

# LOGICAL AND VLOOKUP FUNCTIONS

## LOGICAL FUNCTIONS

**Logical functions** are used to create decision-making formulas. These functions can test whether or not a certain condition exists within your spreadsheet and will prompt Excel to take specific actions based on the results. Table 1 shows Excel's logical functions. Logical and all other functions are built using **arguments** (independent variables or inputs that alter the functions' results).

Function	Description	Example
AND(logical1,logical2)	Checks whether all arguments are <i>TRUE</i> , and returns <i>TRUE</i> if all arguments are <i>TRUE</i> .	=AND(B2,A2)
FALSE()	Returns FALSE The function takes no arguments.	=FALSE()
IF(logical_test,value_if_true,value_if_false)	Performs a logical test and returns a value based on the result.	=IF(B8>B7,"Greater", "Less than")
NOT(logical)	Changes FALSE to TRUE, or TRUE to FALSE.	=NOT(B3)
OR(logical1,logical2...)	Checks whether any of the arguments are TRUE, and returns TRUE or FALSE. Returns FALSE only if all arguments are FALSE.	=OR(A2=B2,A1=B1)
TRUE()	Returns TRUE The function takes no arguments.	=TRUE()

## IF FUNCTION

The **IF function** checks the logical condition of a statement and will return one value if **true** and a different value if **false**. The **syntax** (i.e., the rules that specify how to correctly enter a function) of the **IF FUNCTION** is **IF(logical test, value if true, value if false)**

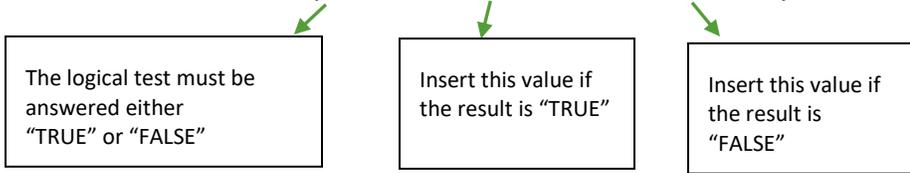
- The value returned may be either a **number** or **text**.
  - If the value to be returned is **text**, it must be placed in **quotes**.

All *IF functions* include the following three components:

- The logical test**— A **logical test** is any value that can be determined to be **TRUE** or **FALSE**. Commonly used logical tests include:
 

<b>A=B</b> A is equal to B	<b>A&gt;=B</b> A is greater than or equal to B
<b>A&gt;B</b> A is greater than B	<b>A&lt;=B</b> A is less than or equal to B
<b>A&lt;B</b> A is less than B	<b>A&lt;&gt;B</b> A is not equal to B
- The result if the test is **TRUE**
- The result if the test is **FALSE**

**=IF(A1>59,"Passed","Failed")**



## NESTED FUNCTIONS

Another function can be used as an argument of an IF function as well as other Excel functions. For example, the AVERAGE and SUM functions are nested within the IF function in the example below:

**=IF(AVERAGE(B2:B5)>100,SUM(E2:E5),0)**

## IF STATEMENTS PRACTICE EXERCISES

**Instructions:** Use the **IF function** to complete the following exercises.

1. Open Excel and create the workbook below:

	A	B	C	D	E
	Name of Salesperson	No. of Cars Sold in Oct.	IF Statement 1	IF Statement 2	IF Statement 3
1					
2	Brenda	5			
3	Jose	10			
4	Bradley	7			
5	Carla	11			
6	Dennis	14			
7	Felix	19			

2. Construct **IF functions** using the syntax **=IF(logical test, value if true, value if false)** for the following scenarios and place the results in the specified columns.
  - a. **IF Statement 1 column**—The number of cars sold in October by an individual salesperson is **greater than 10**, the salesperson will receive a **bonus (TRUE)**. If the number of cars sold by an individual salesperson is **not greater than 10 (FALSE)**, then the salesperson will receive **no bonus**.
  - b. **IF Statement 2 column**—If the number of cars sold in October by an individual salesperson is **greater than or equal to 10**, the salesperson will receive a **\$200 bonus (TRUE)**. If the number of cars sold by an individual salesperson is **less than 10 (FALSE)**, then the salesperson will receive **"no bonus."**
  - c. **IF Statement 3 column**—If the number of cars sold in October by an individual salesperson is **greater than or equal to 10**, the salesperson will receive a **\$500 bonus (TRUE)**. If the number of cars sold by an individual salesperson is **less than 10 (FALSE)**, then the salesperson will receive **\$0**.

If you complete the IF functions above correctly, your spreadsheet should display the following results:

	A	B	C	D	E
	Name of Salesperson	No. of Cars Sold in Oct.	IF Statement 1	IF Statement 2	IF Statement 3
1	Brenda	5	no bonus	no bonus	\$0
2	Jose	10	no bonus	\$200	\$500
3	Bradley	7	no bonus	no bonus	\$0
4	Carla	11	bonus	\$200	\$500
5	Dennis	14	bonus	\$200	\$500
6	Felix	19	bonus	\$200	\$500

	A	B	C	D	E
	Name of Salesperson	No. of Cars Sold in Oct.	IF Statement 1	IF Statement 2	IF Statement 3
1	Brenda	5	=IF(B2>10,"bonus","no b	=IF(B2>=10,"\$200","no b	=IF(B2>=10,"\$500","\$0")
2	Jose	10	=IF(B3>10,"bonus","no b	=IF(B3>=10,"\$200","no b	=IF(B3>=10,"\$500","\$0")
3	Bradley	7	=IF(B4>10,"bonus","no b	=IF(B4>=10,"\$200","no b	=IF(B4>=10,"\$500","\$0")
4	Carla	11	=IF(B5>10,"bonus","no b	=IF(B5>=10,"\$200","no b	=IF(B5>=10,"\$500","\$0")
5	Dennis	14	=IF(B6>10,"bonus","no b	=IF(B6>=10,"\$200","no b	=IF(B6>=10,"\$500","\$0")
6	Felix	19	=IF(B7>10,"bonus","no b	=IF(B7>=10,"\$200","no b	=IF(B7>=10,"\$500","\$0")

## VLOOKUP

**VLOOKUP** is a function used to search for and retrieve data in a table. The **V** in VLOOKUP indicates that the data in the table **must be arranged vertically, with data in rows**. The VLOOKUP is used to search for *exact matches* or the *nearest value* that is **less than or equal** to the search value. For example, you can use VLOOKUP to find an item description for a part number, assign a letter grade for a test score, and much more.

To perform a *VLOOKUP*, you will need to make sure that your table is designed so that the lookup values display in the **first (left-most) column**. However, the result values can appear in any column to the right of the first column in the table.

All VLOOKUP functions include three required arguments and one optional argument:

**=VLOOKUP(lookup\_value,table\_array,col\_index\_num,[range\_lookup])**

1. The **lookup\_value** is the cell reference that contains the **value to look up**.
2. The **table\_array** is the range of cells that contains the **lookup table**.  
**IMPORTANT!!** The **table array** must be **absolute**, the **value you want to look up** must be located in the **first column**, and **cannot include column labels** for the lookup table.
3. The **column\_index\_num** is the **column number** in the **lookup table** which you want to retrieve the result.
4. The **range\_lookup (optional argument)** determines how the VLOOKUP function handles lookup values that are not an *exact match* for the data in the lookup table.
  - By default, the range\_lookup is set to **TRUE**. Leave the optional argument blank or type **TRUE** if you want the VLOOKUP function to find the nearest value that is less than or equal in the table to the lookup value. If defaulting to **TRUE**, the **first column in a VLOOKUP table array should be sorted from smallest to largest (or A to Z alphabetically)** (Mulbery et al. 2017, p. 512).
  - To look up an **exact match**, enter **FALSE** in the **range\_lookup** argument.

## GUIDELINES FOR CREATING THE LOOKUP TABLE

A **lookup table** is a range of cells containing a table of values and text from which data can be retrieved. The table should contain the following:

- At least **two rows**, not including headings.
- At least **two columns**, not including headings.
- If the values you want to look up are **exact values**, you can arrange the first column in **any logical order**.
- If the values you want to look up are **approximate values**, you must arrange the data from the lowest to the highest value and include **only the lowest value in the range** instead of the complete range. The lowest value is known as the **breakpoint**.

Grading Scale		Grades Lookup Table	
Range	Grade	Range	Grade
90–99	A	0	F
80–89	B	60	D
70–79	C	70	C
60–69	D	80	B
Below 60	F	90	A

## NESTED FUNCTIONS

Similarly to the IF function, you can nest functions as arguments inside the VLOOKUP function. For example, the figure below illustrates shipping amounts based on weight and location (Boston and Chicago). Typing the VLOOKUP function

**=VLOOKUP(A3,\$E\$3:\$G\$5,IF(B3="Boston",2,3))** in cell **C3** will find the correct shipping cost for the package in cell A3.

“The weight, 14 pounds, is compared to the data in the table array argument, which is **\$E\$3:\$G\$5**. To determine which column of the lookup table to use, an **IF function** is **nested** as the

**column\_index\_number** argument. The nested IF function compares the city stored in cell **B3** to the text **Boston**. If cell B3 contains Boston, it returns **2** to use the

**column\_index\_number** to identify the shipping value for a package that is going to Boston. If cell B3 does not contain **Boston** (i.e., the only other city in this example is Chicago), the **column\_index\_number** is 3” (Poatsy et al 2017, 513). **Important!** “When a nested function is used as an argument, the nested function must return the same type of value that the argument uses. For example, if the argument returns a **TRUE** or **FALSE** value, the nested function must return a **TRUE** or **FALSE** value”.

Customer Data			Lookup Data		
Weight	Location	Shipping	Weight	Boston	Chicago
14	Boston	\$19.95	0	\$9.95	\$12.95
4	Chicago	\$12.95	5	\$14.95	\$16.95
8	Boston	\$14.95	10	\$19.95	\$22.95

## SOURCES

Klein, Mark. *Microsoft Excel: Formulas and Functions : Lesson 5: Lookups, Charts, Statistics, and Pivot Tables*. 2014. <http://www.howtogeek.com/school/microsoft-excel-formulas-and-functions/lesson5/> (accessed November 9, 2016).

Poatsy, Mary Anne, Keith Mulbery, Cynthia Krebs, Lynn Hogan, Eric Cameron, Jason Davidson, Linda K. Lau, Rebecca Lawson, and Jerri Williams. *Microsoft Office 2016 Volume 1*. Exploring Series, series editor Mary Anne Poatsy. Boston, MA: Pearson, 2017.