

THE IF FUNCTIONS



M.L. HUMPHREY

INTRODUCTION

- The IF functions are some of the most powerful functions available to you in Excel.
- IF and nested IF functions allow you to build decision trees where you get different results depending on what your data shows.
- SUMIF(S), COUNTIF(S), and AVERAGEIF(S) allow you to sum, count, or average values if your specified criteria are met.
- You want to know how much customers from Alabama who bought widgets spent last year, easy. Use SUMIFS. You want to know the average spend, use AVERAGEIFS. You want to know how many customers fit that criteria, COUNTIFS.

WHAT WE'RE GOING TO COVER

- The IF function
- Nested IF functions
- Troubleshooting IF functions
- COUNTIF and COUNTIFS
- SUMIF and SUMIFS
- AVERAGEIF and AVERAGEIFS

INTRODUCTION

- This course is part of the Easy Excel Essentials series of courses and is based on the books of the same name.
- Each course is meant to cover one specific topic.
- The assumption is that you already familiar with Excel but want to broaden your understanding in that one area.
- The videos in this course are extracted from the course *Intermediate Excel* by M.L. Humphrey which provides a broader coverage of intermediate Excel topics.

INTRODUCTION

- I'm using Excel 2013 for this course
 - It should look familiar to users of Excel 2007 or later
- What qualifies me to teach this course:
 - I have an Econ degree from Stanford and an MBA from Wharton.
 - More importantly, I've been using Excel for over twenty years in a personal and professional capacity.

THE IF FUNCTION

IF FUNCTIONS

- I love IF functions. It's probably unhealthy how much I love them.
- You can nest IF functions, which means you can build a complex decision tree in just one cell. It's awesome.
- At it's most basic, an IF function says, "If A is true, then do B. If it's not, then do C."
- When you nest IF functions, you can extend that. And say, "If A is true, then do B. If it isn't, but C is true do D. If neither B nor C are true, then do E." And you can just keep going and going and going.
- But you have to get it right. And that can be tricky.

IF FUNCTIONS – A BASIC EXAMPLE

- Let's say you offer free shipping for orders of at least \$25 and charge 5% of the cost for orders under \$25.
- So, the IF question you need to answer is: was the order for at least \$25?
- Let's put customer order amount in column A and shipping charge in column B and let's look at row 2 to start with.
- The formula we want for Column B is:
 - `=IF(A2<25, A2*.05,0)`
- So if our order amount is less than \$25, we want to calculate our order amount times 5% (the shipping charge), otherwise we want 0.

IF FUNCTIONS – A BASIC EXAMPLE

- Think of a basic IF function as three parts.
 - IF x,
 - THEN y,
 - ELSE z
- =IF(If, Then, Else)
- Another way to think of it is as an IF-THEN-OTHERWISE chain.
- =IF(If, Then, Otherwise)
- Always makes sure that the conditions are what you want them to be and in the right place.

IF FUNCTIONS – A COMPLEX EXAMPLE

- What if instead we want to look at a scenario where we provide a rebate based upon amount spent. Spend \$25, get \$5. Spend \$50 get \$10. Spend \$75 get \$15. Spend \$150 get \$20.

The image shows an Excel spreadsheet with two tables. The first table, in columns A and B, lists customer spend and corresponding rebates. The second table, in columns A and B, lists order amounts and calculates the rebate amount using a complex IF formula. The formula bar at the top shows the formula for cell B9: `=IF(A9>A5,B5,IF(A9>A4,B4,IF(A9>A3,B3,IF(A9>A2,B2,0))))`. A tooltip for cell B9 explains the IF function syntax: `IF(logical_test, [value_if_true], [value_if_false])`. Arrows point from the labels 'Data' and 'Formula' to their respective parts in the spreadsheet.

Customer Spend	Rebate
\$25.00	\$5.00
\$50.00	\$10.00
\$75.00	\$15.00
\$150.00	\$20.00

Order Amount	Rebate Amount
5	=IF(A9>\$A\$5,\$B\$5,IF(A9>\$A\$4,\$B\$4,IF(A9>\$A\$3,\$B\$3,IF(A9>\$A\$2,\$B\$2,0))))
10	IF(logical_test, [value_if_true], [value_if_false])
15	0
20	0
25	0
30	5
35	5

IF FUNCTIONS – A COMPLEX EXAMPLE

- This requires a nested IF function where we walk through each tier of spending to see if it was met. I've started with the highest tier and worked my way down.

The image shows an Excel spreadsheet with two columns: 'Customer Spend' (A) and 'Rebate' (B). The data is as follows:

Customer Spend	Rebate
\$25.00	\$5.00
\$50.00	\$10.00
\$75.00	\$15.00
\$150.00	\$20.00

Below this, a second table shows 'Order Amount' (A) and 'Rebate Amount' (B) for rows 9 to 15:

Order Amount	Rebate Amount
10	5
15	0
20	0
25	0
30	5
35	5

The formula bar at the top shows the nested IF function: `=IF(A9>A5,B5,IF(A9>A4,B4,IF(A9>A3,B3,IF(A9>A2,B2,0))))`. An arrow labeled 'Formula' points to this bar. Another arrow labeled 'Data' points to the data in the first table. A tooltip for the IF function is visible, showing the syntax: `IF(logical_test, [value_if_true], [value_if_false])`.

IF FUNCTIONS – A COMPLEX EXAMPLE

- Let's break that down.

```
=IF(A9>$A$5,$B$5,IF(A9>$A$4,$B$4,IF(A9>$A$3,$B$3,IF(A9>$A$2,$B$2,0))))
```

- The first IF Function can be seen as =IF(A9>\$A\$5,\$B\$5,ELSE) where ELSE is everything else that happens if that isn't true. Is the value in Cell A9 greater than the value in Cell A5? If so, return the value in Cell B5.
 - Because we're using a reference table here I've used \$ signs to fix the cell references.
- If you ever try to build a formula like this and have trouble, break it down that way. Strip away all the extra IF functions to see what you have left for each step.

IF FUNCTIONS – A COMPLEX EXAMPLE

- When I originally wrote this formula it wasn't working for me and that's what I had to do to figure out why. Partially because I'd written it moving from the lowest tier to the highest tier which meant I had the ELSE portion of my formula all the way at the end.
- When I stripped it down it was `=IF(A9>A2,THEN,B2)`
- Which meant I was saying if they spent less than \$25 they should get a rebate of \$5. It was impossible to see easily with the formula, but blatantly obvious when I stripped things back.

IF FUNCTIONS – A COMPLEX EXAMPLE

- This is why I changed things so I started at the top for the final version. It's much easier to build and evaluate an IF function to see if it's working if you build it so that your entire first IF function is completed before the next one starts.
- If you build it in that order, your IF function will just end with a bunch of closing parens. Like this:

```
=IF(A9>$A$5,$B$5,IF(A9>$A$4,$B$4,IF(A9>$A$3,$B$3,IF(A9>$A$2,$B$2,0))))
```

TROUBLESHOOTING

- Always test the logic of your IF function to make sure it's doing what you think it is.
- If the function returns an error message:
 - Check that every IF has an opening paren immediately after.
 - Make sure that you have a closing paren to correspond to every opening paren.
 - You can arrow through the equation and Excel will color and bold matching parens for you as you do so.
 - This is usually the actual cause for the error message telling you you have too many arguments.

IF FUNCTION SUMMARY

- IF functions follow an IF-THEN-ELSE pattern
- You can nest IF functions by replacing either the THEN portion or the ELSE portion of an IF function with another IF function
- If you get an error message that you've entered too many arguments, check for a misplaced or missing paren
- Always test your IF function after you've written it to make sure it's doing what you want it to do
- If you're referencing a table of fixed values with an IF function, be sure to use \$ so the references stay fixed when you copy the function.

THE COUNTIFS FUNCTION

COUNTIFS FUNCTION

- The COUNTIFS function allows you to count the number of times your specified criteria are met in your chosen data set.
 - This function did not exist in older versions of Excel. I think it was released with Excel 2007.
 - COUNTIF did. You can now use COUNTIFS as if it were the COUNTIF function simply by limiting it to values in one column.
- If you use COUNTIFS on one column of data, it will simply count the number of times your criteria is met within that singular range.
- If you use COUNTIFS on multiple ranges of data, you can specify multiple criteria that must be met for a result to be counted.

COUNTIFS EXAMPLE

- Let's say I want to see how many of my customers are from Zimbabwe.
 - I can use COUNTIF or COUNTIFS for this. If Country is listed in Column B of my data:
 - =COUNTIF(B2:B6,"Zimbabwe")
 - =COUNTIFS(B2:B6,"Zimbabwe")
- If I want to see how many customers are from Zimbabwe AND bought Whatsits
 - I can only use COUNTIFS. Assuming Country is in Column B and product is in Column D:
 - =COUNTIFS(B2:B6,"Zimbabwe",D2:D6,"Whatsits")

COUNTIFS (Cont.)

- With COUNTIFS, all criteria you specify have to be met for Excel to count the entry.
- You can also use wildcards like the * sign in your count criteria.
 - For example, =COUNTIFS(A2:B6,"*e") will count all times that a cell in the range from A2 through B6 includes an e.
- You can count across rows or columns, but if you have multiple count criteria, the ranges you specify have to be the same dimensions. In other words, the same number of columns across and rows down.
- You can also use count criteria that are numeric.
 - =COUNTIFS(C2:C6,">25") will count all values greater than 25.

COUNTIFS (Cont.)

- You can't count across the same range twice. (It won't work to see customers who bought Whatsits and Whatchamacallits since those will exclude each other.)
- If you select columns of data for your range, Excel will look across individual rows to see if the criteria are met.
- If you select rows of data for your range, Excel will look across columns to see if the criteria are met.

ANOTHER EXAMPLE

- Here is an example of student grade results. We have the students listed in Column G and their grades on three tests listed in Columns H through J.
 - If we want to know how many times any student scored over a 90, we can use `=COUNTIFS(H2:J4,">90")`
 - If we want to see how many tests there were where all three students scored over 90 we can use `=COUNTIFS(H2:J2,">90", H3:J3,">90", H4:J4,">90")`
 - If we want to see how many students scored over 90 on all three tests we can use `=COUNTIFS(H2:H4,">90", I2:I4,">90", J2:J4,">90")`

COUNTIFS (Cont.)

- COUNTIFS is incredibly powerful, but it's very easy to set it up wrong. It took a certain mental gymnastics for me to think which direction I needed my function to go to get the result I wanted.
- What I do on something like this is run it against a small sample that I can visually evaluate. Like our student test example above. Once I get it working on that small sample, I can then just update the formula to change the row references to cover an entire population.
- (And in some scenarios, you might find that it's easier to take a different approach when you're dealing with a much larger data set. For the tests over 90 option, I might do that in a two-step approach if I had a lot of student records I was dealing with.)

THE SUMIFS FUNCTION

THE SUMIFS FUNCTION

- SUMIFS works much like COUNTIFS except it sums values instead of counting them. I use it all the time.
 - For example, on Amazon my books sell in up to seven or eight different marketplaces, all with their own currency. So in a given month I can expect payments in USD, GBP, EUR, AUD, CAD, and sometimes INR or BRL.
 - I can't just add those values together to see what I've earned because of currency rates. (Especially not with INR and BRL.)
 - So what I do is sum all pending payments by currency and then convert those amounts to (for me) U.S. dollars.

AN EXAMPLE

- Let's look at that example I just gave you.
- On the left-hand side I have pending payments, including their currency and a notation as to whether or not that amount has already been paid.
- On the right-hand side I have a list of total amount outstanding by currency and then a converted amount and a sum of the amount that's outstanding.

AN EXAMPLE

- The formula I have in the row for USD is this*:
 - =SUMIFS (B2:B22,D2:D22,"USD",E2:E22,"")
- That formula is saying, “sum the values in range B2 through B22 if the values in the range from D2 to D22 equal “USD” and cells in the range from E2 to E22 are blank.
- Excel evaluates each line at a time. So it looks at D2 and E2 and if the criteria are met, it includes B2 in the values it’s going to add together.

*In the actual sample I used \$ signs just so it was easy to copy and paste for the other currencies.

SUMIFS (Cont.)

- Here are a couple other ways to use SUMIFS:
 - To track outstanding bills for the month by using an X to mark paid bills
 - To calculate the amount of payables from customers that are past 30 days
 - To calculate the dollar amount of sales for customers who meet multiple criteria such as country, product type, and salesperson
- Just like with COUNTIFS there is a singular version of SUMIFS called SUMIF. However, unlike with COUNTIFS, the order of the information you include is different. You have to know which one you're using before you write your formula. But just like with COUNTIF and COUNTIFS, you can use SUMIFS to deal with a single column.
- Also, SUMIFS didn't exist in early versions of Excel.

THE AVERAGEIFS FUNCTION

THE AVERAGEIFS FUNCTION

- AVERAGEIFS works much like COUNTIFS and SUMIFS except it averages values instead of counting them or summing them.
- And like SUMIFS and SUMIF, AVERAGEIFS has a counterpart, AVERAGEIF, that can be used when there's just one criteria but the order of the values you enter is different for the two functions, so you have to know in advance which one you're going to use.
- AVERAGEIF was the only optional available prior to Excel 2007.

THE AVERAGEIFS FUNCTION

- Let's look at an example of how to use AVERAGEIFS. Here we want to see the average score for boys versus girls for different teachers. So we have two criteria, teacher name and student gender.

	A	B	C	D	E	F	G	H	I	J	K
1	Score	Teacher	Gender								
2	50	Smith	F								
3	49	Barker	M			Female		Male			
4	68	Vasquez	F			80.25	Smith	84.50			
5	75	Smith	M			90.00	Barker	68.67			
6	90	Barker	F			68.00	Vasquez	76.00			
7	94	Smith	M								
8	93	Barker	M		Cell F4:	=AVERAGEIFS(\$A\$2:\$A\$13,\$B\$2:\$B\$13,G4,\$C\$2:\$C\$13,"F")					
9	91	Smith	F		Cell H4:	=AVERAGEIFS(\$A\$2:\$A\$13,\$B\$2:\$B\$13,G4,\$C\$2:\$C\$13,"M")					
10	76	Vasquez	M								
11	82	Smith	F								
12	64	Barker	M								
13	98	Smith	F								

CONCLUSION

CONCLUSION

- So that was the IF functions.
- Hopefully now you understand just how powerful they are.
- If you get stuck, reach out to me at mlhumphreywriter@gmail.com and I'm happy to help.
- And if you want to cover more Excel topics, then drop by my website for links to other classes and/or books on Excel at www.mlhumphrey.com. (This includes discount codes for all the courses.)