

# The IF Function

By Dick Evans

IF is the logical function in Excel and one most users find hard to grasp. Microsoft has a good deal of help available within Excel and you should take a look at it. Here is what they have to say about the syntax:

## **IF(logical\_test,value\_if\_true,value\_if\_false)**

**Logical\_test** is any value or expression that can be evaluated to TRUE or FALSE. For example, A10=100 is a logical expression; if the value in cell A10 is equal to 100, the expression evaluates to TRUE. Otherwise, the expression evaluates to FALSE. This argument can use any comparison calculation operator.

Comparison operator	Meaning (Example)
= (equal sign)	Equal to (A1=B1)
> (greater than sign)	Greater than (A1>B1)
< (less than sign)	Less than (A1<B1)
>= (greater than or equal to sign)	Greater than or equal to (A1>=B1)
<= (less than or equal to sign)	Less than or equal to (A1<=B1)
<> (not equal to sign)	Not equal to (A1<>B1)

**Value\_if\_true** is the value that is returned if logical\_test is TRUE. For example, if this argument is the text string "Within budget" and the logical\_test argument evaluates to TRUE, then the IF function displays the text "Within budget". If logical\_test is TRUE and value\_if\_true is blank, this argument returns 0 (zero). To display the word TRUE, use the logical value TRUE for this argument. Value\_if\_true can be another formula.

**Value\_if\_false** is the value that is returned if logical\_test is FALSE. For example, if this argument is the text string "Over budget" and the logical\_test argument evaluates to FALSE, then the IF function displays the text "Over budget". If logical\_test is FALSE and value\_if\_false is omitted, (that is, after value\_if\_true, there is no comma), then the logical value FALSE is returned. If logical\_test is FALSE and value\_if\_false is blank (that is, after value\_if\_true, there is a comma followed by the closing parenthesis), then the value 0 (zero) is returned. Value\_if\_false can be another formula.

Let's build a test worksheet. Open Excel and enter the following data:

	A	B	C	D	E
1	<b>Sales Analysis</b>				
2					
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>	<b>Commission</b>	<b>Action</b>
4	Barbara	16,850.00			
5	Dianne	22,000.00			
6	Jennifer	25,489.00			
7	Mary	10,000.00			
8	Pamela	27,892.00			
9	Rebecca	38,000.00			
10					
11					
12					
13	Sales Level	Rate			
14	0	10%			
15	15,000	15%			

The company pays commissions based on the total amount of sales. The current rules are as follows:

Sell between \$0 and \$14,999 in one month and the commission will be 10% of the total sales. Sell \$15,000 or more in one month and the commission will be 15% of the total sales.

Since the sales level and the commission rate might vary from time to time, their values were placed in an assumption area in the worksheet (A13:B15)

We need to construct a formula to place the commission rate earned in the cells in column C. We could take a look at the total sales in column B and decide on each percentage, one at a time. The first, in cell C4, would be 15% because the amount sold was greater than 15,000.

However, Excel is not a word processor and we are not to use our head or our calculators to discover results and type them in. Let Excel do the work and for this problem we need to use the IF function.

Let's review the three arguments in the IF function:

**IF(logical\_test,value\_if\_true,value\_if\_false)**

Think of the logical test as a statement of fact. The value if true is the value or formula you want placed in the cell if the statement is true. Conversely, the value if false is the value or formula you want placed in the cell if the statement is not true.

Start with cell C4. The statement should be  $B4 < A15$  and reads like this, the sales amount in cell B4 is less than the sales level for the top commission percentage which is currently 15%. (Alternatively we could say  $B4 \geq A15$ ; what changes is the comparison operator and which formulas are used for true and false)

Now we add the second argument, TRUE. If the statement is true, B4 is less than A15, then we want the cell to contain the formula B15 and display the commission percentage 15%.

The third argument is FALSE. If the statement is NOT true, B4 is NOT less than A15, then we want the cell to contain the formula B14 and display commission percentage 10%.

The formula should read:

**=IF (B4<A15 ,B15 ,B14)**

C4	=IF(B4<A15,B15,B14)				
	A	B	C	D	E
1	<b>Sales Analysis</b>				
2					
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>	<b>Commission</b>	<b>Action</b>
4	Barbara	16,850.00	0.10		
5	Dianne	22,000.00			
6	Jennifer	25,489.00			
7	Mary	10,000.00			
8	Pamela	27,892.00			
9	Rebecca	38,000.00			
10					
11					
12					
13	Sales Level	Rate			
14	0	10%			
15	15,000	15%			

To be able to copy the formula in C4 down through C9, we must make the reference to the assumptions absolute. Doing so tells Excel to absolutely leave them as is in the new formulas while relatively changing the relative cell references to match the resulting cells. In this case the sales level in A15 and the percentages in B14 and B15 all need to be absolute. Reference to the sales amount must be relative so it can change as the formula is copied.

To change a cell reference from relative to absolute, click in the cell reference to be changed, and then press F4 on the keyboard. This add a \$ to the row and to the column reference. Change the formula so it reads:

**=IF (B4<\$A\$15 , \$B\$15 , \$B\$14)**

With C4 selected, mouse over the fill handle (square in bottom right corner) until the white cross changes to a black plus sign. Hold the left mouse button down and drag through cell C9, then drop the mouse button.

	A	B	C	D	E
1	<b>Sales Analysis</b>				
2					
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>	<b>Commission</b>	<b>Action</b>
4	Barbara	16,850.00	0.10		
5	Dianne	22,000.00	0.10		
6	Jennifer	25,489.00	0.10		
7	Mary	10,000.00	0.15		
8	Pamela	27,892.00	0.10		
9	Rebecca	38,000.00	0.10		
10					
11					
12					
13	Sales Level	Rate			
14	0	10%			
15	15,000	15%			

Hold down Ctrl and tap ~ to display the formulas instead of the resulting values. (~ is below the Esc key)

	A	B	C
1	<b>Sales Analysis</b>		
2			
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>
4	Barbara	16850	=IF(B4<\$A\$15,\$B\$15,\$B\$14)
5	Dianne	22000	=IF(B5<\$A\$15,\$B\$15,\$B\$14)
6	Jennifer	25489	=IF(B6<\$A\$15,\$B\$15,\$B\$14)
7	Mary	10000	=IF(B7<\$A\$15,\$B\$15,\$B\$14)
8	Pamela	27892	=IF(B8<\$A\$15,\$B\$15,\$B\$14)
9	Rebecca	38000	=IF(B9<\$A\$15,\$B\$15,\$B\$14)
10			
11			
12			
13	Sales Level	Rate	
14	0	0.1	
15	15000	0.15	

Add the formula in D4 to calculate the commission amount, and then copy it down through D9

	A	B	C	D	E
1	<b>Sales Analysis</b>				
2					
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>	<b>Commission</b>	<b>Action</b>
4	Barbara	16,850.00	0.10	=B4*C4	
5	Dianne	22,000.00	0.10		
6	Jennifer	25,489.00	0.10		
7	Mary	10,000.00	0.15		
8	Pamela	27,892.00	0.10		
9	Rebecca	38,000.00	0.10		
10					
11					
12					
13	Sales Level	Rate			
14	0	10%			
15	15,000	15%			

	A	B	C	D	E
1	<b>Sales Analysis</b>				
2					
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>	<b>Commission</b>	<b>Action</b>
4	Barbara	16,850.00	0.10	1,685.00	
5	Dianne	22,000.00	0.10	2,200.00	
6	Jennifer	25,489.00	0.10	2,548.90	
7	Mary	10,000.00	0.15	1,500.00	
8	Pamela	27,892.00	0.10	2,789.20	
9	Rebecca	38,000.00	0.10	3,800.00	
10					
11					
12					
13	Sales Level	Rate			
14	0	10%			
15	15,000	15%			

	A	B	C	D
1	<b>Sales Analysis</b>			
2				
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>	<b>Commission</b>
4	Barbara	16850	=IF(B4<\$A\$15,\$B\$15,\$B\$14)	=B4*C4
5	Dianne	22000	=IF(B5<\$A\$15,\$B\$15,\$B\$14)	=B5*C5
6	Jennifer	25489	=IF(B6<\$A\$15,\$B\$15,\$B\$14)	=B6*C6
7	Mary	10000	=IF(B7<\$A\$15,\$B\$15,\$B\$14)	=B7*C7
8	Pamela	27892	=IF(B8<\$A\$15,\$B\$15,\$B\$14)	=B8*C8
9	Rebecca	38000	=IF(B9<\$A\$15,\$B\$15,\$B\$14)	=B9*C9

Change the Sales level to 25,000 and the high percentage to 20% and view the results.

	A	B	C	D	E
1	<b>Sales Analysis</b>				
2					
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>	<b>Commission</b>	<b>Action</b>
4	Barbara	16,850.00	0.20	3,370.00	
5	Dianne	22,000.00	0.20	4,400.00	
6	Jennifer	25,489.00	0.10	2,548.90	
7	Mary	10,000.00	0.20	2,000.00	
8	Pamela	27,892.00	0.10	2,789.20	
9	Rebecca	38,000.00	0.10	3,800.00	
10					
11					
12					
13	Sales Level	Rate			
14	0	10%			
15	25,000	20%			

Often, the IF function is used to display text depending on some logical test. In this case, if the sales are less than the high commission level, display the word “call” under action.

The statement will be B4<A15 or the sales amount is less than \$25,000. Enter this into cell E4. (Alternatively we could have said C4=A15 and checked to see if their commission percentage was at the lowest level)

Keeping in mind that we want to be able to copy this formula down through E9, include absolute cell referencing.

**=IF (B4<\$A\$15, "Call", "")**

When entering textual data, the data must be surrounded with quotes; formulas and values are not. Notice the third argument. It is simply two quotes indicating a null value. If the statement is not true, we want an empty cell. All three arguments must be filled in. Let's copy the formula down.

	A	B	C	D	E
1	<b>Sales Analysis</b>				
2					
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>	<b>Commission</b>	<b>Action</b>
4	Barbara	16,850.00	0.20	3,370.00	Call
5	Dianne	22,000.00	0.20	4,400.00	Call
6	Jennifer	25,489.00	0.10	2,548.90	
7	Mary	10,000.00	0.20	2,000.00	Call
8	Pamela	27,892.00	0.10	2,789.20	
9	Rebecca	38,000.00	0.10	3,800.00	
10					
11					
12					
13	Sales Level	Rate			
14	0	10%			
15	25,000	20%			

	A	B	C	D	E
1	<b>Sales Analysis</b>				
2					
3	<b>Sales Person</b>	<b>Sales</b>	<b>Commission Rate</b>	<b>Commission</b>	<b>Action</b>
4	Barbara	16850	=IF(B4<\$A\$15,\$B\$15,\$B\$14)	=B4*C4	=IF(B4<\$A\$15,"Call", "")
5	Dianne	22000	=IF(B5<\$A\$15,\$B\$15,\$B\$14)	=B5*C5	=IF(B5<\$A\$15,"Call", "")
6	Jennifer	25489	=IF(B6<\$A\$15,\$B\$15,\$B\$14)	=B6*C6	=IF(B6<\$A\$15,"Call", "")
7	Mary	10000	=IF(B7<\$A\$15,\$B\$15,\$B\$14)	=B7*C7	=IF(B7<\$A\$15,"Call", "")
8	Pamela	27892	=IF(B8<\$A\$15,\$B\$15,\$B\$14)	=B8*C8	=IF(B8<\$A\$15,"Call", "")
9	Rebecca	38000	=IF(B9<\$A\$15,\$B\$15,\$B\$14)	=B9*C9	=IF(B9<\$A\$15,"Call", "")
10					
11					
12					
13	Sales Level	Rate			
14	0	0.1			
15	25000	0.2			

In summary, the IF function is most useful in a variety of ways. It is also the most difficult for many users to understand. It has three arguments which must be filled in for the function to successfully calculate the correct value. The first argument contains a statement of fact. The second argument contains the value or formula the cell should act upon if the fact is true. The third argument contains the value or formula the cell should act upon if the fact is not true. Arguments are separated with commas.

**IF (statement\_of\_fact, value\_or\_formula\_if\_true, value\_or\_formula\_if\_false)**