EVERY EXCEL LOOKUP EXPLAINED

Get ready to become an Excel lookup expert!

Excel Lookups Explained

Over the years, I've noticed a lot of folks having trouble understanding Excel LOOKUP functions. By lookup functions I mean LOOKUP, HLOOKUP, VLOOKUP, MATCH, and XLOOKUP.

So, in the essay, I am trying to bring together what all of these lookup functions have in common. In this way, my hope is that you get a sense of the theory that comprise these functions. If you can understand the theory, then the old functions take on new meaning. Better yet, new functions like XLOOKUP make a lot more sense – and you'll learn them quicker.

All Excel lookup functions follow this same framework.

A LOOKUP FUNCTION FRAMEWORK

Let's take a look at the VLOOKUP function:

```
VLOOKUP( what_we're_searching_for, where_we're_going_to_look,
column_number_to_pull, the_match_type)
```

Now, let's replace the following parameters from our VLOOKUP with symbols

🔎 = what_we're_searching_for

🚪 = where_we're_going_to_look

… = column_number_to_pull

❓ = the_match_type

…and let's put them back into our lookup:

VLOOKUP(🔎, 🚪, …, ❓)

Let's consider "…" to refers to any *optional* parameter that is part of a lookup. And now let's extend this idea…

The MATCH function, which returns the record location where a value is matched within a row or column, follows a similar pattern.

```
MATCH( what_we're_searching_for, where_we're_going_to_look, the_match_type)
```

… and we can assign the symbols as follows….

🔎 = what_we're_searching_for

🚪 = where_we're_going_to_look

❓ = the_match_type

MATCH(🔎, 🚪, ❓)

In fact, we can summarize ALL excel lookup functions with the following axioms:

1. The first parameter 🔎 is always what we're looking for
2. The second parameter 📄 is always where we're going to look
3. The third parameter … represents additional options specific to that lookup type (MATCH has no options; VLOOKUP and HLOOKUP have options; XLOOKUP does as well, we'll get to that in a second)
4. The final parameters(s) ❓ is/are always the match type(s)

Which means all Excel lookups following this generalized form:

LOOKUP(🔎, 📄, …, ❓)

VLOOKUP & INDEX/MATCH

With the understanding of how all Excel lookups work, let's compare what VLOOKUP against INDEX/MATCH. The core difference really comes down to the two different workflows each function represents.

VLOOKUP, as you might recall, always searches the left-most side of a table. For VLOOKUP to work best, that left most column must contain unique values. Each of these unique values is what I call a *key*. If you have some database experience, using the term key (or more aptly *primary key*) might not be new for you. Either way, the workflow VLOOKUP best recreates is that of ordering coffee at a coffee shop.

	TALL 12 FL OZ	GRANDE 16 FL OZ	VENTI 20 FL OZ
ESPRESSO			
Cappuccino	2.95	3.65	4.25
Caffè Latte	2.95	3.65	4.45
Caffè Americano	2.25	2.65	3.25
Espresso	1.95	2.45	2.50
Espresso Macchiato	2.05	2.45	2.55
White Chocolate Mocha	3.95	4.45	4.95
Caramel Macchiato	3.95	4.65	4.95
COFFEE, TEA & MORE			
Coffee	1.95	2.10	2.45
Iced Coffee	2.45	2.75	2.95
Hot Chocolate	2.75	3.25	3.45
Iced Tea	1.95	2.45	2.75
Iced Tea Lemonade	2.65	3.25	3.65
Chai Tea Latte	3.45	4.15	4.45
FRAPPUCCINO			
Coffee	3.95	4.75	4.95
Caramel	3.95	4.75	5.25
Mocha	3.95	4.75	5.25
Java Chip	3.95	4.75	5.25
Strawberries & Creme	3.95	4.75	5.25
Vanilla Bean Creme	3.45	4.45	4.75
Double Chocolatey Chip	3.95	4.75	5.25

When you order food, you identify the food you want on the left side. Then you identify the size of what you want by looking at the columns across the top. If we wanted to order a Grande Espresso at Starbucks, our VLOOKUP would look like this:

VLOOKUP(🔎 = "Espresso", 📄 = [ENTIRE STARBUCS MENU], column no 4 ("Grande"), ❓ = EXACT_MATCH = FALSE)

Now let's imagine this menu on a spreadsheet. We imagine that it will take up a cell range of a1:d100. So that means where we're going to look must equal a1:d100 (📄 = a1:d100).

The new formula looks like this:

VLOOKUP(🔎 = “Espresso”, 📓 = [ENTIRE STARBUCS MENU], column no 4 (“Grande”), ❓ = EXACT_MATCH = FALSE) =

VLOOKUP(🔎 =“Espresso”, 📓 = a1:d100, ... = 4, ❓ = FALSE) =

VLOOKUP(“Espresso”, a1:d100, 4, FALSE)

This works great if you always want to look up the key on the left and then identify associated data in the column fields to the right.

But what if you wanted to know the least expensive item in the VENTI column? In this case VLOOKUP wouldn’t work. Looking to find the key associated with a given piece of data is a different workflow.

If VLOOKUP is all about finding the unique identifier and associated information, then MATCH is all about using what we know about a specific piece of data and reversing into the key (or other associated fields).

Let’s find the least expensive item in the VENTI column. This would take the form of

MATCH(🔎 = min(venti_column), 📓 = venti_column , ❓ = EXACT_MATCH) =

MATCH(min(venti_column) = 2.45, venti_column = D1:D100 , EXACT_MATCH = FALSE) =

MATCH(2.45, D1:D100 , FALSE)

….where the menu takes up cell address a1:d100 (just use your imagination)

Remember, that MATCH though only returns a number. We’re using our imaginations here as I haven’t superimposed the menu on to a spreadsheet. So let’s say the result of our MATCH(2.45, D1:D100 , FALSE) = 8. That means the minimum amount was found within the given column at the 8th row location.

Because we only know the row location, we’ll need to take another step to find out other information associated with that record. In this case, we can use INDEX.

INDEX is like an Excel lookup in reverse. The first argument expects an entire row or column (or table, even). The next argument contains the coordinates of where you want to look within the range provided. That might sound complicated. But let’s think of a simple workflow: I want to grab the 8th record of a column. I would use INDEX like this:

INDEX(where_we_want_to_look = 📓, row_number_of_interest = 🎯) =

INDEX(📓 = A1:A100, 🎯 = 8) =

INDEX(A1:A100, 8) = “Coffee”

So, if we wanted to figure out which key was associated with a specific data field, in Excel, we would use INDEX/MATCH, which would effectively take the following form:

INDEX(🗄_return, MATCH(🔎, 🗄_data, ❓)) =

where

🗄_data is the column where we'll search for the value of interest and...

🗄_return is the corresponding column with data you're interested in at the MATCH'd row

In Excel, this would look like:

```
INDEX(A1:A100, MATCH(2.45,  D1:D100 , FALSE))
```

All of which is to say both VLOOKUP and INDEX/MATCH were designed for specific workflows that analysts commonly solve.

But fi we think about it for a moment, it may seem silly that VLOOKUP requires that you specify a hardcoded column index. Sillier, even, that you would have to use INDEX/MATCH if you wanted to create a lookup that must look at column fields to the left of the match field. Neither is very elegant.

Enter XLOOKUP.

XLOOKUP EXPLAINED

XLOOKUP let's you combine both of the functionalities of VLOOKUP and INDEX/MATCH into one handy dandy lookup. Let's take a look:

```
XLOOKUP (lookup, lookup_array, return_array, [not_found], [match_mode],
[search_mode])
```

If we reduce it down, it still fundamentally looks like this:

XLOOKUP(🔎, 🗄, …, ❓) , where

🔎 = lookup = what_we're_searching for

🗄 = lookup_array = where_we're_searching for

… = return_array, [not_found]

❓ = [match_mode], [search_mode]

Thank back to INDEX/MATCH from before. As you might recall, MATCH returned a row number. Then INDEX took in that row number and looked in that position in a separate column. With XLOOKUP we combine it all together. The return_array … becomes our column of interest.

In other words,

INDEX(A1:A100, MATCH(2.45, D1:D100 , FALSE)) =

INDEX(🧱_return, MATCH(🔎, 🧱_data, ❓)) =

XLOOKUP(🔎, 🧱_data, 🧱_return) =

XLOOKUP(2.45, D1:D100, A1:A100)

We can do the same thing with the VLOOKUP from the problem from above

VLOOKUP("Espresso", a1:d100, 3, FALSE) =

XLOOKUP(🔎 = "Espresso", 🧱_data = d1:d100, 🧱_return = a1:a100) =

XLOOKUP("Espresso", d1:d100, a1:a100)

Unlike in other lookups, XLOOKUP always defaults to an exact match, so we don't need to set it.

We can also say that XLOOKUP takes on the general form...

XLOOKUP(🔎, 🧱_data, 🧱_return)

🔎 = what_we're_searching for

🧱_data = where_we're_searching for

🧱_return= where_we're_returning data from

You might want to know what the other parameters do. I'll go over them very quickly:

[not_found] = let's you set a specific return value if the match isn't found. This effectively replaces IFERROR(VLOOKUP(….), "Not found")

[search_mode] = this specifies the type of search. Honestly, I haven't really used this enough to go into.

Want to learn more?

Become an Excel expert with the Excel.TV academy. Try it for only $1 for the next 30 days.