

## 10. More on Functions

### 10.1 Basic Statistical Functions

The table below shows the use of four basic statistics functions with results based on the following data range...

56	98	23	45	87	12
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<b>Function Name</b>	<b>Purpose</b>	<b>Result using above</b>
= MAX	Find biggest value in range	98
= MIN	Find smallest value in range	12
= AVERAGE	Find the average value in range	53.5
= COUNT	Find the number of values in a range	6

Each formula has the same basic pattern: =MAX(A1:F1). The range must refer to the cell addresses of the numbers, of course.

### 10.2 Logical Formulae

#### Overview

At their most basic, logical formulae compare 2 things using a 'relational operator' ...

<b>Operator</b>	<b>Meaning</b>
<	Less than
>	Greater than
=	Equal to
<=	Less than or equal to
>=	Greater than or equal to
<>	Not equal to

C	D	E	F	G
5		FALSE		=C1=C2
9		FALSE		=C1>C2
		TRUE		=C1<C2
		TRUE		=C1<>C2
		FALSE		=C1>=C2
		TRUE		=C1<=C2

A logical formula always evaluates to either TRUE or FALSE.

For example, in the sheet above, there are 2 numbers in cell C1 and C2. In column E starting at cell E1, there are logical formulae using each of the above operators. In column G the formulae are displayed as text.

The formulae are written in the form ... =C1=C2 (This is the formula in cell E1).

If the number in cell C1 is equal to the number in cell C2, the formula will evaluate to True which is displayed in cell E1. Otherwise the formula will evaluate to False.



**It is often helpful to think of a logical formula as asking a question such as ... 'is the number in cell C1 equal to the number in cell C2?'**

**The answer must be either Yes (TRUE) or No (FALSE).**

Just as arithmetical formulae recalculate when the numbers in the cells on which they are based are changed, so do logical formulae. Changing the numbers in cell C1 and C2 will lead to differing patterns of TRUE and FALSE in column E.

### **10.3 IF Formulae**

The very simple logical formulae referred to above become much more useful when they are incorporated in longer formulae, which typically begin with the =IF function.

IF statements make decisions. They are used for carrying out a test and then doing one of two actions, depending upon whether the test evaluates to TRUE or FALSE.

As a result of the test carried out by an IF Statement, you may want StarOffice Calc to display text, values or carry out calculations.

### **10.4 Syntax of an IF Function**

IF statements have the following syntax...

=IF(Logical Test; Action If True; Action If False)

Although it is usually better to include all 3 arguments in the formula, you can omit the Action If False argument. If the test evaluates to FALSE, StarOffice Calc displays the word FALSE in the cell where you wrote the formula.

For example, =IF(C1>C2;'Yes') is a valid formula which would show Yes only if the contents of cell C1 were greater than those in cell C2. If the condition is not true, the word 'FALSE' appears in the cell.

## 10.5 Example of an IF Function

IF Statements are often used to check whether figures balance within a worksheet.

	A	B	C	D	E	F	G	H
1								
2	23							
3								
4								
5								
6			<b>Result</b>			<b>If the contents of cell A2 are the same as</b>		
7	30		<b>Incorrect</b>			<b>A7 display "Balance".</b>		
8						<b>If not, display "Incorrect".</b>		
9	<b>=IF(A2=A7;"Balance";"Incorrect")</b>							

For example to check whether a figure in cell address A2 is equal to a figure in cell address A7... If they are equal, display the word 'Balance' in the result cell, if it is false, display the word 'Incorrect' in the result cell.

The formula is =IF(A2=A7;'Balance';'Incorrect')

An example of a situation where such formulae are useful would be where commission or bonus rates are being calculated, where the result is dependent upon a certain sales target being achieved. In fact, logical formulae can be very useful indeed, much more so than they may seem at first sight.

## 10.6 Nested IF Functions

An IF function will test for 1 of 2 possibilities. Sometimes however there may be a need to test for a further possibility. For example, when you compare 2 numbers there are 3 possibilities...

1. The first number may be **less than** the second number
2. The first number may be **equal to** the second number
3. The first number may be **greater than** the second number

Although each IF function will only allow you to test for 1 of 2 possibilities, IF functions can be nested so that a second IF function can test the results of the first IF function and consider two further possible results. For example...

IF(H5>H4;'Profit';IF(H5=H4;'Broke even';'Loss'))

This formula replaces the 'Action if False' argument with a new complete IF function which also requires 3 arguments. Note that the IF function in the middle of the formula is not preceded by the equals sign '='.



**Note the way that the above formula is punctuated. Pay careful attention to closing brackets, speech marks and semi-colons, (there must always be the same number of opening and closing brackets).**

Other situations where you may need to take into account a number of possibilities would be where you want to check a list for outstanding invoices which may be less than 30 days old, 30 to 60 days old, 60 to 90 days old and more than 90 days old. This could be done with a logical formula, (though it would be fairly long).

## 10.7 Using AND and OR with IF

An additional useful feature is the ability to combine tests using the logical operators AND and OR. For example, you may have a spreadsheet which lists invoices and is used to check which invoices are overdue.

F4						
f(x) Σ = =IF(AND(D4<TODAY()-30;E4<>"Yes");"Yes";"")						
	A	B	C	D	E	F
1	<b>Invoices</b>					
2						
3						
	<b>Inv No</b>	<b>Customer</b>	<b>Amount</b>	<b>Inv date</b>	<b>Paid</b>	<b>Overdue</b>
4	34124	AB Forgings	640.00	23 Jan	No	Yes
5	34125	High Street Services	1,267.78	07 Feb	No	Yes
6	34126	District Council	571.56	16 Feb	Yes	
7	34127	AB Forgings	2,121.00	21 Jan	No	Yes
8	34128	Black Horse	320.65	26 Feb	No	
9	34129	District Council	1,589.35	01 Feb	Yes	
10	34130	AB Forgings	4,879.21	05 Feb	No	Yes
11	34131	Black Horse	154.75	14 Mar	No	

The formula in column F reads ... =IF(AND(D3+30<TODAY());E3<>'Yes');'Yes';'')

The formula adds 30 days to the invoice date to calculate the due date, and checks to see whether this is less than today's date. In other words, have we gone past the due date? If today's date is later than the due date and Yes is not in the Paid column, StarOffice Calc enters Yes in the Overdue column, otherwise it displays nothing.



**You should use two double quotes together "" to indicate a blank entry.**

If you wanted to test for either condition enter OR instead of AND in the formula above. Remember that OR will return a True result if either or both of the conditions are met.

## 10.8 Spreadsheet Functions

### Overview

There are a number of functions in the Spreadsheet Category which offer a powerful way of accessing data in a tables (sometimes called an 'array'). The table below describes the 3 most useful Spreadsheet functions...

<b>Function Name</b>	<b>Meaning</b>	<b>Description</b>
<b>VLOOKUP</b>	<b>Vertical Lookup</b>	<b>For finding a value located in a specific row.</b>
<b>HLOOKUP</b>	<b>Horizontal Lookup</b>	<b>For finding a value located in a specific column.</b>
<b>INDEX</b>		<b>For finding a value located in a specific cell.</b>

## 10.9 The VLOOKUP Function

For most people this is the most useful Spreadsheet function – though it is in the Spreadsheet category on the Function Wizard. It has the following syntax -  
=VLOOKUP(Search criterion; Array; Col index num; Sort order)

### **Search criterion**

*Is the value to be looked up and is found in the first column of the table. Lookup value can be a numeric value, a reference to a cell address or text.*

### **array**

*Is the table of data to be looked in. Cell references or a range name can be used, (range names are usually easier to work with, especially if you need to copy the formula).*

### **Index**

*Once the lookup value is found in the first column, the **Index** specifies the column number in the table array from which the matching value should be returned. A number of 2 returns the value in the second column whilst a number of 3 returns the value in the third column, etc.*

### **sort order**

***sort order** is an optional parameter that you may need to use if the the first column in the array is not sorted in ascending order. Enter the value FALSE if the first column is not sorted in ascending order and you want an exact match only.*

## 10.10 VLOOKUP Example

You may want to set up your lookup table in such a way that a user can type in a product code and then see the information for that product such as its name, supplier, unit cost, lead-time, selling price and so on...

1. The information to be looked up vertically, (such as product ID) must be listed in the first column of the table.
2. The other columns within the table would contain information to be referenced, (such as Product Name and Unit Cost).
3. Although you can write the formula using cell addresses, it is usually better to create named ranges for the cell containing the Search Criterion and the array. The range names make the formula easier to write, easier to interpret and easier to copy (as named ranges are treated as absolutely addressed). In the example below, the Search Criterion cell (F2) has been named 'Ref' and the lookup table has been named 'Products'.

The following is an example of how VLOOKUP can be used, returning the Product Name and Unit Price, when the Product ID is entered in cell F2...

	A	B	C	D	E	F	G
1	<b>Product ID</b>	<b>Product Name</b>	<b>Unit Price</b>				
2		1 Charamsala Tea	18.00		Product ID	10	
3		3 Liquorice Syrup	10.00		Product Name	Fish Roe	
4		9 Mishi Kobe Beef	97.00		Unit Price	£31.00	
5		10 Fish Roe	31.00				
6		11 Cabrales Cheese	21.00				
7		13 Kelp Seaweed	6.00				
8		14 Bean Curd	23.25				
9		17 Alice Springs Lamb	39.00				
10		28 Rossie Sauerkraut	45.60				
11		31 Gorgonzola Telino	12.50				
12		32 Mascarpone Fabioli	32.00				
13		33 Goat Cheese	2.50				
14		48 Dutch Chocolate	12.75				


The completed VLOOKUP statement to find the Product Name is ...

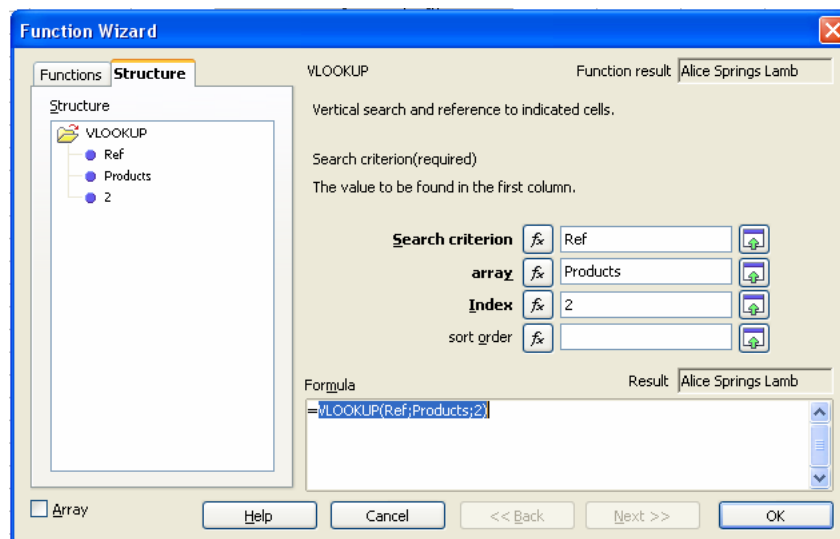
**=VLOOKUP(Ref;Products;2)**

To display the Unit Price we would use the following statement...

**= VLOOKUP(Ref; Products;3)**

## 10.11 Setting-up a VLOOKUP Table

- enter the information for the lookup table and give it a range name
- position the mouse pointer where the result of VLOOKUP is to appear
- click the **Function Wizard** button 
- select the **Spreadsheet** category
- click **VLOOKUP** and click the **Next** button



- in the **Search criterion** field enter the Range Name (or cell address) where you will enter the value you want to search for



**Use the 'Shrink button to the right of each field to go back to the worksheet and select the cells by pointing.**

- in the **array** field enter the table array name
- in **Index** field enter the column number for the data
- either leave the **sort order** field empty, (for an approximate match) or enter FALSE for a precise match
- choose **OK** when done

Remember the general principle that you must either sort the data on the first column of the lookup table or use the FALSE argument if you want an exact match.

## 10.12 Lookup Hints and Tips

1. Think carefully whether you want to find exact matches or the nearest value lower than the lookup value
2. If necessary sort the data table and avoid duplicates in the lookup column or row, (remember that if an exact match is not found StarOffice Calc displays the nearest entry *before* than the value you entered).
3. If you ask for a precise match and StarOffice Calc cannot find it you will be alerted of the error by **#NA** appearing in the VLOOKUP cell.
4. Use a named range to define the *entire* data table and use this in all lookup formulae
5. If you need help with lookups select the cell containing the lookup function and then select the Function Wizard button, (this will show you the syntax of the function and also has a Help button)

## 10.13 The HLOOKUP Function

This is very similar to VLOOKUP but the value is looked up in the top row rather than the first column. StarOffice Calc then looks down that column to find the desired value.

The syntax is also very similar to VLOOKUP...

**=HLOOKUP(search criteria; array; [Row] Index; sorted)**

As with VLOOKUP, if you want StarOffice Calc to look for only an exact match, enter **FALSE** in the **sorted** field.

**=HLOOKUP(F3,foodtable,3,FALSE)**

This formula tells StarOffice Calc to look along the first row of the range called foodtable for an exact match for the value specified in cell F3. Once located, StarOffice Calc displays the entry found in the third row of the table.

## 10.14 The INDEX Function

Index locates a cell by means of a row and column offset.

The syntax is as follows...

=INDEX(Array,Row no,Col no)

For example ...

	A	B	C	D	E	F	G	H
1		1	2	3		Row No	2	
2		<b>Product ID</b>	<b>Product Name</b>	<b>Unit Price</b>		Column No	3	
3	1	17	Alice Springs Lamb	39.00		Product Name	23.25	
4	2	14	Bean Curd	23.25				
5	3	11	Cabrales Cheese	21.00				
6	4	1	Charamsala Tea	18.00				
7	5	48	Dutch Chocolate	12.75				
8	6	10	Fish Roe	31.00				
9	7	33	Goat Cheese	2.50				
10	8	31	Gorgonzola Telino	12.50				
11	9	13	Kelp Seaweed	6.00				
12	10	3	Liquorice Syrup	10.00				
13	11	32	Mascarpone Fabioli	32.00				
14	12	9	Mishi Kobe Beef	97.00				
15	13	28	Rossie Sauerkraut	45.60				

**=INDEX(FoodTable;G1;G2)**

This is the formula in the illustration above. It tells StarOffice Calc to look in the range called Foodtable, 2 rows down from the top and 3 columns from the left as the numbers 2 and 3 are in cells G1 and G2.

By typing different row and column numbers into cells G1 and G2 the formula will extract the relevant item of information from the table.