paste values, paste formulas, paste formatting, etc.) Choose  Transpose. Select B5. Press CTRL, SHIFT and down arrow to select all the state names. Choose  Remove Duplicates. **Data Tab.**
- **Add a Helper Cell:** On the Table tab, type "1" in cell D2.

Practicing an HLOOKUP

Lookup formulas have four parts: the lookup value, the table array, the row index num, and the range lookup. When you click on part of the formula in the formula bar, one of these four phrases will bold to tell you what Excel thinks it is. You need an HLOOKUP when your lookup value is organized horizontally in the source datasheet. You need a VLOOKUP when your lookup value is organized vertically in the source datasheet.

- **Lookup Value:** Go to 'Table' tab. Select C5. Type "HLOOKUP(\$B5&\$D\$2)," into the formula bar. The state name (\$B5) is the lookup value, it's what you want the formula to find and match in the source tab. The \$ locks in the column or row it's put in front of. You always want the formulas to look for the state name, so you lock in column B. So in other words, you want the formula to find United States Total (B5) and 1 (D2) or 'United States Total1' in the first row of the array.
- **Table Array:** The Table Array tells you where you want excel to look. Go to the Source tab and select C11 to EB197. Use CTRL, Shift, arrows to help do it quickly. Then lock in the array with \$. Type them in or use F4.
- **Row Index Num:** This is the row number of the value you want. Excel starts counting from the first row in the array, not the spreadsheet. So to get "Individual Income" we'll type in "27" instead of "37"
- **[Range lookup]:** You almost always want an exact match [0 or FALSE]. Occasionally you may want an approximate match [1 or TRUE].
- Your final formula in C5 should look like this:
"HLOOKUP(\$B5&\$D\$2),Source!\$C\$10:\$EB\$197,27,0)"
- **Copying Over the Formula:** Copy and paste the formula into cells D5 and E5. Adjust the row index number to reflect other values you're interested in, say corporate income (28) and general sales (20). Highlight C5, D5 and E5 and double click on the green square in the corner to fill down.

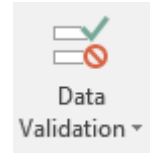
Practicing a VLOOKUP

- Create a new tab and call it "VLOOKUP"
- Copy and paste the state names into cell B5 on this tab.
- Practice entering a VLOOKUP into cell C5. Use the "Table" tab as your source array. Retrieve Sales Tax revenue by state.

Making an Interactive Table with a Drop-Down Menu

- **Practice Your Conceptual Understanding:** Try changing the 1 in cell D2 to a “3”. Now change it to “4”. See how the figures change? That’s because you’re now pulling from the “state only” or “local only” columns respectively.
- **Create a Helper Drop Down Tab:** Create a new tab. Call it ‘Drop Down’. Type in the following:

	A	B	C	D
1				
2		State & Local	1	
3		State Only	3	
4		Local Only	4	
5				
6				



- **Create a Dropdown:** On the **Table** tab, select E2. Choose the **Data** tab. Click Under “Allow” change the drop down from ‘any value’ to ‘list’. Click on the space beneath ‘Source’ then navigate to or type in “=‘Drop Down!’\$B\$2:\$B\$4”
- **Adjusting the LOOKUP to Reference the New Drop Down:** The current formula says: “=HLOOKUP(\$B5&D\$2),Source!\$C\$10:\$EB\$197,27,0)”. We want to change the D2 cell reference to the dropdown, and we’re going to use a VLOOKUP to help us. In your formula bar, delete D\$2 and type in/ navigate to instead “(VLOOKUP(\$E\$2, ‘Drop Down!’\$B\$2:\$C\$4,2,0))”. In other words, you’re asking Excel to Look for whatever text is in E2 in your helper Drop Down tab and return to you right number you need to join the state name to get the state only or local only or state & local data for any given state.

- Your final formula should look like this:

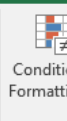

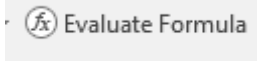
=HLOOKUP(\$B5&(VLOOKUP(\$E\$2,‘Drop Down!’\$B\$2:\$C\$4,2,0)),Source!\$C\$10:\$EB\$197,27,0)

- Copy over to columns D and E and adjust the row numbers again to 28 and 20. Fill down. Now you have an interactive table

Checking

*This example doesn’t lend itself to a good check, but If we had a source dataset with a total, then we could **SUM** the variables in our table to make sure the sum of our variables equals the total in the source data. To show how this works, let’s create a fake Sum and Total. In cell G5 and Cell H5 type “=SUM(C5:E5)”. Label one “Sum” and one “Total”, as if that were the case for this data.*

- **IF CLAUSES:** IF clauses are useful for all kinds of things, especially a quick check. An IF clause has 3 parts: the logical test, the value if true, the value if false.
 - **The Logical Test:** Does the sum equal the total or G5=H5
 - **The Value if True:** “TRUE” or “0” or “” (whatever you want)
 - **The Value if False:** “FALSE” or 1”
 - In Cell I5, type the full formula: ‘=IF(G5=H5,0,”X”)

- **Conditional Formatting:** To make certain values stand out, say the “X”s in your IF clause Check column. Highlight the area you want the rules to apply (Column I). On the **Home** tab, select **Conditional Formatting**, then **Highlight Cell Rules**, then **Text that Contains**, and type in X. Add an intentional error in your table. Watch as a red X pops up in the check column. 
- **How to Quickly Scan Formulas:** Select a cell. Simultaneously press **CTRL** and ` (tilde) to see all cells in formula mode. Select the triangle in the left-most corner  to select all rows and columns. Double-click on the line between any two columns to stretch all columns to the full width of their contents. Scan formulas for anomalies. To return to normal press CTRL and ` again.
- **IFERROR:** You may have a dataset that returns a “#DIV/0!” error because you can’t divide by 0 for every state. You can use IFERROR to make those cells blank instead, so they’re more visually appealing. IFERROR has just two parts: value, value if error. In cell K5, type “=IFERROR(H5/D5,”)”. As you can see, “” returns nothing if there’s an error instead of “#DIV/0!”.
- **Evaluate Formula:** Sometimes, understanding how a nested formula calculates the final result is difficult because there are several intermediate calculations and logical tests. Click on cell C5 for example, go to the **Data** tab and select  Keep clicking Evaluate

Ways to Avoid Common LOOKUP Errors

- Make sure the first row or column of your “table array” in the source data contains the information you want to look up. The HLOOKUP will not be able to locate ‘Alabama’ if Alabama is not in the first row of the array. The VLOOKUP will not be able to locate ‘Alabama’ if it is not the left-most column in your array.
- Make sure the table array is locked with \$ and includes the whole dataset
- Spot check a few of your LOOKUPS to make sure you’ve put in the right row or column number as the ‘index number’ to get the data you want. Remember that you have to start counting the rows or columns from the first in the *array*, not the first in the *spreadsheet*

Other Useful Formulas

There are countless useful excel tips and tricks but my two big pieces of advice are to make use of YouTube tutorials, and practice resolving your own errors. Scan this list of key formulas below and make sure you're familiar with them. If not, watch some YouTube Videos and learn!

Useful Formulas

	Description
VLOOKUPS	=VLOOKUP(Value you want to look up, range where you want to lookup the value, the column number in the range containing the return value, Exact Match or Approximate Match – indicated as 0/FALSE or 1/TRUE). Use VLOOKUP when your comparison values are located in a column to the left of the data you want to find.
HLOOKUPS	Searches for a value in the top row of a table or an array of values, and then returns a value in the same column from a row you specify in the table or array. Use HLOOKUP when your comparison values are located in a row across the top of a table of data, and you want to look down a specified number of rows.
IF	The IF function is one of the most popular functions in Excel, and it allows you to make logical comparisons between a value and what you expect. In its simplest form, the IF function says: IF(Something is True, then do something, otherwise do something else). So an IF statement can have two results. The first result is if your comparison is True, the second if your comparison is False.
AND	Use the AND function, one of the logical functions, to determine if all conditions in a test are TRUE.
OR	Use the OR function, one of the logical functions, to determine if any conditions in a test are TRUE.
SUM	You can add individual values, cell references or ranges or a mix of all three.
SUMIF	You use the SUMIF function to sum the values in a range that meet criteria that you specify. For example, suppose that in a column that contains numbers, you want to sum only the values that are larger than 5. You can use the following formula: =SUMIF(B2:B25,">5")
COUNTIF	Use COUNTIF, one of the statistical functions, to count the number of cells that meet a criterion; for example, to count the number of times a particular city appears in a customer list.
IFERROR	Returns a value you specify if a formula evaluates to an error; otherwise, returns the result of the formula. Use the IFERROR function to trap and handle errors in a formula.
AVERAGE	Returns the average (arithmetic mean) of the arguments.
MEDIAN	Returns the median of the given numbers. The median is the number in the middle of a set of numbers.

CONCAT or &	The CONCAT function combines the text from multiple ranges and/or strings, but it doesn't provide the delimiter or IgnoreEmpty arguments.
TRIM	Removes all spaces from text except for single spaces between words. Use TRIM on text that you have received from another application that may have irregular spacing.
FIND/REPLACE	Find and replace text and numbers using wildcards or other characters. You can search sheets, rows, columns, or workbooks.
MATCH/INDEX	The MATCH function searches for a specified item in a range of cells, and then returns the relative position of that item in the range. The INDEX function returns a value or the reference to a value from within a table or range. Together, you can use them with fewer limitations than VLOOKUPs and HLOOKUPs.
GO TO SPECIAL	You can use the Go To command to quickly find and select all cells that contain specific types of data (such as formulas or blanks).
TEXT TO COLUMNS	You can take the text in one or more cells, and spread it out across multiple cells. For example, if you have a column of full names, you can split that column into separate first name and last name columns.
EVALUATE FORMULA	Sometimes, understanding how a nested formula calculates the final result is difficult because there are several intermediate calculations and logical tests. However, by using the Evaluate Formula dialog box, you can see the different parts of a nested formula evaluated in the order the formula is calculated
PASTE SPECIAL	There are two ways to paste specific cell contents or attributes like a formula, format, or comment copied from another cell. You can either pick a specific paste option directly from the Paste menu or click Paste Special , and pick an option from the Paste Special box.
PROPER	Capitalizes the first letter in a text string and any other letters in text that follow any character other than a letter. Converts all other letters to lowercase letters.
LOWER	Converts all uppercase letters in a text string to lowercase.
UPPER	Converts text to uppercase.

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