

Using the IF Function

The If function allows users to make logical comparisons between values, returning a value of either True, or False. Based on the result of the logical comparison, the if function can carry out a specific operation, based on a true or false value.

The syntax for an if function is: **=IF(logical_test, value_if_ture, value_if_false)**

- **Logical test:** any value or expression that can return a TRUE or FALSE
- **Value_if_true:** The value to be returned, or operation to be performed, if the condition is TRUE.
 - This can be text (must be in double quotes "text"), a number, or a function.
- **Value_if_false:** The value to be returned, or operation to be performed, if the condition is FALSE.
 - This can be text (must be in double quotes "text"), a number, or a function.

Simply put, the if function is:

IF(Comparison, if true then perform this action, otherwise do something else).

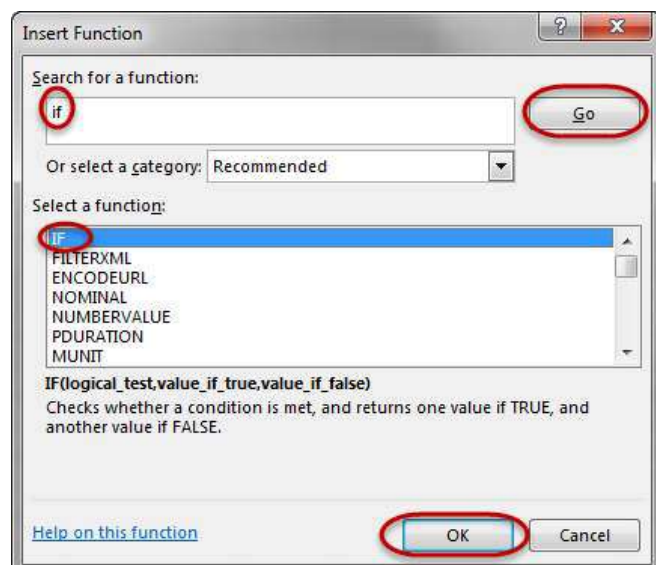
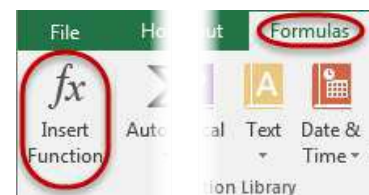
Excel Comparison Operators

Comparison Operator

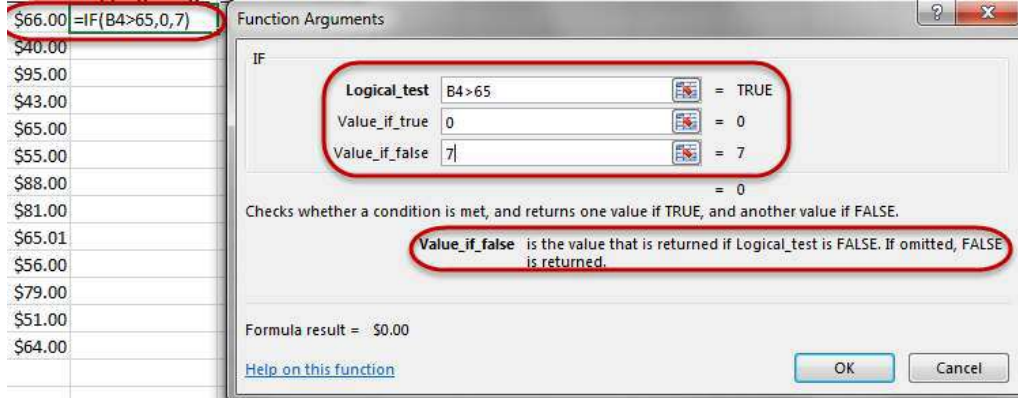
- = (equal sign)
- > (greater than sign)
- < (less than sign)
- >= (greater than or equal to sign)
- <= (less than or equal to sign)
- <> (not equal to sign)

Steps for an If Statement:

1. Place cursor in the cell that will contain the If Statement.
2. Navigate to the Formulas tab, and click on the Insert Function icon.
3. Within the Insert Function window, search for If in the search textbox and hit the Go Button.
4. Select the if function from the select a function box. Select it by either double clicking on it or by selecting it and clicking the OK button



- In the Functions Argument window, we are able to see each argument of the if function. For the logical test, we want to select the Cell that we are comparing.



- Value_if_true. What do we want to happen if our argument is True?
 - This can be as simple as a number, text(must be in quotes ""), an arithmetic function, or even another function entirely.
- Value_if_false. What do we want to happen if our argument is False?
 - This can be as simple as a number, text (must be in quotes ""), an arithmetic function, or even another function entirely.
- When we have all of our arguments filled out, click on the OK button and our function is now complete.
- To copy this function to the remaining cells, click back on the cell that contains the original function. Move your mouse into the lower right corner until your mouse turns into a dark plus sign.

Order Total	Shipping Charge	T
\$66.00	\$0.00	
\$40.00		
- Click and hold with your mouse as you drag to the bottom of the rest of the data. The function has now been copied to all of the other cells.

Best practices with if statements

Generally, it is not good practice to put static values (values that may need to change from time to time) directly into functions in Excel. The main reason for this is because if a change ever has to be made, the values can be hard to find and change. It is best to put these values into their own individual cell, and then reference the cell containing the value in the function. This way, any time the values has to change, the referenced cell's value is changed and all functions related to that function are now updated immediately. There isn't a need to search for each function to update them.

Display a formula with color coded cell references

When troubleshooting a function while in Excel, hit the F2 key. This will display all arguments in a function as color coded cell references and cells.

Sales		Total sales	Commission	Training completed	Year-end
Qtr1	Qtr4	\$8,500	\$0	=IF(AND(H9="yes",F9>\$B\$4),F9*\$B\$5,"")	

Cell References

When creating functions in Excel, users must know that there are two different cell reference types, Relative and Absolute.

Relative cell reference

It is important to understand how Excel identifies cells in formulas. By default, all cell references are relative references, which means the function is related to the cells around it. As a function is copied across multiple cells, it is updated based on the relative position of rows and columns.

The way Excel reads a function is by looking at the relationship of the cell references in relation to the cell containing the function. For example, in the function contained in cell C3 to the right, Excel reads this as “take the number located two cells to the left and add that to the number in the cell

	A	B	C	
1	Dept A	Dept B	Totals	
2	100	300	400	=A2+B2
3	200	400	600	=A3+B3

located one column to the left”. Therefore, when this function (which appears as =A2+B2) is copied to the cell below, it performs the calculation using the same pattern, “take the number located two cells to the left and add that to the number in the cell located one column to the left”, but updates the formula to reflect the appropriate cell addresses. This is called a Relative Reference and is the feature that enables users to copy the same function to a different location within a worksheet.

Absolute cell reference

An absolute reference is a reference to a particular cell, or range of cells, that never updates as the function is copied to a new location. Absolute references can be made to an individual cell, or to keep a row or a column constant as the function is copied to a new location.

To make a cell reference absolute so that it will not adjust when a formula is copied, insert a dollar sign (\$) in the appropriate position. By navigating into the formula in the Formula bar, users can cycle through the absolute reference options by hitting the F4 key on the keyboard. The first time the F4 key is pressed, a user will create an absolute reference to the cell reference in the function, the second time the reference will be to the row only, and the third time the reference will be to a particular column.

Press the F4 key one time: =B5/\$B\$12

Two times: =B5/B\$12

Three times: =B5/\$B12

Position the cursor in the cell reference that you want to change

Example 1: \$B\$12 Both the Row and the Column are held Constant

Example 2: B\$12 The Row is held constant; the Column will update as the function is copied.

Example 3: \$B12 The Column is constant; the Row will update as the function is copied.

Using OR & AND Functions

The And & Or functions are great functions to use within an if function because they will return a value of either True or False, which is what the first portion of an if statement needs in order to complete the function.

The And and Or functions will allow for multiple logical expressions to be created within the argument of the function. Each logical expression must be separated by a comma.

And Function

The And function is used to check multiple logical expressions and will return a True value if every one of the logical expressions is true.

The syntax is; **=AND(logical1,[logical2],...)**

OR Function

The OR function is used to check multiple logical expressions and will return a True value as long as one of the logical expressions is true.

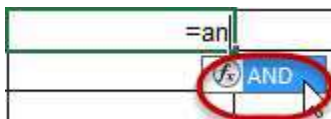
The syntax is; **=OR(logical1,[logical2],...)**

Nesting an AND or OR function into an If function

The easiest to incorporate an AND or OR function into an if function is to first start with the And or Or Function and then incorporate the function into the logical_test argument of an IF function.

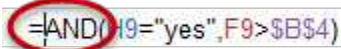
Steps to create a nested AND or OR function within an IF function;

1. Navigating to the cell to contain the IF function and type in an equal sign, followed by AND. Select the AND function by double clicking on it, or using the arrow keys to select the function and then hit the tab key.



2. When the function has been selected, type in the first logical expression. When the first logical has been entered, type in a comma to enter in the second, third, fourth, etc. logical expression, making sure each expression is separated by a comma.
3. When the AND function is complete, finish the function by entering in a closed bracket).

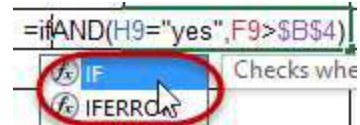
- Now, use the mouse and place the cursor between the equal sign and the A in the front of the AND function.



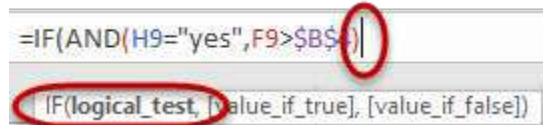
- Users may also use the formula bar to do this, as it may be easier to access the first portion of the function in the formula bar.



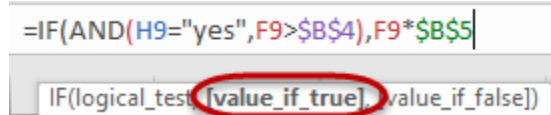
- With the cursor between the equal sign and the A, start typing if. Excel will populate a list of functions under the cell. Either double click on the If function, or use the arrow keys to highlight IF and then hit the tab key.



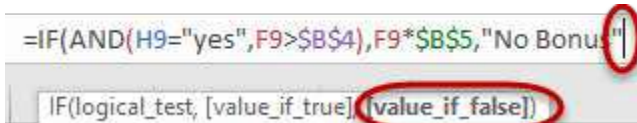
- Excel will now display the arguments for the IF function underneath the cell, or the formula bar, depending on where the user is working. The argument that will be bolded will be the logical_test, which has already been completed with the AND function. To enter in to the second portion, value_if_true, of the expression, move the cursor to the far right of the AND function, after the closed bracket and type in a comma.



- Enter in what is to be done if the AND function is true, then type a comma to get to the last portion of the IF function, the value_if_false.

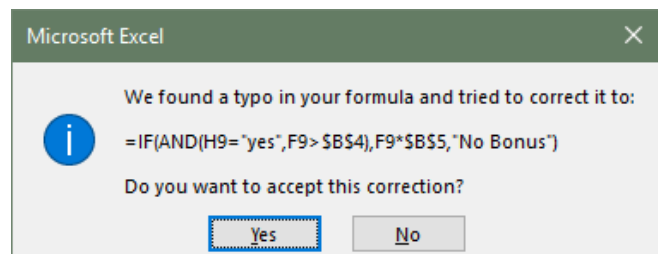


- Enter in what is to be done if the AND function is false.



- When all arguments have been fulfilled, hit the type in a closed bracket to complete the function.

- Note:** Users may hit the Enter key to complete the function, which may result in the following error;
- This error is just notifying the user that the last closed bracket is missing. By accepting this error, Excel will insert the closed bracket to complete the function.



Nested IF Statement

Sometimes there is more than one condition that needs to be tested in order to return a value. To test multiple conditions, users can use a nested IF function. A nested IF statement is an easy way to test for multiple conditions. Typically, the first condition will be tested and an answer will be provided if the condition is True. If the condition is false, a new IF statement will be used to test in the value_if_false portion of the first if statement.

The syntax would look similar to this;

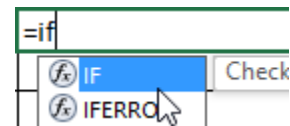
=IF(logical_test,value_if_true,IF(logical_test,value_if_true,value_if_false))

Note: Excel can nest up to 64 if statements.

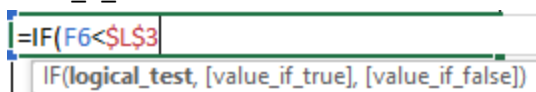
Tip: When comparing values within a scale, make sure the values are sorted in either increasing or decreasing order to help make the nested if statement easier to assemble. If the scale is in Increasing order, the less than < sign will be used in the arguments and if the scale is in decreasing order, the greater than > sign will be used in the arguments.

Steps for a Nested IF statement.

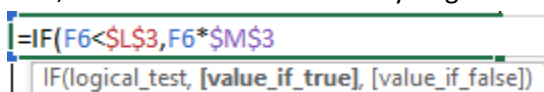
1. Position the cursor in the cell that will contain the formula. Type in an equal sign, followed by if. When if populates under the cell, either double click on if to select it, or use the arrow keys to highlight it and then hit the tab key to select the IF function.



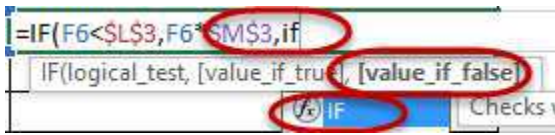
2. Enter in the first logical test within the If function, then hit the comma key to get to the value_if_true.



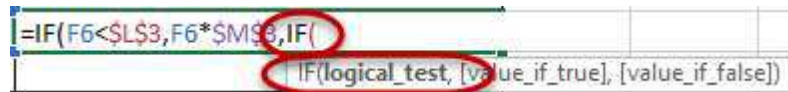
3. In the value_if_true portion of the argument, enter in what is to be done if the first logical test is true, and then hit the comma key to get to the value_if_false.



4. In the value_if_false, a new if statement will have to be started since we are comparing multiple logical tests. To start a new if statement, start typing IF within the value_if_false portion, the exact same way we would start a brand new IF function, but without the equal sign.



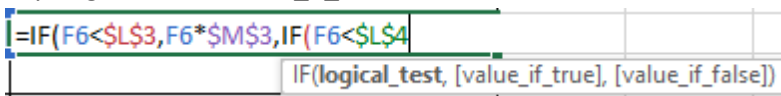
- a. Excel will populate the if function underneath the cell that is being typed in. Select the if function, just as if this was a brand new if statement that was being started, by double clicking on the If, or by highlighting it and then hitting the tab key.



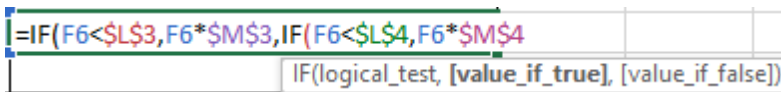
- b. When this is done, users will notice that the argument below the cell changed from being in the value_if_false portion of the first IF function to now being the logical_test of the second if statement.

Tip: Treat this new IF function as its own, free standing if function by entering in all arguments within the IF function.

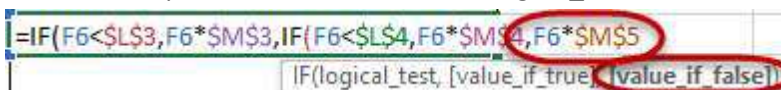
5. In the second IF functions logical_test, enter in the second comparison and then hit the comma key to get into the value_if_true.



6. In the value_if_true portion of the argument, enter in what is to be done if the first logical test is true, and then hit the comma key to get to the value_if_false.



7. In this example, we are only comparing two values, so in the value_if_false portion, enter in what is to be performed if neither of the logical_tests are met.



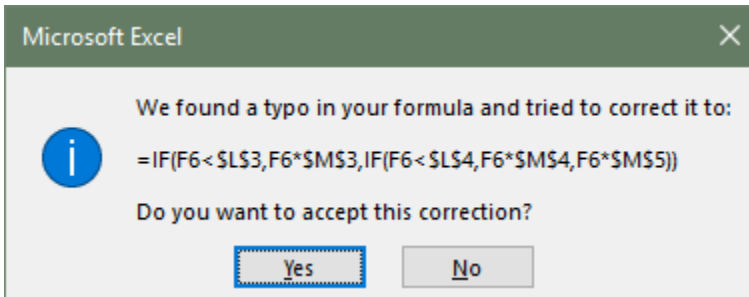
Note: If more logical tests were being compared, another IF function would be entered into the value_if_false portion, following the same steps that were taken in step 4.

8. After the value_if_false portion is completed, complete the second IF function by typing in a closed bracket).



- a. When the closed bracket is typed, users will notice that the IF function argument below the cell will now display the value_if_false argument of the first IF function. Since the second IF statement has completed the value_if_false portion of the first IF function the nested if is now complete.
9. To complete the nested IF function, either type in another closed bracket), or hit the Enter key.

Note: Users may also hit the Enter key after completing the second IF function. If this is done, Excel will populate a window indicating that there is a typo in the formula, meaning there aren't any closed brackets to complete the function. To have Excel enter in the closed brackets, hit the Yes button.



To verify the nested IF was entered in correctly, click on the cell containing the IF function and then hit the F2 key. This will display the function with colored cell references related to the cells on the worksheet.

report				Sales	Commission	
				Below	\$7,000.00	0
					\$14,000.00	1%
				Above	\$14,000.00	3%
0	\$8,500	=IF(F6<\$L\$3,F6*\$M\$3,IF(F6<\$L\$4,F6*\$M\$4,F6*\$M\$5))				

VLOOKUP

The VLOOKUP function is used to find a value in the left-hand column of a vertical array of data, and returns the corresponding value from another column in the same array. VLOOKUP's are a basic form of a database. The V stands for vertical, so the lookup table must be arranged vertically.

The syntax for VLOOKUP is; **=VLOOKUP(Lookup_value,Table_array,Col_index_num,Range_lookup)**

- **Lookup_value** – This is the value that is being searched for in the Table_Array.
- **Table_array** – A table with two or more columns.

There are several rules to remember about the table_array.

1. The left column must contain the values being searched for. In other words, the first column must equal a value associated with the Lookup_Value.
 2. The leftmost column cannot have duplicate values.
 3. This list must be sorted in ascending order based on the leftmost column if the range_lookup is set to TRUE, or left blank.
 4. The Table_array must be absolute referenced within the VLOOKUP function
- **Col_index_num** – The column number in the table_array which will be returned.
 - **Range_lookup**(optional) – a logical value containing either True or False.
 - **TRUE(or blank)** - an approximate match is returned (if an exact match is not found, the next largest value that is less than the Lookup_Value is returned)
 - **FALSE** – an exact match must be found to return the value in the col_index_num

Creating a Lookup Table

Before using the VLOOKUP function, a lookup table needs to be created that will include the values that are being searched for, as well as the return value that will be populated when a value is found.

The lookup table must;

- Be arranged vertically
- Contain the searchable data in the leftmost column
- The leftmost column must be arranged in ascending order.
- Have the return value in any column, except the leftmost column, within the data
- Arranged in ascending or alphabetic order if looking for an approximate match. Meaning the Range_lookup value is TRUE or blank.

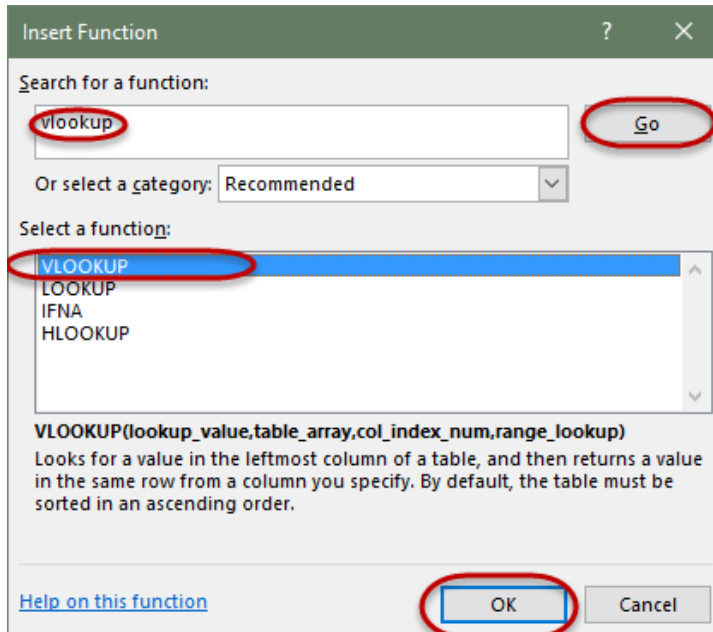
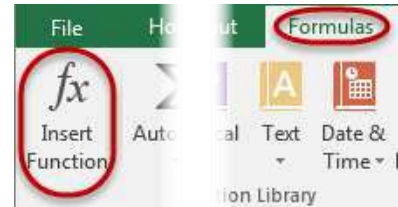
To the right is an example of a lookup_table. The lookup value is in the leftmost column, arranged in ascending order. The return value is the letter grade, which is in column two.

	A	B
1	Score	Grade
2	0.00%	F
3	60.00%	D
4	70.00%	C
5	80.00%	B
6	90.00%	A

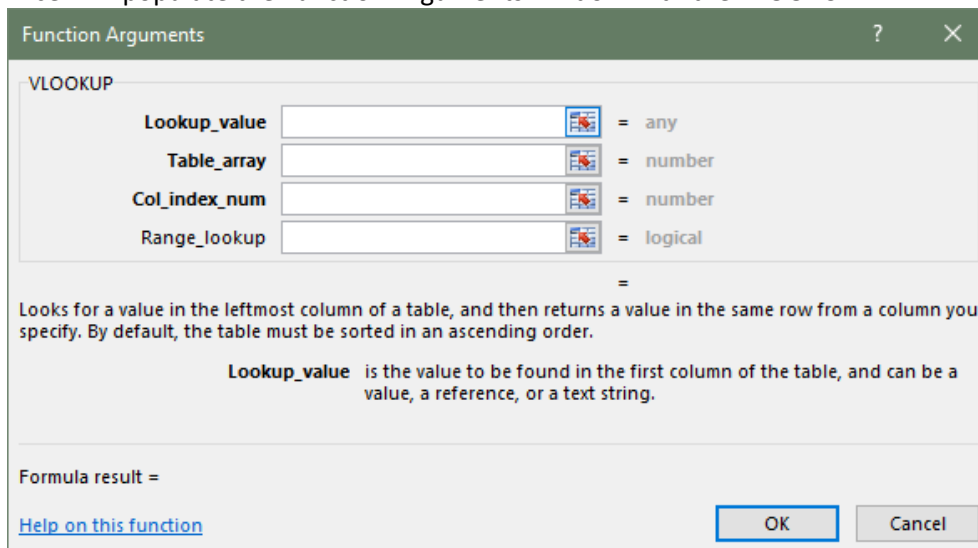
Steps to create a VLOOKUP

Typically, it is easiest to create a VLOOKUP from the Formulas tab using the Insert Function option. Here are the steps to create a VLOOKUP this way;

1. Place the cursor in the cell that is to hold the VLOOKUP function. This will be the cell that will display the value that will be populated from the table_array.
2. Navigate to the Formula tab and then click on the Insert Function icon. The Insert Formula dialog will appear.
3. In the Search for a Formula: text box, type "vlookup" and click Go.



4. Highlight VLOOKUP and click OK.
5. Excel will populate the Function Arguments window with the VLOOKUP



6. **Lookup_value** – this is the value that is to be searched for in the leftmost column of the **Table_array**.
7. **Table_array** – The location of the **Table_array**.
 - **Note:** This must be absolute referenced.
 - The leftmost column must contain the **lookup_value**
8. **Col_index_num** – the column number that the return value is located in
 - The first column of the **table_array** is column 1 and contains the **lookup_value**
9. **Range_lookup** – If the **lookup_value** doesn't have to be an exact match, this can be left blank
 - If the **lookup_values** must match exactly, this must be **FALSE**.
10. When all arguments have been entered, click on the OK button.

Here is an overlay pointing out the arguments of the VLOOKUP function.

The screenshot shows the 'Function Arguments' dialog for the VLOOKUP function. The arguments are:

- Lookup_value:** I2 (value: 0.855714286)
- Table_array:** LetterGrade!\$A\$1:\$B\$5 (value: {0,"F";0.6,"D";0.7,"C";0.8,"B";0.9,"A"})
- Col_index_num:** 2 (value: 2)
- Range_lookup:** (value: logical)

The formula result is **B**. The **Range_lookup** field is circled in red. Red arrows point from the dialog fields to the corresponding cells in the worksheet:

- From **Lookup_value** to cell I2 (85.57%)
- From **Table_array** to the range A1:B5
- From **Col_index_num** to cell J2 (D)

The worksheet data is as follows:

	A	B
1	0.00%	F
2	60.00%	D
3	70.00%	C
4	80.00%	B
5	90.00%	A