In this lesson we will look at a few more functions that expand the range of things we are able to do with Excel.

Logical Functions

Logical functions are like the Boolean operators we have used to retrieve information from databases. In essence they test whether something is TRUE or FALSE.

**AND(X,Y)**

*The AND(X,Y) function tests whether both X and Y are TRUE.*

If both X and Y are TRUE
Then AND(X,Y) is TRUE
Otherwise AND(X,Y) is FALSE

**OR(X,Y)**

*The OR(X,Y) function tests whether either X or Y are TRUE.*

If X is TRUE then OR(X,Y) is TRUE
If Y is TRUE then OR(X,Y) is TRUE
If both X and Y are FALSE then OR(X,Y) is FALSE

**IF(Test Condition,Value1,Value2)**

*The IF function in a cell tests a condition to see if the condition is TRUE or FALSE. The function displays one value in the cell if it is true. The function displays another value in the cell if it is false.*

If Test Condition is TRUE then the cell will contain Value1
If Test Condition is FALSE then the cell will contain Value2
Take a look at the **Logical** worksheet tab that will allow you to play with the three logical functions.

The Logical worksheet illustrates how the three logical functions work. It contains the following functions:

Cell B7: \( \text{=AND(B3=5, B5=6)} \)

Cell B9: \( \text{=OR(B3=5, B5=6)} \)

Cell B11: \( \text{=IF(B3=5,100,200)} \)

Experiment with this worksheet. Ask yourself, what does each of these logical functions do? Try entering different numbers (including 5 and 6) in cells B3 and B5. What is displayed in cells B7, B9, and B11?

**Review: Filters and Conditional Formatting**

Go to the Example 2 worksheet. Let’s suppose that your company is holding a gala affair for major donors who have given over $1000.

There are several ways we could identify these donors on the worksheet. Let’s review two we already have learned.

1. **Filter** the data so that it displays only the donors who have given more than $1000.
   a. When you are done, remove the filter

2. Use **Conditional Formatting** to shade the cells in column G light red if the value in that cell is greater than $1000.
   a. When you are done, remove the conditional formatting
The IF Function

Another way to identify donors of over $1000 is to use the IF function.

- Put the text “Dinner” in cell H3
- In cell H4, put the function shown below
  - IF(G4>1000, “Invite”, “-“)
  - This function asks if cell G4 contains a number greater than $1000
    - If this is true, then “Invite” is displayed in cell H4
    - If this is false, then “-“ is displayed in cell H4
- Copy cell H4 and paste it into the cells below.

Your worksheet now should look like the picture below.

![Example Worksheet 2](image)

When you are finished, delete column H and remove the conditional formatting on the cells in column G.
The AND Function

Go to the Analysis worksheet.

For each of the four cash registers we want to test two things:

- Is the maximum amount earned for the seven days greater than $1,000
- Is the percent for the register greater than 15%

If both of these are true we will keep the register. Otherwise we will remove the register from the store.

We can use an AND function to test if both of the conditions above are true.

The percent and maximum amount earned for Register #1 are in cells B5 and C5, respectively.

- Use this function: \( =\text{AND}(B5>15\%, C5>1000) \)
  - This is true if both \( B5 > 15\% \) and \( C5 > 1000 \)
  - This is false if either condition is not true

We will use this AND function as the Test Condition in an IF function

- Put \( =\text{IF}(\text{AND}(B5>15\%, C5>1000), "Yes", "No") \) in cell D5
  - If the AND function is true then cell D5 will display “Yes”
  - If the AND function is false then cell D5 will display “No”

In cell D5 enter:

\[ =\text{IF}(\text{AND}(B5>15\%, C5>1000), "Yes", "No") \]

\textit{Note that when it is inside the IF function, the AND function does not need an equal sign in front.}

Copy the function in cell D5 and paste it into Cells D6, D7, and D8.

Why is “Yes” displayed in cells D5, D6, and D7, but “No” is displayed in cell D8.
Lookup Functions

Let’s start by adding a set of city tax tables to the Analysis worksheet.

Cells A12 through A17 are numbers formatted as currency with no decimal places.

Cells B12 through B17 are numbers formatted as percent with two decimal places.

Cell E11 in the analysis worksheet is set equal to the register total in cell G18 of the Register worksheet. Share this data between the two worksheets, as described in Lesson 8.

We will pull the tax rate from these tax tables using a lookup function.

**Lookup functions** find information in tables when the table is set up as ranges of values, rather than exact ones. The best way to explain how they work is to look at an example.

Suppose the city within which your business is located imposes a tax on gross receipts. The tax rate levied increases in steps depending on the amount of receipts as shown in the tax tables at the right.

The tax rate is found as follows:

1. Start with your receipt value, for example $12,000
2. Look in the Receipts column of the tax tables
   a. Find the value in the Receipts column directly below your receipt value
   b. For your receipts of $12,000 this would be $10,000
3. Look across the table to the next column and choose this rate
   a. For our example, the rate would be 0.10%

Question: What would your tax rate be if your receipts are $180,000?
Excel’s vertical lookup function handles data in tables like the tax tables discussed on the previous page. The form of the vertical lookup function is shown below..

=VLOOKUP(lookup_value, table_array, offset, [TRUE/FALSE])

- **lookup_value** is the value we are looking up
  - In the picture above, the lookup_value is in cell E11
- **table_array** is the table from which we are pulling the information
  - The upper left cell and lower right cell of the data define the table array
  - In the picture above, the cells corresponding to the table are A12:B17
- **offset** is the column of the table array from which to take the information
  - Column 1 = left column; column 2 = next column to the right; etc.
  - In example above, offset = 2 because we are pulling the tax rate from the second column of the table
- [TRUE/FALSE] generally is omitted
  - The default is TRUE – look for approximate values with a range
  - FALSE instructs Excel to look for only exact values that are actually in the table

**IMPORTANT:** To use the VLOOKUP function, the lookup column of the table must be sorted from smallest to largest.

In cell E13 of the Analysis worksheet, enter

=VLOOKUP(E11, A12:B17,2)

Format cell E13 as shown in the picture at the right.

In cell E15, multiply cell E13 and E11. This calculates the amount of tax.
Inserting a Column or Row

Let’s try one more example of the use of VLOOKUP.

Go to the Example 2 worksheet. First we want to move the Gifts column of this worksheet to the left so we can use it as a lookup table. Select column A and right-click on the column. In the menu that appears, select Insert.

This will open up a new blank column in column A.

Next, move to the Gifts column and select it. Right-click on this column and select Cut from the menu. Move the cursor back to Column A and Paste it there.

Move the title back into cell A1.

Sort the worksheet from smallest gift to largest (as in Lesson 5).

When you complete this, the Example 2 worksheet should look like the picture below.

![Example Worksheet 2](image-url)
Adding a VLOOKUP Function

Now, we will create a VLOOKUP function that uses this table.

We want to be able to input a gift level (maybe $2000) and pull the name of the first donor whose gift is directly under this value.

- In cell G3 enter the text “Minimum Gift”
- In cell G4 enter a number, such as 2000. Format this cell as accounting or currency with no decimal places.
- In cell G6 enter the text “Last Name”
- In cell G7 use a VLOOKUP function to find the last name
  - The VLOOKUP function is on the last page of this lesson. Don’t look until you have written your own function.
- In cell G8 use a VLOOKUP function to tell the amount of that person’s donation.
  - Again, the answer is on the last page.
**Answers**

Cell G7: The VLOOKUP function is  
   \[=VLOOKUP(G4, A4:F40,3)\]

Cell G8: The VLOOKUP function is  
   \[=VLOOKUP(G4, A4:F40,1)\]