How a Nested IF Function Works

The Excel IF function adds flexibility to your spreadsheets by introducing decision making. It does this by testing a specified condition in your spreadsheet to see if it is true or false.

If the condition is true, the function will carry out one action. If the condition is false, it will carry out a different action.

The function allows you to specify what actions it should carry out depending on whether the condition is true or not. These actions can include executing a formula, inserting a text statement, or leaving the target cell blank.

The usefulness of the IF function can be extended by using one or more Nested IF functions. A nested function in Excel refers to one function being placed inside another.

Nested IF functions increase the number of possible outcomes that can be tested for and increase the number of actions that can be taken to deal with these outcomes.

In Excel 2010 and 2007, sixty four IF functions can be nested inside one another.
Nested IF Function Step by Step Tutorial

This tutorial uses a nested IF function (one IF function inside another) to calculate the annual deduction for employees based on their yearly salary.

The function tests to see if an employee's annual salary is in one of three categories:

- less than $30,000
- between $30,000 and $49,999
- $50,000 or more

Depending on the result, different deduction rates are used by the nested IF function in calculating the employee's annual deduction.

Following the steps in the tutorial topics below walks you through creating and using the nested IF function seen in the image above to calculate the deduction for a number of employees.

**Entering the Tutorial Data**

<table>
<thead>
<tr>
<th>Deduction Calculations for Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deduction Rate</td>
</tr>
<tr>
<td>&lt; $30,000:</td>
</tr>
<tr>
<td>$30,000 to $49,999</td>
</tr>
<tr>
<td>&gt;= $50,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Salary</th>
<th>Deduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smith B.</td>
<td>$45,987</td>
<td></td>
</tr>
<tr>
<td>Wilson C.</td>
<td>$23,412</td>
<td></td>
</tr>
<tr>
<td>Thompson J.</td>
<td>$67,265</td>
<td></td>
</tr>
<tr>
<td>James R.</td>
<td>$27,354</td>
<td></td>
</tr>
<tr>
<td>Ramirez A.</td>
<td>$34,678</td>
<td></td>
</tr>
</tbody>
</table>

**Entering the Tutorial Data**

The first step to using the IF function in Excel is to enter the data.

**Tutorial Steps**

Enter the data into cells D1 to F6 of an Excel worksheet as seen in the image above.
For those who do not feel like typing, the data and instructions for copying it into Excel are available at [this link](#).

**Note:** The instructions for copying the data do not include formatting steps for the worksheet.

This will not interfere with completing the tutorial. Your worksheet may look different than the example shown, but the IF function will give you the same results.

## Starting the First IF Function

![IF Function Dialog Box](#)

### Opening the IF Function Dialog Box

When entering a function into a cell in a [worksheet](#), most people use the [dialog box](#) to enter the function's [arguments](#).

While this is a straightforward task for a regular [function](#), it becomes a bit trickier when entering nested functions because the nested function must be typed in. We cannot open a second dialog box to enter the second set of arguments for the nested function.

In this tutorial, the nested IF function will be entered into the third line of the dialog box - the [Value_if_false](#) argument.

Since we are calculating the annual deduction for several employees, we will setup the IF function so that the same function can be used for all employees. This will be done by first entering the function into one [cell](#) F7 and then copying it to cells F8:F11.

## Tutorial Steps

1. Click on cell F7 to make it the [active cell](#). This is where we will enter the IF function.

2. Click on the [Formulas](#) tab.
3. Click on the **Logical** icon on the **ribbon** to open the Logical function drop down list.

4. Click on **IF** in the list to bring up the IF function's dialog box.

The data that we enter into the blank lines in the dialog box form the arguments of the IF function.

These arguments tell the function what condition we are testing and what actions to take depending on whether the condition is true or not.

**Entering the First Logical_test Argument**

The **Logical_test** **argument** is always a comparison between two pieces of **data**. This data can be numbers, **cell references**, the results of **formulas**, or even text data.

In this tutorial we have three salary levels that determine an employee's annual deduction.

- less than $30,000
- between $30,000 and $49,999
- $50,000 or more

A single IF function can compare two levels, but the third salary level is what requires us to use the second (nested) IF function.

The first comparison will be between the employee's annual salary, located in cell E7, with the threshold salary of $30,000. If the employee's salary is less than $30,000 we always want to multiply it by 6% to find the annual deduction.

We place a **comparison operator** between the two items being compared. Since we want to know if E6 is less than $30,000, we will use the **Less Than** operator " < ".
A complete list of the comparison operators that can be used with the IF function can be found [here](#).

**Tutorial Steps**

1. Click on the *Logical_test* line in the dialog box.

2. Click on cell E7 to add this cell reference to the *Logical_test* line.

3. Press the less than key " < " on the keyboard.

4. Type **30000** after the less than symbol.

5. **Note**: Do not enter the dollar sign ( $ ) or a comma separator ( , ) with the above amount. An **Invalid** error message will appear at the end of the *Logical_test* line if either of these symbols is entered along with the data.

6. The completed logical test should read: **E7 < 30000**

**Entering the First Value_if_true Argument**

The **Value_if_true** argument tells the IF function what to do if the Logical Test is true.
The Value_if_true argument can be a formula, a block of text, a value, a cell reference, or the cell can be left blank.

In this tutorial we are first testing to see if the data in cell E7 is less than $30,000. If it is, we want the IF function to use a formula to multiply the employee's annual salary in cell E7 by the deduction rate of 6%, which is located in cell E3.

**Relative vs. Absolute Cell References**

After we complete the IF function in cell F7 we will be copying it to cells F8 to F11 to find out the deduction rate for the other employees in our data sample.

Normally, when a function is copied to other cells the cell references in the function change to reflect the function's new location. These are called relative cell references and they make it easier to use the same function in multiple locations.

Occasionally however, having cell references change when a function is copied will result in errors.

To prevent these errors, the cell references can be made Absolute which stops them from changing when they are copied. Absolute cell references are created by adding dollar signs around a regular cell reference, such as $E$3.

Adding the dollar signs is easily done by pressing the F4 key on the keyboard after the cell reference has been entered into the dialog box.

For this tutorial we will enter the deduction rate located in cell E3 as an absolute cell reference into the Value_if_true line of the dialog box.

**Tutorial Steps**

1. Click on the Value_if_true line in the dialog box.

2. Click on cell E3 in the worksheet to add this cell reference to the Value_if_true line.

3. Press the F4 key on the keyboard to make E3 an absolute cell reference ( $E$3 ).

4. Press the asterisk ( * ) key on the keyboard. The asterisk is the multiplication symbol in Excel.
5. Click on cell E7 to add this cell reference to the Value_if_true line.

6. **Note:** We will **not** make E7 into an absolute cell reference because we want it to change when the function is copied.

7. The completed Value_if_true line should read: $E$3 * E7.

**Starting the Nested IF Function**

The nested IF function will be entered into the Value_if_false line of the dialog box.

Normally, the Value_if_false argument tells the IF function what to do if the Logical Test is false.

In this tutorial, however, we still have two deduction levels left to deal with:

- employees with a salary between $30,000 and $49,999
- and those with a salary greater than or equal to $50,000

And we can only give the IF function one instruction per argument.

To get around this problem, we use a second IF function with a Logical test that will break down the two remaining deduction levels into separate groups.

As mentioned at the beginning of the tutorial, we cannot open a second dialog box to enter the second set of arguments for the nested function so the nested IF function must be typed into the Value_if_false line.
Tutorial Steps

1. Click on the Value_if_false line in the dialog box.

2. Type the word `if` followed by an open round bracket " ( " (no quotes).

3. At this point, the nested IF function on the Value_if_false line should read:

   ```
   if ( 
   ```

Entering the Nested IF Function Logical_test Argument

As mentioned in the previous step, we still have two deduction levels left to deal with:

- employees with a salary between $30,000 and $49,999
- and those with a salary greater than or equal to $50,000

The Logical_test of the nested IF function can be written so that it breaks down the two remaining deduction levels into two mutually exclusive groups.

The two groups will be:

- employees with a salary of less than $50,000
- employees with a salary greater than or equal to $50,000

Note: We do not have to worry about those employees with a salary of less than $30,000 being included with the group who make less than $50,000 because the first IF function has already dealt with them.
Employees who make less than $30,000 have been removed from the data being used for the second IF function.

**Tutorial Steps**

Following the open round bracket " ( " entered in the previous step,

1. Click on cell E7 to enter that cell reference at the beginning of the nested IF function Logical_test.

2. Press the less than key " < " on the keyboard.

3. Type 50000 after the less than symbol.

4. Type a comma ( , ) **AFTER** the 50000.

5. At this point, the nested IF function on the Value_if_false line should read:
   
   if (E7 < 50000,

**Note:** The comma is used as a separator between the three arguments of the IF function. When using the dialog box to enter the IF function, Excel enters the comma for us.

When typing in the function, entering a comma in any location other than as a separator between the three arguments will cause an error in the final results.

![Adding the nested IF function's Value_if_true argument with the absolute cell reference $E$4](image.png)
**Entering the Nested IF Function Value if True Argument**

In the previous step the logical test for the nested IF function divided the remaining employees into two groups:

- employees with an annual salary of less than $50,000 (when the logical test is TRUE)
- employees with an annual salary of $50,000 or more (when the logical test is FALSE)

The Value_if_true argument for the nested IF function will calculate the annual deduction for the first group of employees. The second group's annual deduction will be calculated by the Value_if_false argument in the next step of the tutorial.

The deduction rate for this first group of employees is 8%. The amount of the deduction will be their annual salary multiplied by 8%.

As with our first Value_if_true argument in step 5, we need to use an absolute cell reference for the deduction rate when entering the formula to calculate the annual deduction.

The absolute cell reference will prevent errors from occurring when we copy the nested IF function to other cells in the last step of the tutorial.

**Tutorial Steps**

Following the nested IF function Logical_test "E7 < 50000, " entered in the previous step,

1. Click on cell E4 to enter that cell reference into the nested IF function Value_if_true argument.

2. Press the F4 key on the keyboard to make E4 an absolute cell reference ($E$4).

3. Press the asterisk ( * ) key on the keyboard. The asterisk is the multiplication symbol in Excel.

4. Click on cell E7 to add this cell reference to the Value_if_true argument.

5. **Note:** We will not make E7 into an absolute cell reference because we want it to change when the function is copied.
6. Type a comma (,) after E7. The comma is used to separate the Value_if_true argument from the Value_if_false argument that will be entered in the next step of the tutorial.

7. At this point, the nested IF function on the Value_if_false line should read:
   \[ \text{if (E7 < 50000, $E$4*E7, } \]

   **Entering the Nested IF Function Value_if_false Argument**

   The Value_if_false argument tells the IF function what to do if the Logical Test is FALSE.

   In this case, the Value_if_false argument for the nested IF function will be a formula that will calculate the annual deduction for those employees making $50,000 or more.

   The formula will multiply the employee's annual salary in cell E7 by the deduction rate of 10%, which is located in cell E5.

   As with the preceding step, we will be entering the deduction rate ( E5 ) into the Value_if_true line of the dialog box as an absolute cell reference ($E$5).

   This is being done to prevent cell reference errors from occurring when we copy the IF function to other cells in the last step of the tutorial.

   **Tutorial Steps**

   For help with these instructions, click on the image above.

   Following the nested IF function Value_if_true " E7 < 50000, " entered in the previous step,
1. Click on cell E5 to add this cell reference to the Value_if_false argument.

2. Press the F4 key on the keyboard to make E4 an absolute cell reference ( $E$5 ).

3. Press the asterisk ( * ) key on the keyboard. The asterisk is the multiplication symbol in Excel.

4. Click on cell E7 to add this cell reference to the Value_if_false argument.

5. **Note:** We will not make E7 into an absolute cell reference because we want it to change when the function is copied.

6. Type a closing round bracket " ) " after E7 to complete the nested IF function.

7. Click OK to close the dialog box and enter the completed IF function into cell F7.

8. The value of $3,678.96 should appear in cell F7.

9. Since B. Smith earns more than $30,000 but less than $50,000 per year, the IF function uses the formula $45,987 * 8\%$ to calculate his annual deduction.

10. When you click on cell F7, the complete function

    
    \[
    = \text{IF} \ ( \ E6<30000, \ \$E$3*E7, \ \text{IF} \ ( \ E7<50000, \ \$E$4*E7, \ \$E$5*E7 ))
    \]

    appears in the formula bar above the worksheet.

**Copying the Nested IF Function using the Fill Handle**
Copying the Nested IF Function using the Fill Handle

To complete the worksheet, we need to add the IF function to cells F8 to F11.

Since our data is laid out in a regular pattern, we can copy the IF function in cell F7 to the other four cells.

As the function is copied, Excel will update the relative cell references to reflect the function's new location while keeping the absolute cell reference the same.

To copy down our function we will use the Fill Handle.

**Tutorial Steps**

For help with these instructions, click on the image above.

1. Click on cell F7 to make it the active cell.

2. Place the mouse pointer over the black square in the bottom right corner. The pointer will change to a plus sign " + ".
3. Click the left mouse button and drag the fill handle down to cell F11.

4. Release the mouse button. Cells F8 to F11 will be filled with the results of the IF function.

5. If you have followed the steps of this tutorial your worksheet should resemble the example on page 1 of this tutorial.