Excel Solutions for Accountants: Book 2

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Book 2

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1 Introduction

This is the second in a series of three books with the title of *Excel Solutions for Accountants*.
The essence of the book is that we have chosen a series of topics that we believe are of direct interest and relevance to accountants: we know that from the work we do every day. That is not to say that everything an accountant ever needs or does is included in this book; rather it's a general book aimed at the accountant who knows that Excel can be made to do a lot more than it does but he just doesn't know what that might be.

We have taken a very hands on approach with this book and for everything we talk about there is something for you to do: there is a spreadsheet for you to work with, too, so that you can always check your work and your accuracy at every stage.

One of our over riding ambitions was to make this book both as direct and as easy to use as possible. You will not find massive files with hideously complex formulas in them, each of which might take you an hour or two just to begin to unravel. What we have done is to give you straightforward examples with non complex lists and databases so that you come to learn the techniques and functions rather than worrying about the database.

Part Two of the book comprises the following

- Accountant Specific 2
- Compound Interest and Discounting: the time value of money
- Data Validation and Form Controls
- Ratio Analysis 2
- Graphs 2
- Pivot Tables 2

You can see immediately from the titles of these chapters that the accountant is the target here!
Secondly you should see that four of the chapters have the number 2 after them: that tells you that in books 1 and/or 3 there is another chapter or chapters on the same topic. Take a look at the contents of books 2 and 3:

Part One	Part Three
Accountant Specific 1	Accountant Specific 3
Excel Tables	Dashboarding
Depreciation	Pivot Tables 3
Ratio Analysis 1	Forecasting
Graphs 1	Budgeting
Pivot Tables 1	AGGREGATE, OFFSET and SOLVER

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More than one way to skin a cat! We present one or more solutions to the problems we present in this book and from time to time we say: Excel provides more than one way to solve this problem. If you already know a better way to solve a problem than we are presenting, stay with it. Even if you think our method is better but are happy with your own method, stick with it if it doesn't mean you are wasting time or being inefficient. Don't be stubborn though: like the cost accountant who saw our solution to his problem but preferred not to follow our advice: that meant he preferred to wait 20 minutes every morning for his main Excel file to open and then wait a further 45 seconds or so **every time he pressed the Enter key**. Our solution meant no waiting time at all as we replaced his 30,000 volatile function workbook with a Pivot Table based solution that provided almost instant responses.

Templates: we have tried at every stage of every chapter of this book to provide templates for you to work with and/or create. After all, what's the point of programming a spreadsheet over and over again when you shouldn't have to? Excel deals with some of the most predictable things you can do and templates are consistent with that. Therefore, take each of our examples either as a template or as your template in the making. We stress **PPP** too: **paper, pencil, plan**. The PPP approach means, don't just dive in to a spreadsheet problem, take you time and plan it out on paper first. Then develop your solution. Then derive your template if appropriate.

A total of 18 chapters and by the end of all three books we believe you can easily call yourself an intermediate user of Excel. We also feel that you will have unlocked so much potential in Excel that you will want more and more from it.

This book has been written with **Excel 2013 for Windows**: that will mean that some of the things we have done will be a little bit different sometimes from what any other version of Excel might do. We have kept such differences to a minimum, however. Nevertheless, we would encourage you to upgrade to 2013 soon anyway.

Excel Files Available

All of the Excel files mentioned in this book can be found on this book's page at:
http://bookboon.com/en/excel-solutions-for-accountants-book-2-ebook

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Other sources of help for Excel: there are many sources of help other than Excel itself. Here are just a few examples of where to get help: just search for these online to get there!

excelmaster.co: my own Excel Blog

Excel-G: online/email based discussion list for general level questions on Excel. There are about 1,000 members of this group and they are friendly and really helpful people. Please note, this is a general level list and anything too advanced should be directed at…

Excel-L: online/email based discussion list for Excel Developers. This is the more advanced list and seems to concentrate mainly on VBA problems and solutions.

OzGrid: this is a free and commercial site offering some brilliant resources.

chandoo.org: this is another really useful site whose founder, Chandoo, has the objective of making you *awesome in Excel*! A lot of the materials on this site are free but some of them are commercial. Chandoo also offers online and offline courses.

Jon Peltier: Jon seems to be the world's foremost authority on graphs and charts. Again, this is a combined free and commercial site but there are many wonderful free resources on there.

Mr Excel: Bill Jelen is a prolific Excel materials developer and explanator! Bill provides a lot of free and highly commendable materials, again both free and commercial.

Charley Kyd: Charley has specialised in the past in dashboarding and whilst he still does that, he offers a lot of free Excel based materials too. Well worth searching out.

John Walkenbach: John has been around for ages and he writes the *Excel Bibles*, among other Excel based titles. John is always comprehensive and has a lot of useful things to offer

YouTube: there are thousands of videos on YouTube now and more appear every day. Some of them are really very good and others will leave you wondering what on earth they were trying to say. It's pot luck really but once you find a good YouTube provider, stick with them!

There are many more people/organisations/lists that can help you so these are just a few of the ones we recommend.

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2 Accountant Specific 2

Introduction

In this second of three chapters in which we work through a series examples and techniques that accountants need for their everyday work, we will discuss:

- SUMPRODUCT
- SUMIF
- SUMPRODUCT v SUMIF
- IFERROR
- Interest Functions in Excel
- Create a Trial Balance Using a Pivot Table
- Prepare Financial Statements Using a Pivot Table

Not all accountants need all of these but every accountant needs some of them!

2.1 SUMPRODUCT v SUMIFS

See the spreadsheet *sumprod_sumifs.xlsx* for this demonstration: which is based on a web page from David Ringstrom, the URL for which is in that spreadsheet file. We have taken David's SUMPRODUCT() ideas and programmed them using his information. In parallel we have also programmed our version, the SUMIFS() version.

Excel 2007 tells us that their functions such as SUMIFS require less space, less memory and so on and are therefore more efficient than other similar fuctions. The comparison between the two functions we are discussing here are clearly shown when I asked the two functions to add together sales based on several criteria.

We will be using the SUMPRODUCT() and SUMIFS() functions and this is their syntax:
= SUMPRODUCT(array1,array2,array3 …)
=SUMIFS(sum_range,critera_range1,criteria1,[criteria_range2,criteria2] …)

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This is a screenshot of what we are doing, Figure 1:

Comparison of SUMPRODUCT and SUMIFS
Duncan Williamson: Excel Master from www.excelmaster.co.uk
Based on David Ringstrom's page: http://www.accountingweb.com/topic/excel/some-unlikely-uses-sumproduct
My article on my blog: http://excel2007master.wordpress.com/
25th March 2010

Region	City	Chain	Product	Total Sales
North GA	Atlanta	Fruit R Us	Oranges	61,650
North GA	Atlanta	Fruit R Us	Apples	85,106
North GA	Atlanta	Fruit R Us	Bananas	75,548
North GA	Atlanta	Bob's Fruit	Oranges	93,816
North GA	Atlanta	Bob's Fruit	Apples	21,910
North GA	Atlanta	Bob's Fruit	Bananas	98,420
North GA	Blue Ridge	Mountain Fruit	Oranges	89,810
North GA	Blue Ridge	Mountain Fruit	Apples	83,538
North GA	Blue Ridge	Mountain Fruit	Bananas	60,900
North GA	Clarkesville	Fruit Direct	Oranges	9,604
North GA	Clarkesville	Fruit Direct	Apples	82,030
North GA	Clarkesville	Middle Georgia Fruit	Bananas	107,406
Mid GA	Macon	Middle Georgia Fruit	Oranges	71,097
Mid GA	Macon	Middle Georgia Fruit	Apples	15,764
Mid GA	Macon	Whistlestop Fruit Stand	Bananas	14,730
Mid GA	Macon	Whistlestop Fruit Stand	Oranges	149,745
Mid GA	Macon	Whistlestop Fruit Stand	Apples	108,147
Mid GA	Macon	Whistlestop Fruit Stand	Bananas	87,934

Change one or more of the variables you want to test for

Region	City	Chain	Product
North GA	Atlanta	Fruit R Us	Apples

	SUMPRODUCT	SUMIFS
Product	396,495	396,495
Product and Region	272,584	272,584
Product, City and Region	107,016	107,016
Product, City, Chain and Region	85,106	85,106

Figure 1 SUMPRODUCT and SUMIFS

We are working on a list of sales data relating to various regions, cities, products and outlets. We are asking Excel to interrogate this list and tell us total sales values by

- Product
- Product and region
- Product, city and region
- Product, city, chain and region

Let's explore these options via Figure 2

	J	K	L
31	**Product**	396,495	396,495
32	**Product and Region**	272,584	272,584
33	**Product, City and Region**	107,016	107,016
34	**Product, City, Chain and Region**	85,106	85,106

Figure 2 Interrogation of the Database

The formulas we need:

K31 =SUMPRODUCT((D8:D25=I29)*E8:E25)

K32 =SUMPRODUCT((A8:A25=F29)*(D8:D25=I29)*E8:E25)

K33 =SUMPRODUCT((A8:A25=F29)*(B8:B25=G29)*(D8:D25=I29)*E8:E25)

K34 =SUMPRODUCT((A8:A25=F29)*(B8:B25=G29)*(C8:C25=H29)*(D8:D25=I29)*E8:E25)

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L31 =SUMIFS(E8:E25,D8:D25,I29)
L32 =SUMIFS(E8:E25,A8:A25,F29,D8:D25,I29)
L33 =SUMIFS(E8:E25,A8:A25,F29,B8:B25,G29,D8:D25,I29)
L34 =SUMIFS(E8:E25,A8:A25,F29,B8:B25,G29,C8:C25,H29,D8:D25,I29)

In every case, the SUMIFS() formula is the shorter of the two but we have not tested the relative speeds of the two functions. You would not normally use both of these functions together in the way we are showing here as we are merely demonstrating them!

2.2 IFERROR()

In the not too distant past, we used to control errors that we could anticipate in this way, by using a combination of the IF() and ISERROR() functions. In some situations that led to quite complex formulations. Then Excel introduced us to the IFERROR() function and we will look at that now.

Look Back: how it used to work: ARRAY formula =SUM(IF(ISERROR(C5:C13),0,C5:C13)): what is it trying to do? It says add everything together in the range C5:C13 and if there is an error, ignore it and concentrate on the good values in that range. You MUST enter this as an ARRAY formula otherwise it will not work.

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Look Forward: now consider this more efficient ARRAY formula =SUM(IFERROR(C5:C13,0))…try it, it really works! The IFERROR() function came with Excel 2007 and is much more direct and easy to understand than the older version. Again, you must ARRAY enter this formula or it won't work.

Now consider this ARRAY entered formula
=AVERAGE(IF(ISERROR(C5:C13),FALSE,IF(C5:C13="",FALSE,C5:C13)))…what does it do? Well, try to understand it on your own. Better still, consider the more up to date version that does exactly the same by ARRAY entering this =IFERROR(AVERAGE(C5:C13),AVERAGEIFS(C5:C13,C5:C13,">0"))… still complicated isn't it?

Now try the following NON ARRAY entered IFERROR(…)
lternative =AVERAGEIFS(C5:C13,C5:C13,">0")…this one is much more direct and much easier to use!

It is worth your while to learn the new Excel 2007 and 2010 functions: after all, there aren't that many of them!

Take a look at the file *morlin_porlin.xlsx*, both tabs, if you feel the need to practice these two functions. That workbook is aimed at preparing budgets but we built in this aspect to help with that too.

2.3 Trial Balance Using a Pivot Table

In this section the aim is to provide an example and a spreadsheet to show you how to create a Trial Balance by combining a simple list and a Pivot Table. The file to open is called *tb_from_pivot_table.xlsx*.

This example demonstrates the creation of a Trial Balance from a list of payments and receipts by using a Pivot Table. You will see that setting up the PT takes a BIT of time but once you have done it, it's done! After that, you would only need to change anything if you add a new account or account code.

Please note: as with many of our examples, we create simple data sets or situations. We do this so that you appreciate the process without getting lost in the data. **However, if you expand this example, we recommend you move the Trial Balance to a separate sheet otherwise your PT could expand and interfere with it.**

2.3.1 Setting up the Data Area

Stat by setting up an **Excel Table** for this part of the exercise: always a good idea.

2.3.2 Create a List

The first major step in this process is to **create a list of payments and receipts**. Don't worry about the list being sorted in date or time order, the Pivot Table will sort that out for you.

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Trial Balance from a pivot table

date	details	amount	Dr account name	Dr account number	Cr account name	Cr account number
1/1/2003	cash deposited by owner	10,000	cash	2	capital	1
1/1/2003	purchase of goods	1,379	stocks of goods for resale	11	cash	2
2/1/2003	sale of goods	1,630	cash	2	sales	10
5/1/2003	wages	500	wages	13	cash	2
7/1/2003	sale of goods	1,784	M Hanson	7	sales	10
7/1/2003	purchase of goods	1,230	stocks of goods for resale	11	J Smith	6
10/1/2003	electricity	100	electricity	4	cash	2
10/1/2003	telephone	50	telephone	12	cash	2
10/1/2003	postage	15	postage	8	cash	2
13/1/2003	rent of building	750	rent of building	9	cash	2
13/1/2003	sale of goods	1,430	cash	2	sales	10
15/1/2003	purchase of computer	1,000	stocks of goods for resale	11	I Jack	5
17/1/2003	wages	350	wages	13	cash	2
19/1/2003	sale of goods	1,381	D Edwards	3	sales	10
22/1/2003	purchase of software	450	stocks of goods for resale	11	J Smith	6
24/1/2003	wages	375	wages	13	cash	2
26/1/2003	postage	5	postage	8	cash	2
28/1/2003	purchase of goods	1,085	stocks of goods for resale	11	cash	2
28/1/2003	electricity	15	electricity	4	cash	2
29/1/2003	sale of goods	1,403	cash	2	sales	10
31/1/2003	purchase of goods	1,453	stocks of goods for resale	11	cash	2
31/1/2003	wages	350	wages	13	cash	2

Figure 3 Set up your List

2.3.3 VLOOKUP() Function

To help with the Pivot Table, we have set up a VLOOKUP() function in columns E and G to convert account names into account numbers. If you don't do this, your PT will sort alphabetically rather than numerically and it may be more difficult to manage. In any case, accountants use **charts of accounts** that are often based on numbers so this is consistent with that.

We have created the **range name** *accountlookup* for use with the VLOOKUP() function: Figure 4

	H	I	J	K	L
26	**Lookup table**				
27	**account number**	**account name**	**account number**	**account type**	**account sub type**
28	1	capital	1	capital	capital investment of the owner
29	2	cash	2	current asset	cash in hand
30	3	D Edwards	3	current asset	debtor
31	4	electricity	4	expense	electricity
32	5	I Jack	5	current liability	creditor
33	6	J Smith	6	current liability	creditor
34	7	M Hanson	7	current asset	debtor
35	8	postage	8	expense	postage
36	9	rent of building	9	expense	rent of building
37	10	sales	10	revenue	sales
38	11	stocks of goods for resale	11	current asset	stocks
39	12	telephone	12	expense	telephone
40	13	wages	13	current asset	wages

Figure 4 Lookup Table

Once your list is complete, create a Pivot Table…see the *pivot_and_TB tab*…

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2.4 Setting up the Pivot Table

The way this works is that we have to create a Pivot Table (PT) as a matrix, as you can see in Figure 5:

Dr Account Number and
Dr Account Name
… in the ROWS area

Cr Account Number and
Cr Account Name
… in the COLUMNS area

Make sure the Values are shown as **Sum of**…and not **Count of**…or **Average of**…

Include Grand Totals for rows and columns: Figure 5

	A	B	C	D	E	F	G	H
1								
2								
3	Sum of amount		Cr account number	Cr account name				
4			1	2	5	6	10	Grand Total
5	Dr account number	Dr account name	capital	cash	I Jack	J Smith	sales	
6	2	cash	10,000				4,748	14,748
7	3	D Edwards					1,538	1,538
8	4	electricity		115				115
9	7	M Hanson					1,433	1,433
10	8	postage		20				20
11	9	rent of building		750				750
12	11	stocks of goods for resale		3,592	1,000	1,585		6,177
13	12	telephone		50				50
14	13	wages		1,575				1,575
15	Grand Total		10,000	6,102	1,000	1,585	7,719	26,406

Figure 5 Pivot Table as a Matrix

2.4.1 Trial Balance Creation

Hard code the Account numbers which are entered in the range I18:I30 in this example: Figure 6

	I	J	K	L
17	**Account Number**	**Account Name**	**Dr**	**Cr**
18	1	capital	#N/A	10000
19	2	cash	14748	6102
20	3	D Edwards	1538	#N/A
21	4	electricity	115	#N/A
22	5	I Jack	#N/A	1000
23	6	J Smith	#N/A	1585
24	7	M Hanson	1433	#N/A
25	8	postage	20	#N/A
26	9	rent of building	750	#N/A
27	10	sales	#N/A	7719
28	11	stocks of goods for resale	6177	#N/A
29	12	telephone	50	#N/A
30	13	wages	1575	#N/A

Figure 6 Initial Trial Balance

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Use VLOOKUP() to find the account name from the account number: it uses the range name *accountlookup2* although it could use an INDEX…MATCH combination with the range name **accountlookup**.

For the Debit balances we have used VLOOKUP() again but notice the range it uses: Figure 5, B6:H14 which EXCLUDES the first column and the last row. That is, it is working from the account names and it included the grand totals in column H.

For the Credit balances we have used **HLOOKUP()** but notice the range it uses: Figure 5, C5:G15 which EXCLUDES the first two rows and the last column. That is, it is working from the account names and it included the grand totals in row 15.

All trial balances must balance so create a SUM() formula to check that the total Debits = the total Credits…Figure 7, Cells O36 and P36 and put a check in cells O37 and P37 to make sure they agree with the value in the final overall grand total in the PT, in cell H15 in Figure 5 in this example.

The check is just about the simplest there can be, which is, for the Debit column, =L35=H15…if they agree, Excel shows the word TRUE otherwise we would see the word FALSE there. You can change this to hide the word TRUE and show only the word FALSE, of course, by changing that formula. For example, =IF(L35<>H15,"ERROR","").

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	M	N	O	P
31	**Trial Balance**			
32	**Account Number**	**Account Name**	**Dr**	**Cr**
33	1	capital		10,000
34	2	cash	14,748	6,102
35	3	D Edwards	1,538	
36	4	electricity	115	
37	5	I Jack		1,000
38	6	J Smith		1,585
39	7	M Hanson	1,433	
40	8	postage	20	
41	9	rent of building	750	
42	10	sales		7,719
43	11	stocks of goods for resale	6,177	
44	12	telephone	50	
45	13	wages	1,575	
46			**26,406**	**26,406**

Figure 7 Final Trial Balance

That was a bit long winded as we said it would be but if you are trying to manage a small business or a club or society using a spreadsheet, the trial balance is something you should consider creating and this method will work for you!

2.5 Preparing Financial Statements using Pivot Tables

We are often asked the question of whether it is possible to prepare an income statement and a balance sheet in Excel. I always reply that of course it is simple to do that providing you know the basic layout of those statements.

This example illustrates that all you really need to prepare an income statement and a balance sheet using Excel are:

- **The data**: a list of revenues, expenses, assets, liabilities and capital are all you need. In these notes, we will be dealing with the income statement and balance sheets separately
- **A Pivot Table**: well, two Pivot Tables but the homework at the end of the notes is for you to combine everything into one list and one Pivot Table

We are **assuming** that you already know the basics of:

- Financial statements
- Preparing and using a Pivot Table

2.5.1 Just put Everything into a list

One major lesson that we give to anyone who is looking to prepare financial and other quantitative statements is to follow these simple rules

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Classify everything first: write down **what it is you want to see at the end of this process**
Set up a table to record all of your data based on step 1
Record everything in the form of a list in that table: you don't even need to sort it
Now create a Pivot Table from your list

Honestly, that's it: **the secret** of your success is in step 1, **classifying everything before you start** Let's work through the examples, firstly the income statement.

2.5.2 Income Statement

We are going to take you through the process out of order. So we will begin with steps 2 and 3 together then step 1 and finally step 4. We need you to see the importance of step 1 so will demonstrate what happens when you don't take it.

Here is a screenshot, Figure 8, of some basic income statement data; but notice that some numbers are positive and some are negative…these are equivalent to debits and credits and the rules are

- All revenues, income, money coming in are shown as positive figures
- All expenses, costs and money going out are shown as negative figures

Applying these two rules helps to make the process entirely automated

	A	B
1	Bookkeeping Question: use a Pivot table to create an Income Statement	
2		
3	Inputs	
4	**Figures taken from the books of Sally's Small Shop as at 1 May 2011**	
5	Sales	343,825
6	Opening Stock	-9,261
7	rental income	753
8	dividends received	1,274
9	Purchases	-314,064
10	vehicle license and tax	-1,661
11	telephone	-3,918
12	wages and salaries	-9,419
13	petrol	-3,413
14	advertising	-2,653
15	stationery	-1,172
16	postage	-519
17	Discounts allowed	-354
18	Discounts received	152
19	Sales returns	-1,070
20	Purchase returns	2,444
21	Closing Stock	8,308

Figure 8 Income Statement 1

	F	G
27	**Account Name**	**Amount**
28	Sales	343825
29	Sales returns	-1070
30	Opening Stock	-9261
31	Purchases	-314064
32	Purchase Returns	2444
33	Closing Stock	8308
34	Rental Income	753
35	Dividends Received	1274
36	Discounts Received	152
37	Advertising	-2653
38	Discounts Allowed	-354
39	Petrol	-3413
40	Postage	-519
41	Stationery	-1172
42	Telephone	-3918
43	Vehicle License And Tax	-1661
44	Wages And Salaries	-9419

Figure 9 Data Reorganised for Demonstration…

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We need to create column headings so that Excel knows how to set up a Pivot Table

We have put the information in a bit more of a logical order now, Figure 9; but is it ready to create a Pivot Table from this table now…does it give you what you want…can it give you what you want?

The answer is that no, it is not good enough for preparing a final income statement. What is missing is step 1, the classification of accounts…we need a chart of accounts for this, as follows, Figure 10:

	D	E	F
27	**Account Category**	**Account Number**	**Account Name**
28	1000 Revenues	1010	Sales
29	1000 Revenues	1020	Sales returns
30	2000 Cost of Sales	2010	Opening Stock
31	2000 Cost of Sales	2020	Purchases
32	2000 Cost of Sales	2030	Purchase Returns
33	2000 Cost of Sales	2040	Closing Stock
34	3000 Other Income	3010	Rental Income
35	3000 Other Income	3020	Dividends Received
36	3000 Other Income	3030	Discounts Received
37	4000 Expenses	4010	Advertising
38	4000 Expenses	4020	Discounts Allowed
39	4000 Expenses	4030	Petrol
40	4000 Expenses	4040	Postage
41	4000 Expenses	4050	Stationery
42	4000 Expenses	4060	Telephone
43	4000 Expenses	4070	Vehicle License And Tax
44	4000 Expenses	4080	Wages And Salaries

Figure 10 Basic Chart of Accounts

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By classifying the accounting information, we have split everything into these categories:

- Revenues
- Cost of sales
- Other income
- Expenses

We have then sub classified everything by giving them their own account number…, again see Figure 10. So we can see that all revenues are classified as account category 1000 and then sales are allocated to account number 1010 and sales returns are allocated to account number 1020.

All other categories work in a similar way. Prepare the Pivot Table now and what happens?
Our Pivot Table based Income Statement looks like this now, Figure 11:

	A	B	C
1			
2			
3	Sum of Amount		
4	Account Category	Account Name	Total
5	1000 Revenues	Sales	343825
6		Sales returns	-1070
7	2000 Cost of Sales	Closing Stock	8308
8		Opening Stock	-9261
9		Purchase Returns	2444
10		Purchases	-314064
11	3000 Other Income	Discounts Received	152
12		Dividends Received	1274
13		Rental Income	753
14	4000 Expenses	Advertising	-2653
15		Discounts Allowed	-354
16		Petrol	-3413
17		Postage	-519
18		Stationery	-1172
19		Telephone	-3918
20		Vehicle License And Tax	-1661
21		Wages And Salaries	-9419

Figure 11 Pivot Table Income Statement

It works…but some things are missing…where is the gross profit, the gross income and the net profit? Well, we didn't set up any categories for them…yet. In our case we have coded them as follows, Table 1:

Account Category	Account Number	Account Name
2500 Gross Profit	2500	Gross Profit
3500 Gross Income	3500	Gross Income
4500 Net Profit	4500	Net Profit

Table 1 Additional Chart of Account Codes

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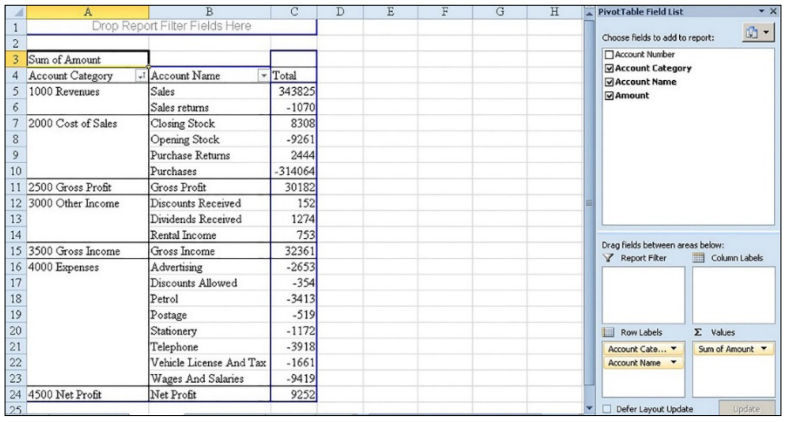
Add those to your list and program the necessary formula to calculate these values and you should find the following, Figure 12, below.



	A	B	C
1	Drop Report Filter Fields Here		
2			
3	Sum of Amount		
4	Account Category	Account Name	Total
5	1000 Revenues	Sales	343825
6		Sales returns	-1070
7	2000 Cost of Sales	Closing Stock	8308
8		Opening Stock	-9261
9		Purchase Returns	2444
10		Purchases	-314064
11	2500 Gross Profit	Gross Profit	30182
12	3000 Other Income	Discounts Received	152
13		Dividends Received	1274
14		Rental Income	753
15	3500 Gross Income	Gross Income	32361
16	4000 Expenses	Advertising	-2653
17		Discounts Allowed	-354
18		Petrol	-3413
19		Postage	-519
20		Stationery	-1172
21		Telephone	-3918
22		Vehicle License And Tax	-1661
23		Wages And Salaries	-9419
24	4500 Net Profit	Net Profit	9252
25			

Figure 12 Final Pivot Table Income Statement

As a matter of interest, as we hinted at the beginning, you could simply type these extra categories at the end of the table without sorting and the Pivot Table will use your coding to put everything in its proper place: see Figure 10 again.

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By the way, you could consider creating a category for cost of sales and total other income…we didn't and have programmed the gross profit, gross income and net profit cells accordingly. For example, Gross profit in cell G34 =SUM(G28:G29)+SUM(G30:G33)…you should see the benefits of negative and positive values now.

2.5.3 Balance Sheet

In this example, we are going to give you just three things

- The data: Figure 13
- The chart of accounts: Figure 14
- The final Pivot Table: Figure 15

The rest is up to you!!

	A	B
3	Inputs	
4	**Figures taken from the books of Sally's Small Shop as at 1 May 2011**	
5	Buildings	66,549
6	Long Term Loan	74,144
7	Bank Overdraft	6,424
8	Stocks of raw materials	19,076
9	Stocks of goods	8,842
10	Creditors	59,807
11	Share Capital	61,594
12	Cash in Hand	749
13	Tax Owing	15,764
14	Share Premium Account	16,345
15	Equipment	5,363
16	Profit and Loss Account	37,972
17	Land	95,468
18	Vehicles	17,303
19	Cash at Bank	6,529
20	Debtors	82,530
21	5% Debenture	30,359

Figure 13 Balance Sheet Data

	D	E	F	G
24	**Account Category**	**Account Number**	**Account Name**	**Amount**
25	5000 Fixed Assets	5010	Land	95468
26	5000 Fixed Assets	5020	Buildings	66549
27	5000 Fixed Assets	5030	Equipment	5363
28	5000 Fixed Assets	5040	Vehicles	17303
29	5500 Total Fixed Assets	5500	Total Fixed Assets	184683
30	6000 Current Assets	6010	Stocks of raw materials	19076
31	6000 Current Assets	6020	Stocks of goods	8842
32	6000 Current Assets	6030	Debtors	82530
33	6000 Current Assets	6040	Cash at Bank	6529
34	6000 Current Assets	6050	Cash in Hand	749
35	6500 Total Current Assets	6500	Total Current Assets	117726
36	6750 Total Assets	6750	Total Assets	302409
37	7000 Current Liabilities	7010	Creditors	59807
38	7000 Current Liabilities	7020	Tax Owing	15764
39	7000 Current Liabilities	7030	Bank Overdraft	6424
40	7500 Total Current Liabilities	7500	Total Current Liabilities	81995
41	8000 Long Term Liabilities	8010	Long Term Loan	74144
42	8000 Long Term Liabilities	8020	5% Debenture	30359
43	8500 Total Long Term Liabilities	8500	Total Long Term Liabilities	104503
44	9000 Capital and Reserves	9010	Share Capital	61594
45	9000 Capital and Reserves	9020	Share Premium Account	16345
46	9000 Capital and Reserves	9030	Profit and Loss Account	37972
47	9500 Total Capital and Reserves	9500	Total Capital and Reserves	115911
48	9750 Capital Employed	9750	Capital Employed	302409

Figure 14 Balance Sheet Chart of Accounts

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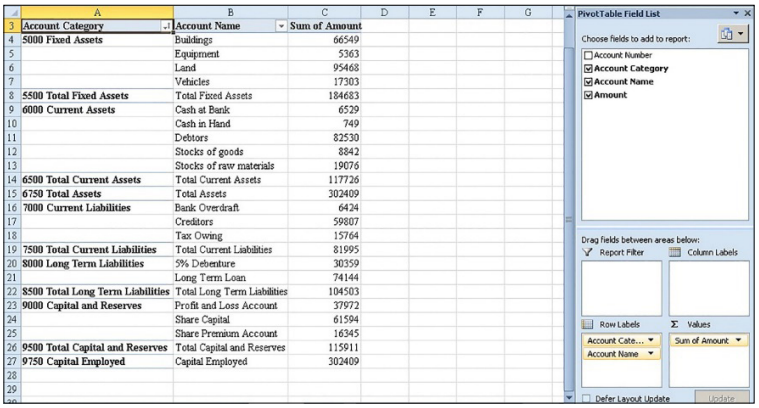

Account Category	Account Name	Sum of Amount
5000 Fixed Assets	Buildings	66549
	Equipment	5363
	Land	95468
	Vehicles	17303
5500 Total Fixed Assets	Total Fixed Assets	184683
6000 Current Assets	Cash at Bank	6529
	Cash in Hand	749
	Debtors	82530
	Stocks of goods	8842
	Stocks of raw materials	19076
6500 Total Current Assets	Total Current Assets	117726
6750 Total Assets	Total Assets	302409
7000 Current Liabilities	Bank Overdraft	6424
	Creditors	59807
	Tax Owing	15764
7500 Total Current Liabilities	Total Current Liabilities	81995
8000 Long Term Liabilities	5% Debenture	30359
	Long Term Loan	74144
8500 Total Long Term Liabilities	Total Long Term Liabilities	104503
9000 Capital and Reserves	Profit and Loss Account	37972
	Share Capital	61594
	Share Premium Account	16345
9500 Total Capital and Reserves	Total Capital and Reserves	115911
9750 Capital Employed	Capital Employed	302409

Figure 15 Pivot Table Balance Sheet

Exercise for you to do

Combine the two sets of data and prepare one Pivot Table to prepare a combined Income Statement and Balance Sheet.

Conclusions

In this chapter we have presented another series of cases and exercises that are broad ranging in nature and that either introduce new ideas or build on ideas we have already discussed.

We have worked through from SUMPRODUCT() and SUMIF() to some specific bookkeeping and accounting work with Pivot Tables: Creating a Trial Balance and then Preparing Financial Statements.

Preparing almost any statement by combining the power of a classified list and a Pivot Table is such an easy and smart thing to do. As we have demonstrated here, it's not that difficult with just a little bit of knowledge of accounting and Pivot Tables. You should feel confident after having worked though this with us of doing and finishing the extra exercise and of completing similar projects yourself. See Accountant Specific 1 and 3 in books one and three for further examples along the lines you have seen here.

Excel Files Available

All of the Excel files mentioned in this book can be found on this book's page at:
http://bookboon.com/en/excel-solutions-for-accountants-book-2-ebook

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3 Compound Interest and Discounting: the time value of money

Introduction

Accountants are often asked to carry out calculations based on interest rates or interest rate methodology and that is what this chapter is concerned with: the calculation of interest, both compound and simple; and with calculations based on annual, quarterly, monthly…any calculation base.

In this chapter we will look at simple and compound interest as the foundation of all of the work of the finance function and then build and use data tables including using them to see how to find future and present values given certain data we then take a look at compounding on a basis other than annual: that is, to see how to find compound interest if the compounding period is a day, a week, a month or some other period.

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We will use 11 of the built in financial functions, ranging from the FV() or future value function to the XNPV() function that finds the net present value of an income stream where the period lengths are variable and not just one year.

Finally we will conclude the chapter by considering the annual percentage rate (APR) that will show us, for example, the true annual cost of a 2% discount offered for early payment.

3.1 Definitions

- **Simple interest** is a method of calculating interest in which the interest is calculated for a period on the principal or amount invested or borrowed only.
- **Compound interest** is a method of calculating interest in which the interest is calculated for a period and both the principal and the interest earned earn interest.

3.2 Simple Interest Calculations

Simple Interest (SI) is among the simplest kind of calculations we can make: really! You probably remember something like this formula from school

SI = PRT ÷ 100

Where

SI = Simple Interest
P = Principal, the amount of money
R = Rate of interest
T = Time

We apply this formula this way, where P = £1,000, R = 10% and T = 3 years

SI = £1,000 * 10% * 3 ÷ 100 = £30,000 ÷ 100 = £300

Note: we use 10% as the number 10…if you use the interest rate as a decimal, 0.10 in this case then there is no need to divide by 100. Try that:

SI = £1,000 * 0.10 * 3 = £300

There is really nothing else to say about SI except for you to have some practise, so try these now:

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Exercises for you to do

Use the Simple Interest method of calculating interest for the following:

	Principal	Rate	Time (years)	SI
1	1,200	4%	2	
2	6,575	3.5%	6	
3	125	12%	3	
4	650,000	5.675%	9	

3.3 Compound Interest Calculations

The formula to find the interest earned using compound interest is $(P(1 + r)^n) - P$
Again, P is the principal, r is the rate of interest and now n is time.

Where P = £100 r = 10% and n = 2 years, the interest earned is:

$= (£100(1 + r)^n) - £100$
$= (£100(1 + 0.1)^2) - £100$
$= (£100 * 1.1^2) - £100$
$= (£100 * 1.21) - £100$
$= £121 - £100$
$= £21$

Using simple interest, we would earn PRT/100 = £100 * 10% * 2 = £20 and using compound interest we would earn £21 in interest over the two years.

The following diagram introduces the terms present value and future value and they are key to understanding the ideas in the rest of this chapter. We consider today, not surprisingly, to be the present so anything to do with money today is called the present value of that money. When we are dealing with earning and paying interest, though, we talk about the money we are going to receive, the future value of money.

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We assess the present and future value money by using the compound interest formula. Look at Figure 1, below

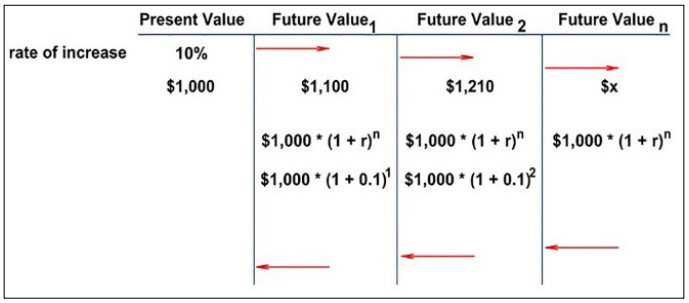
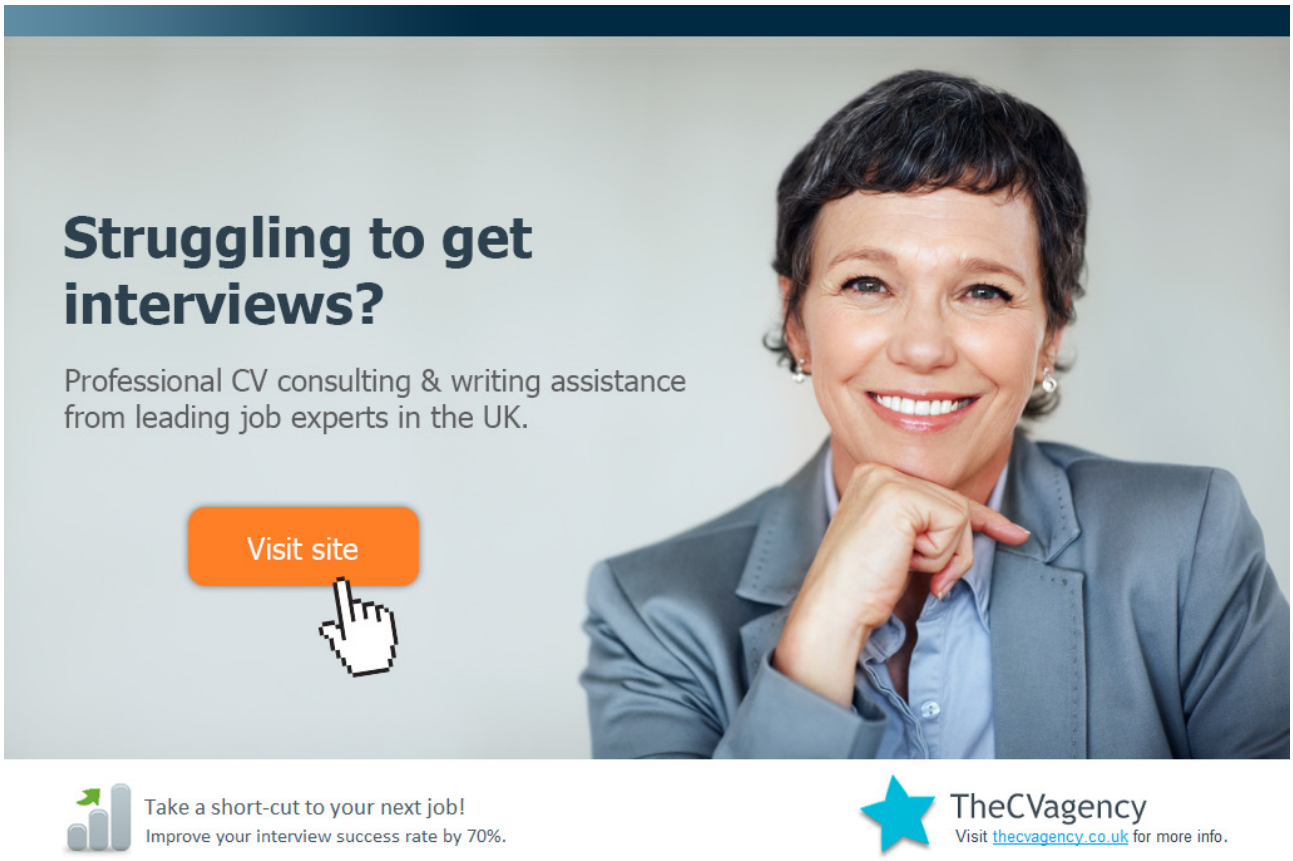


Figure 1 Present and Future Values

Use the ideas you can see in **Figure 1** to answer the following questions answer the following questions.



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Exercises for you to do

a) Using compound interest, use Excel to find the interest due from the following investments

	Amount invested	Rate of interest (%)	Duration of investment (years)
1	£10,000	5	3
2	£2,500	6	2
3	£500	4	5
4	£6,250	7	10

b) Expand on Example 3, £500 at 4% for 5 years, by setting out in full the calculations year by year to demonstrate how the compound interest formula works. Set out your table like this, see **Figure 2**:

Example 3 In full			
Year	Start of Year	Interest	End of year
1	500.00	20.00	520.00
2	520.00	20.80	540.80
3	540.80	21.63	562.43
4	562.43	22.50	584.93
5	584.93	23.40	608.33
		108.33	

Figure 2 Example 3 in Full

3.4 Data Tables

There are times when opening a computer and starting Excel might not be convenient or possible. Under such circumstances, having a set of compound interest factor tables available might be a good thing. As with many things to do with Excel, there really are several ways of preparing **compound interest factors**: remember that compound interest factors are **constants**: that means the compound factor for, say, 7% for 8 years will always be 1.7182 and will never change. So, we can prepare our compound factor tables, print them out and keep them handy.

Here is how to set up what is called a Data Table in Excel that in this case takes the compound interest formula and uses Data Table functionality to turn that formula into an entire table! All we do is set up the input section, put the appropriate formula in the top left hand cell of the Data Table and bingo: Excel does everything else!

You will find the completed data table in *comp_disc.xlsx* file data_tables tab; but here it is and this is how we built it, see Figure 3.

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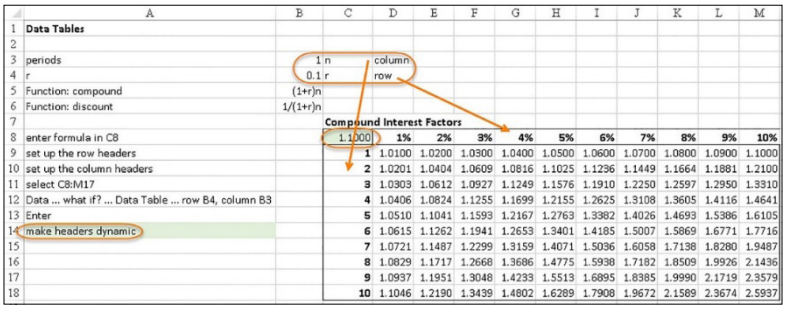

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Data Tables**												
2													
3	periods		1 n	column									
4	r		0.1 r	row									
5	Function: compound		(1+r)n										
6	Function: discount		1/(1+r)n										
7													
8	enter formula in C8			**Compound Interest Factors**									
9	set up the row headers		1.1000	**1%**	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**	**9%**	**10%**
10	set up the column headers		**1**	1.0100	1.0200	1.0300	1.0400	1.0500	1.0600	1.0700	1.0800	1.0900	1.1000
11	select C8:M17		**2**	1.0201	1.0404	1.0609	1.0816	1.1025	1.1236	1.1449	1.1664	1.1881	1.2100
12	Data ... what if? ... Data Table ... row B4, column B3		**3**	1.0303	1.0612	1.0927	1.1249	1.1576	1.1910	1.2250	1.2597	1.2950	1.3310
13	Enter		**4**	1.0406	1.0824	1.1255	1.1699	1.2155	1.2625	1.3108	1.3605	1.4116	1.4641
14	make headers dynamic		**5**	1.0510	1.1041	1.1593	1.2167	1.2763	1.3382	1.4026	1.4693	1.5386	1.6105
15			**6**	1.0615	1.1262	1.1941	1.2653	1.3401	1.4185	1.5007	1.5869	1.6771	1.7716
16			**7**	1.0721	1.1487	1.2299	1.3159	1.4071	1.5036	1.6058	1.7138	1.8280	1.9487
17			**8**	1.0829	1.1717	1.2668	1.3686	1.4775	1.5938	1.7182	1.8509	1.9926	2.1436
18			**9**	1.0937	1.1951	1.3048	1.4233	1.5513	1.6895	1.8385	1.9990	2.1719	2.3579
			10	1.1046	1.2190	1.3439	1.4802	1.6289	1.7908	1.9672	2.1589	2.3674	2.5937

Figure 3 Compound Interest Factor Data Table

Figure 3 shows the instructions for building this Data Table, given in column A starting in A8: follow them line by line and you will find the Data Table of compound interest factors easy to prepare. Experiment by expanding the table for more years and more rates of interest.

3.5 Let's use the Compound Interest Factors

Compound interest factors take us from present values to future values and they work in an uncomplicated way. For example, what is the present value of £2,458.67 worth five years from now at a compound annual interest rate of 4%?

From the compound interest Data Table, see Figure 4, below, which is an extract from Figure 3: the compound interest factor for 5 years at 4% is 1.2167 which we then multiply by 4 years and £2,458.67 = £11,965.86

Compound Interest Factors				
1.1000	**1%**	**2%**	**3%**	**4%**
1	1.0100	1.0200	1.0300	1.0400
2	1.0201	1.0404	1.0609	1.0816
3	1.0303	1.0612	1.0927	1.1249
4	1.0406	1.0824	1.1255	1.1699
5	1.0510	1.1041	1.1593	1.2167

Figure 4 Compound Interest Factor: 4% for 5 years

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Exercises for you to do

1. Find the future values for the situations found in the following schedule by using the Data Table of compound interest factor from the data_tables tab in the *comp_disc.xlsx* file:

	Principal (Present Value)	Annual Compound Rate of Interest (%)	Years	Future Value: amount to receive
1	9,496	7	6	
2	13,300	3	10	
3	7,084	10	5	
4	8,233	9	7	

2. Let's change some of the data in question 1 in this exercise as follows and then answer the question that follows:

	Principal (Present Value)	Annual Compound Rate of Interest (%)	Years	Future Value: amount to receive
1	9,496	7	16	
2	13,300	3	14	
3	7,084	11	5	
4	8,233	19	17	

a) Find the future values from the above data using the data_tables tab in the *comp_disc.xlsx*

b) Check your workings in part a) of this exercise by using the formula for finding the future value $P = (1 + r)^n$

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3.6 Compounding Monthly or Weekly or Daily…Anything but Annually

Whilst the work we have done so far is correct, we need to be aware that paying interest on an annual basis, as we have assumed so far, is not the same as paying interest in a monthly basis: or weekly or daily basis. The reason for this additional section is that when we buy something using credit or debt, we may be quoted monthly rate of interest or a weekly rate of interest and we need to know that that rate is not the annualised rate that we are charged. For example, imagine that we are told that the rate of interest is 2% per calendar month: we want to know the annualised rate for that deal. The answer is not 24%, it's more than that. Take a look at the following:

If interest is charged on a basis other than annual, we find future values by using:

- Monthly $(1 + r/12)^m - 1$
- Weekly $(1 + r/52)^w - 1$
- Daily $(1 + r/365)^d - 1$

What is the annualised rate of interest in the following examples?

- The bank says to me that it will loan £100,000 with interest payable monthly at the rate of 1.5% per month.
- A finance house charges 1% per week for a line of credit: what is that 1% per week as an annualised rate?
- Find the annualised rate of interest on a loan whose interest rate is quoted at the daily rate of 0.5%

You will find the solutions to these problems in the *comp_disc.xlsx* file pv_fv_egs tab

Non Annual Rate Examples		
1 My bank says to me that it will loan me £100,000 with interest payable monthly at the rate of 1.5% per month.		
2 A finance house charges me 1% per week for a line of credit: what is that 1% per week as an annualised rate?		
3 Find the annualised rate of interest on a loan whose interest rate is quoted at the daily rate of 0.05%		
	Solutions	Annualised Rate
	1	19.56%
	2	67.77%
	3	20.02%

Figure 5 Non Annual Rate Examples

The formula for the first example is in cell F25 of this work sheet and it is =(1+0.015)^12-1

Work out the other two formulas before checking the solutions in the spreadsheet file.

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Exercises for you to do

1. Find the annualised rates of interest from the information that follows:

Example	Compounding Basis	Quoted Rate of Interest
1	Monthly	2% per month
2	Quarterly	10% per year
3	Half Yearly	15% per year
4	Daily	5% per half year

2. a) Create a new tab in the *comp_disc.xlsx* file and create the following template that will allow you to enter any combination of the interest rates and payment bases shown

	A	B	C	D	E
1	**Compounding Other than Annually**				
2			**a**	**b**	**c**
3		d			90
4		m		11	
5		n (years)	6	1	2
6		r	0.095	0.07	0.058
7		P	850	500	525
8					
9	Annual compounding	Interest payable = P(1+r)n - P	615.22		
10	Monthly compounding	Interest payable = P(1+r/12)nm – P		71.57	
11	Daily compounding	Interest payable = P(1+r/365)nd – P			73.06

Figure 6 Compounding Other than Annually Template

b) Feel free to extend this template to cater for compounding on bases other than the ones shown in Figure 6.

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3.7 Excel's Built in Finance Functions

As we have mentioned before, Excel has hundreds of built in functions under various headings that include mathematics, engineering, logic, text and financial. There are 55 financial functions in Excel 2013 and we will take a look at 11 of them: all of which are concerned with interest rate calculations in one form or another. You see in the Table 2, below, the name of the 11 functions we will look at together with their syntax:

1. **Future Value**: FV(RATE,NPER,PMT,PV,TYPE)
2. **Interest Rate**: RATE(NPER,PMT PV,FV,TYPE,GUESS)
3. **Number of Periods**: NPER(RATE,PMT,PV,FV,TYPE)
4. **Present Value**: PV(RATE,NPER,PMT,FV,TYPE)
5. **Interest Payment for a given period**: IPMT(rate,period,nper,pv,fv,type)
6. Payment based on constant monthly payments and constant interest rates: PMT(rate,nper,pv,fv,type)
7. Payment on the principal based on constant monthly payments and constant interest rates: PPMT(rate,period,npe r,pv,fv,type)
8. Internal Rate of Return: IRR(values, (guess))
9. **Modified Internal Rate of Return**: MIRR(values,finance_rate,reinvest_rate)
10. Net Present Value for a schedule of Cash Flows Received at the year end: NPV(rate,value1, value2…)
11. Net Present Value for a Schedule of Cash Flows: XNPV(rates,values,dates)

Table 2 Example Finance Functions

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For each of these, see Table 3, below, you will find a fully worked example in the file *fin_func.xlsx* and there are additional exercises following this section and here are the questions we will answer:

1. FV(RATE,NPER,PMT,PV,TYPE)	How much does £1,000 accumulate to after three years at 7% interest per year?
2. RATE(NPER,PMT PV,FV,TYPE,GUESS)	If £1,000 has accumulated to £2,000 in eight years, what has been the average annual growth rate?
3. NPER(RATE,PMT,PV,FV,TYPE)	If I deposit £100,000 and can earn 14% per annum, how many years will it take me to become a millionaire?
4. PV(RATE,NPER,PMT,FV,TYPE)	If I have £10,573.45 in my account and I have earned 1% interest per month for 12 months, what was the original deposit?
5. IPMT(rate,period,nper,pv,fv,type)	At an annual rate of 10%, what is the interest earned in the 100th period of a 120 period deposit of £100,000 that has a future or final value of £250,000?
6. PMT(rate,nper,pv,fv,type)	Same details as with the IPMT exercise…
7. PPMT(rate,period,nper,pv,fv,type)	Same details as with the IPMT exercise , as appropriate…
8. IRR(values, (guess))	What is the IRR of a project that has an initial outlay of £100,000 and cash outflows at year ends 1 to 4 of £50,000, 30,000, 27,500, 23,250 respectively?
9. MIRR(values,finance_rate,reinvest_rate)	The same details as with the IRR example except that the reinvestment rate is 9%
10. NPV(rates,values,dates)	As with the IRR example except that the cash flows
11. XNPV(rates,values,dates)	As with the IRR example except that the cash flows beyond year 0 are 31/12/2015, 30/6/2016, 5/4/2017 and 30/9/2017

Table 3 Additional Finance Function Questions

The solutions are in the *fin_func.xlsx* file, where there are additional exercises for the FV and RATE functions and here are just four of them:

The first exercise concerns the FV() function which is the function to solve $P(1+r)^n$

B15=FV(RATE,NPER,PMT,PV,TYPE)	How much does $1,000 accumulate to after three years at 7% interest per year?
B16=Present value	1000
B17=Rate	0.07
B18=Years	3
B19=Function Applied: Future Value	C19=FV(C17,C18,,-C16) = £1,225.04

Note: in C19 we see that C17 is the interest rate, C18 is the number of years, C16 is the present value or principal which is always entered as a negative number but that there is no PMT, monthly payment, amount so instead of that we see, which tells Excel that the PMT value is 0

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The IPMT function works like this:

B59=IPMT(rate,period,nper,pv,fv,type)	At an annual rate of 10%, what is the interest earned in the 100th period of a 120 period deposit of £100,000 that has a future or final value of £250,000?
B60=Rate (annual…Make it monthly)	0.1
B61=Period (months)	100
B62=NPER	120
B63=PV	100000
B64=FV	250000
B65=Function Applied: IPMT	=IPMT(C60/12,C61,C62,-C63,C64) = £1,766.30

Note: every variable is used in this example but note again that the present value or principal is entered as a negative value

The MIRR function tells us the IRR if the finance rate and the reinvestment rates are different:

B91=MIRR(values,finance_rate,reinvest_rate)	The same details as with the IRR example except that the reinvestment rate is 9%
B92=initial cost of asset	-100000
B93=cash flows generated by asset year 1	50000
B94=year 2	30000
B95=year 3	27500
B96=year 4	23250
B97=finance rate	0.1
B98=reinvest rate	0.09
B99=Function Applied: MIRR	=MIRR(C92:C96,C97,C98)`= 11.33%

The XNPV function lets us find the NPV for perod that are different from 1, 2, 3…they can use any period lengths/values:

B110=XNPV(rates,values,dates)	As with the IRR example except that the cash flows beyond year 0 are 31/12/2015, 30/6/2016, 5/4/2017 and 30/9/2017
B111=1/1/2015	-100000
B112=31/12/2015	-100000
B113=30/6/2016	50000
B114=5/4/2017	30000
B115=30/9/2017	27500
B116=r	0.1
B117=Function Applied: XNPV	=XNPV(C116,C111:C115,B111:B115) = (102,227.22)

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3.8 The True Cost of Giving and Receiving Credit: Annual Percentage Rate

Have you ever stopped to think about the cost of giving or receiving credit? You know, you are offering your customers 2% if they pay after 10 days but within 30 days…Look at the **apr** tab in the file *comp_disc.xlsx*

Let's consider the first of the three examples that are in that tab, see Figure 7:

	A	B	C	D
1	**Find the Annual Percentage Rate (APR)**			
2				
3	Inputs			
4	Discount	0.02	0.015	0.025
5	Days for Discount	10	20	10
6	Days Taken	30	30	45
7				
8	APR	37.24%	55.58%	26.74%

Figure 7 APR

The formula in cell B8=(B4/(100%-B4))*(365/(B6-B5))

Let's analyse that formula in two parts:

Part 1 =(B4/(100%-B4))…this gives us 0.0204 which grosses up the 0.02 or 2% per month to 0.02/0.98
Part 2 =(365/(B6-B5))…the number of times in a year that the discount will be paid assuming that customers take the full credit period.

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This gives us the grossed up APR for example one of 37.24%. In other words, whilst an apparently very small discount of 2% is awarded for early payment, in reality it costs 37.24% per year: very expensive.

Exercise for you to do

Take a look at the other two examples from the apr tab and appreciate why their APRs are 55.58% and 26.74% respectively.

In conclusion, you should realise that 1% per month maybe more appropriate if you are giving credit but of course 2% and 2.5% are acceptable if you are receiving the credit!

Conclusions

In this chapter we have explored a relatively large number of financial functions that have been built into Excel. We have looked at simple and compound interest as the foundation of all of the work of the finance function.

Having considered data tables and how to find future and present values given certain data we then took a look at compounding on a basis other than annual: that is, we learned how to find compound interest if the compounding period is a day, a week, a month or some other period.

We then took a look at 11 of the built in financial functions, ranging from the FV() or future value function to the XNPV() function that finds the net present value of an income stream where the period lengths are variable.

We finished by considering the annual percentage rate (APR) that showed us, for example, that a 2% discount offered for early payment might actually cost as much as 37% per year or even more.

Excel Files Available

All of the Excel files mentioned in this book can be found on this book's page at:
http://bookboon.com/en/excel-solutions-for-accountants-book-2-ebook

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4 Data Validation and Form Controls

Introduction

With **data validation** you can stop someone doing something or make them do something. For example, you can program Excel to prevent someone entering a value of greater than, say, 1,000 in an input cell(s): you would do this if, for example, you are dealing with contract sales in which the maximum value can never be more than £1,000 or in an expense claim file for middle managers whose maximum allowance for a conference trip is £1,000.

Alternatively, you can ensure that users input the name of certain cities or people in one or more cells by validating their inputs: giving them all of the names they are allowed to use and no more: that is, if it's not on the list, they can't enter it.

Secondly, we will work through a series of cases in which we use **Form Controls** as a way of helping spreadsheet users to take control of data in a variety of ways. One example of such an approach is in the area of dashboarding: in this case you might want to allow your users or managers to review your data graphically and to allow them to look at, say, annual data one minute and then quarterly data the next. Or to show Profitability on a graph one minute and liquidity the next. In this chapter we will review the following **form controls**:

- Spinners
- Scroll bars
- Comboboxes
- Lists
- Check boxes
- Buttons

4.1 Data Validation

With data validation, the spreadsheet programmer, you, takes control of what the user can do. As we mentioned in the introduction, that means limiting cells or ranges of cells to being able to show only days of the week, or numbers in a certain range…the possibilities are endless.

We have already prepared a basic file for you: *data_validation.xlsx* and your job is to work with what's on the **practical** tab as you work through this section.

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Starting in cell M24 you will see these data:

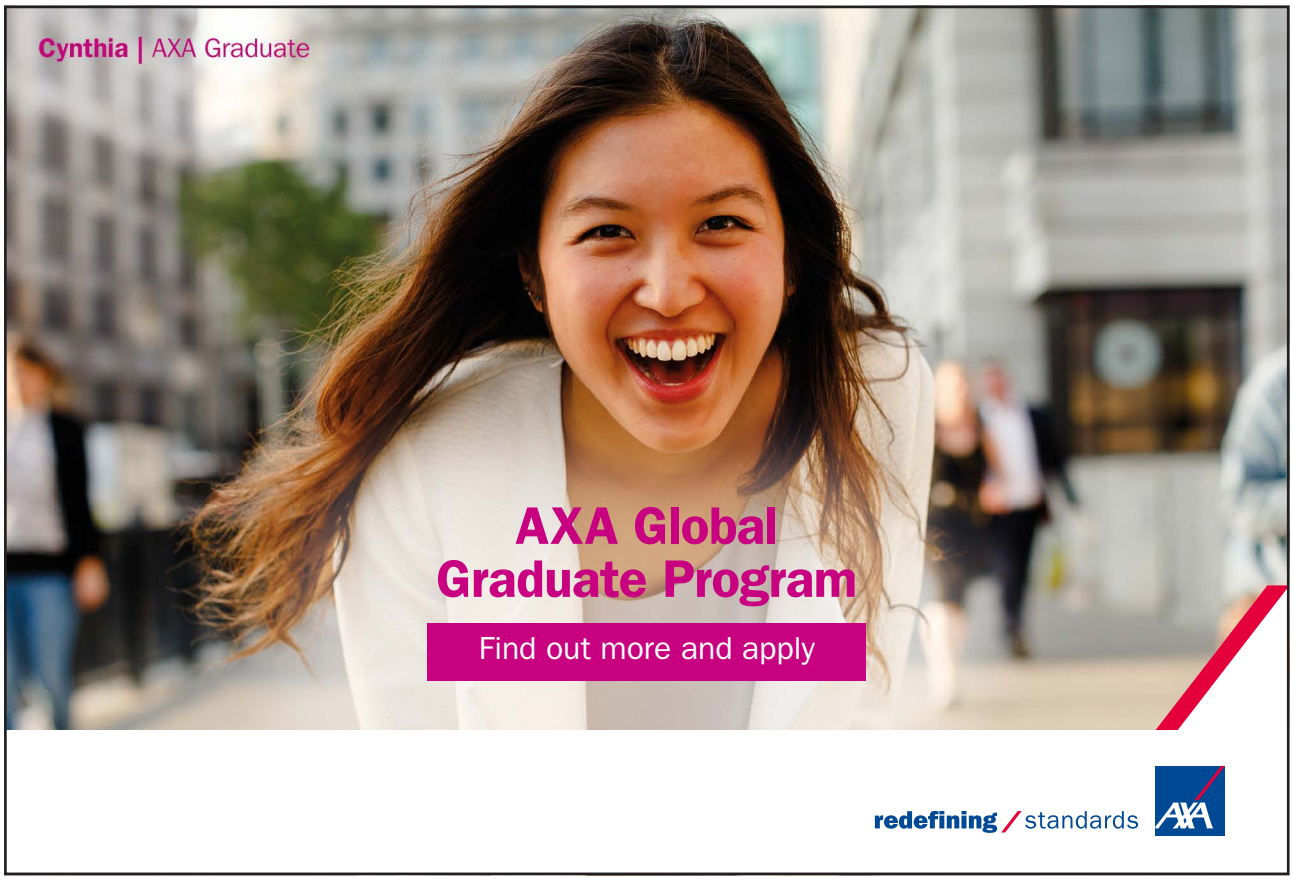
smith	production	Europe	UK	Germany	France	Ireland	Italy	Holland		
williams	stores	AsiaPacific	Thailand	Philippines	China	Malaysia	Singapore	Vietnam	Laos	Indonesia
brown	shipping	SouthAsia	Pakistan	Afghanistan	Bangladesh					
jones	accounting	MiddleEast	UAE	Saudi Arabia	Oman	Kuwait	Bahrain			
green	sales	Americas	USA	Canada	Brazil	Argentina	Colombia	Venezuela		
white	laboratory	Oceania	Australia	New Zealand	Tasmania					

Table 1 Extracts fro the data_validation.xlsx file

Column M contains surnames
Column N contains departments of a business
Column O contains the names of world regions
Columns P:W contain the names of some countries in those regions

Go to cell A4 in that file and enter

A4 Name
B4 Department
C4 Region
D4 Country



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Select the range A5: A14 and keep it selected
Now Open the Data Validation dialogue box:

1. Click Data Tab to select it
2. Click the down arrow next to Data Validation in the Data Tools area
3. Click Data Validation …

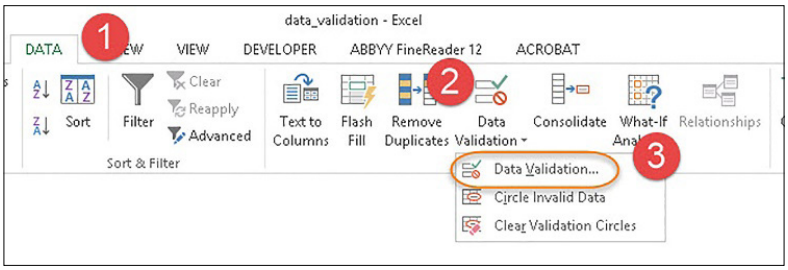
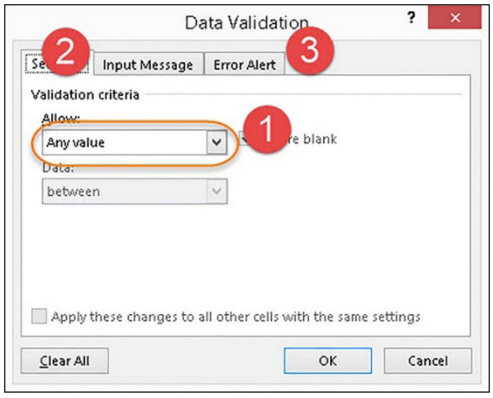


Figure 1 Start the Data Validation Dialogue Box

In the **Allow** area of the Data Validation dialogue box there are many choices:



Any value…this allows us to add anything we like and is not really validation of anything!

Whole number: here we can nominate any integer, whole number and tell Excel that it must be:

- between
- not between
- equal to
- not equal to
- …
- less than or equal to

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You then set the maximum, minimum or exact value as appropriate
Decimal: between minimum and maximum values you set
List: we will use this for our demonstration: how to get Excel to choose only from YOUR list
Date: between a start and an end date that you set
Time: between a start and an end time that you set
Text length: between…not between…equal to…and so on as you decide
Custom: you write a formula that determines what you want Excel to allow your users to do

4.1.1 Let's work on List

- Working in the Data Validation tab Allow…
- With the range A5:A14 still selected
- Allow…List and in the Source box you can either type a list such as or type or point to the range where your list has already been prepared. Select the range M24:M29 and notice that Excel adds the $$$ to make it $M$24:$M$29
- Click OK
- Now click on any of the cells in the range A5:A14, let's start with A5 and you will see a drop down arrow to right of the cell.

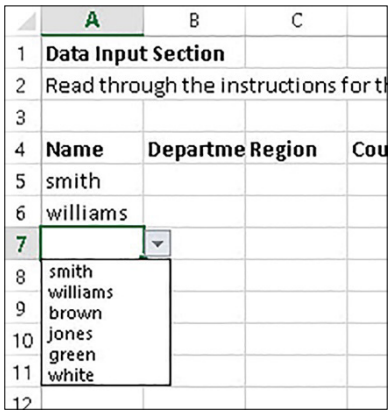

Figure 2 Data Validation Drop Down Box in Action

- Click on that arrow and you will see all of the names in the range M24:M29.
- Click on a name to choose it and that's what you will see in cell A5 now

Do that again for cells A6…A7…and so on

Test this: go to any of the data validated cells now and try and type something in them. It will give you an error message and not let you carry on: which is exactly what you want!

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4.1.2 Letting Users Know What to do…give them a clue

It's not always obvious what the validation is trying to get us to do so let's help our users with some input information. **Select cells A5:A14** again and finish this List validation

- Open the Data Validation dialogue box again and it should be as you left it with all of your settings in place.
- Click on the Input Message tab and where it says Title type Names or another appropriate name
- Where it says Input Message type what you need your users to understand, such as: Select the names of members of staff from this list…
- Click on the Error Alert tab and create a title and a message: we chose Names as the title and the message as Don't try to use any names except the ones you are given here. You could add phone numbers, email addresses and so on to help users to check for updated lists…

When you have finished click and **mouse over the validated list**, the Input message will appear as a floating box and if your users make a mistake, it presents them with the error message.

Repeat this process for Department and make sure it works. At this stage we have made no connection between the names and the departments but we will work on that next.

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4.2 Linking your Lists

When we entered names and departments we did so purely for practise. Looking at Region and Country now, however, we should realise that they must be linked: after all, the UK can only be in the European region can't it! Let's do the following, then:

Two Level Selection List: more advanced
1 Select O24:W29 then from the **Formulas tab** under **Defined Names** click on **Create from Selection** and choose **Left Column…BUT** make sure you **don't have any spaces in your names** or the range name Excel uses will be different from your list and this will not work. For example, instead of Asia Pacific type AsiaPacific and instead of Middle East enter MiddleEast
2 Select Column C…Data, Data Validation, List…Source O24:O29 and click OK
3 Select Column D…Data, Data Validation, List and instead of a range or address type =INDIRECT(C1) which might give you an error message and **if it does just click Yes**

The next step is interesting because what it does is to tell Excel to ignore any empty cells in the range P24:W29. There are blank cells because, for example, Oceania only contains three countries but there are eight available cells in the Oceania range P29:W29.
Please note: this step is optional but it makes you look very professional. Otherwise you will have validation lists with blanks in them.

4 **Select** O24:W29 then the Home tab, Find & Select, Go to Special, Blanks, OK…RC, Delete, Shift cells left…your pick list now contains ONLY cells with names in them
5 **Get rid of the Data Validation from C1 and D1** now if you wish. To do that, select those cells and set validation to Allow Any Value and click OK.

4.3 Other Examples of Data Validation

To save this chapter from becoming far too long, why not work on other examples of Data Validation on your own. Download the file that comes with this chapter and make sure you can follow what we have done. There are no surprises!!

In the accompanying file we have included a tab called **others** and on that tab there are five further examples: we have kept them simple so that you learn the methods BEFORE you learn the complications.

Name	Date	Department	Salary	Cost Centre Name
list	date	list	Value between	Maximum number of characters…type what you like!

Select the ranges A2:A10, B2:B10 then Data…Data Validation to see what we have done: change whatever you like as you learn along!

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4.4 Form Controls

In some ways, **form controls** are an advanced form of data validation in that they force us into using pre defined lists and so on. However, they work in a different way by creating drop down boxes, sliders, spinners, buttons…the kinds of controls we use every day in Excel, Word, on web pages and so on. Before we can use our form controls we need to **install** the **Developer Tab** and to do that, do this:

- File
- Options

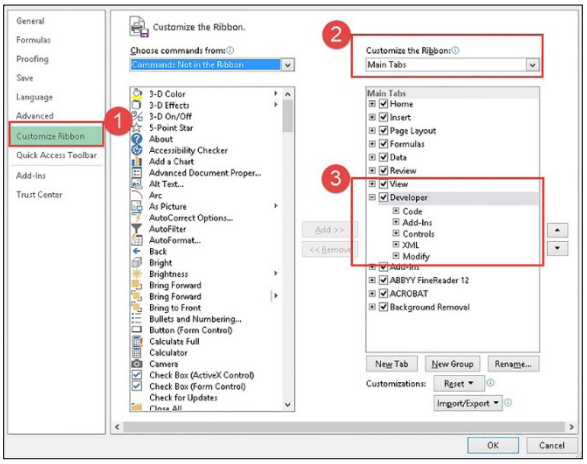

Figure 3 Install the Developer Tab in Excel

1. Customize Ribbon from the left hand menu
2. Make sure Customize to Ribbon is showing Main Tabs
3. The Developer Tab option on the right hand side of the dialogue box: click it to select it

Click OK

The Developer Tab will be there now and ready for use, Figure 4 below.

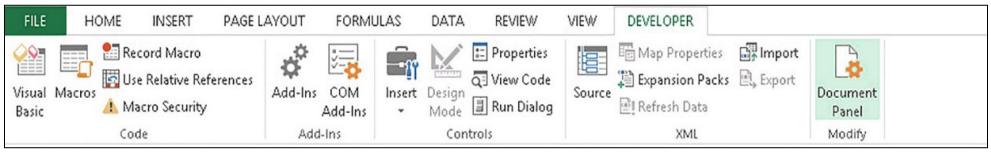

Figure 4 The Developer Tab

Open or keep open the *data_validation.xlsx* file and go to the **forms** tab

We have highlighted the **Insert** icon to click on and what we see when we do that: Form Controls. **Note**: there are two sets of controls there but we are not talking about the Active X Controls at all.

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In this section of this chapter we will use just two of the form controls available but there are other examples to learn in the Excel file, **other_forms** tab

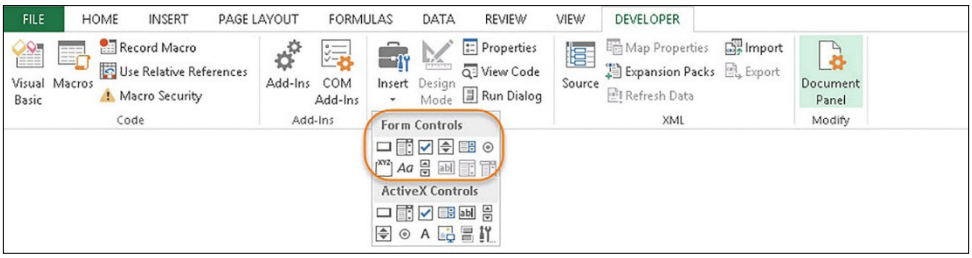

Figure 5 We are Using Form Controls and NOT Active X Controls

The full list of form controls is

Top Row: Button, Combo Box, Check Box, Spin Button, List Box, Option Button

Second Row: Group Box, Label, Scroll Bar, Text Field, Combo List, Combo Drop Down – Edit

We will work with

- Combo Box
- Scroll Bar

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In the *data_validation.xlsx* **forms** tab we have created some very simple specimen data for

Name ID Date Joined Texture Plant

There are eight entries under each heading and some of the entries are generated by using the RANDBETWEEN() function so they change every time you press Enter or F9

This is what the finished worksheet looks like, Figure 6 below:

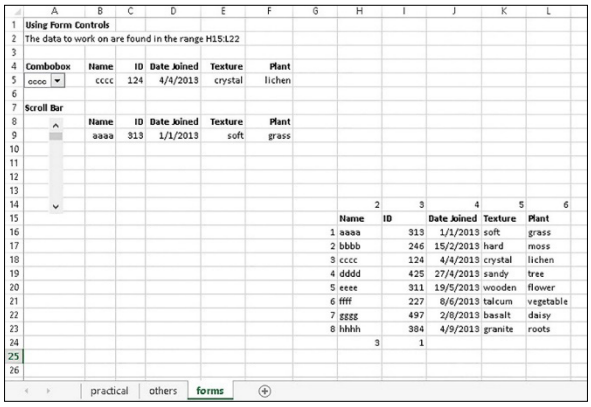

Figure 6 Finished Form Control Examples

On top of cell A5 is a **Combo Box**
On top of cells A8:A14 is a **Scroll Bar**

Both form controls are working with the data you can see in the range H14:L24 but in separate ways.

4.5 Combo Box

To set up the Combo Box do this:

Click on Developer Tab, Controls, Insert and click on Combo Box which is second from the left on the top row.

Your cursor will change to cross hairs and you can draw the outline and size of your Combo Box wherever you want now. In our case we drew it just a bit smaller than cell A5, which is where it stays.

Right click on the Combo Box and select Format Control at the bottom of the menu you will see.
In the dialogue box that opens now make these changes:

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Figure 7, make the

- input range H16:H23…Excel Changes this to $H$16:$H$23 for you
- cell link H24…Excel Changes this to $H$24 for you
- drop down lines 8…you can change this to 1 or 2 or 3…9, 10, 11…as you wish
- click OK

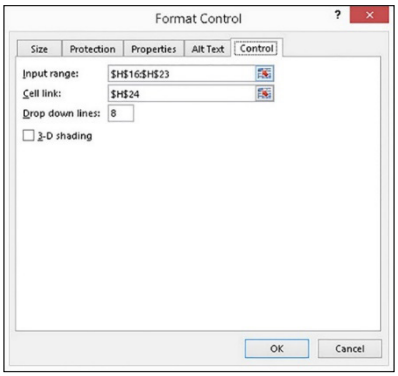

Figure 7 Setting up the Combo Box

Click away from your Combo Box now to deselect it and then click on its down arrow and make a selection from the list inside it: aaaa, bbbb…and notice as you do that that the number in cell H24 changes from 1 to 2 to n…corresponding to the aaaa, bbbb, cccc…It is this number that will drive what we are about to do with this Combo Box.

The main purpose of something like a Combo Box is to use it! In this case we will use this box, via the number in cell H24 to populate the range B5:F5:

Copy the column headers from H15:L15…Name, ID etc…into B4:F4
Click on the Combo Box down arrow and select aaaa

Enter this formula in cell B5: =VLOOKUP($H24,$G$16:$L$23,H14,0)

This formula says:

- look in cell H24
- remember that number and look for it in the first column of G16:L23
- when you find that number move across to column two of that range and tell cell B5 what it found there
- in this case, since the number in cell H24 is 1, the answer for B5 is aaaa

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Make a note of all of the $ in the formula and the cell references and then fill the formula right to F5 This is what it should say when the Combo Box shows aaaa:

Name	ID	Date Joined	Texture	Plant
aaaa	489	1/1/2013	soft	grass

When the Combo Box says eeee:

Name	ID	Date Joined	Texture	Plant
eeee	138	6/5/2013	wooden	flower

4.6 Scroll Bar

We will go through a similar process now to create a scroll bar to organize our data.

The purpose of the **scroll bar** can be exactly the same as the purpose of the Combo Box: get a piece of information and use that to create the kind of table we have just seen under Combo Box. It could be just to get one piece of information or many. It could be used to help us to control graphs or dashboards as we will see later. In any case, this is how scroll bars work.


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Click on Developer Tab, Controls, Insert and click on Scroll Bar (Form Control) which is third from the left on the second row

You cursor will change to cross hairs and you can draw the outline and size of your Scroll Bar wherever you want now: in this case the bars look much better drawn **vertically** rather than **horizontally**. In our case we drew it to cover the range A8:A14 and made it just wide enough to look pleasing, which is where it stays now.

Right click on the Scroll Bar and select Format Control at the bottom of the menu you will see.
In the dialogue box that opens make these changes:

Figure 8, make the

- Current value…leave that alone as Excel keeps track of that
- Minimum Value in this case is 1
- Maximum value in this case is 8
- The incremental change is 1: this tells Excel how many to add to or subtract from the number in the cell link when you click the Scroll Bar arrows once: top arrow decreases, bottom arrow increases
- The Page change is 1: when you click on the Scroll Bar between the arrows, Excel will add to or subtract 1 from the number in the Cell link depending on where you clicked it
- The Cell link is I24: this does the same as it does with the Combo Box but we put it in its own cell to stop any conflicts with the Combo Box
- Click OK

Here is the dialogue box BEFORE any changes:

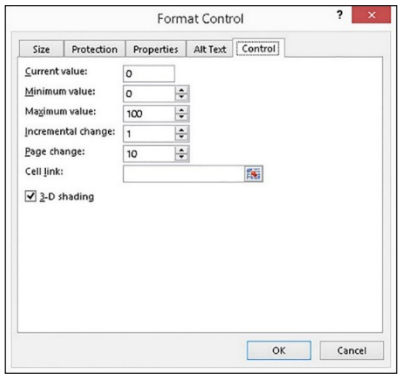

Figure 8 Setting up the Scroll Bar

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Click away from your Scroll Bar now to deselect it and then click on its down arrow. In this case there is nothing to see: you don't see aaaa, bbbb…yet, unlike the Combo Box. However, to see what we need, we now do exactly what we did with the Combo Box except in a different table. Again, the Cell link is the key to using the scroll Bar: click somewhere on the scroll bar and the number in cell I24 changes.

The main purpose of something like a Scroll Bar is to use it! In this case we will use this Scroll Bar, via the number in cell I24 to populate the range B9:F9:

Copy the column headers from H15:L15…Name, ID etc…into B8:F8

Enter this formula in cell B9: =VLOOKUP($H24,$G$16:$L$23,H14,0)

This formula says

- look in cell I24 and see what number is there
- remember that number and look for it in the first column of G16:L23
- when you find that number move across to column two of that range and tell cell B9 what it found there
- in this case, since the number in cell I24 is 1, the answer for B9 is aaaa

Make a note of all of the £ in the formula and the cell references and then fill the formula right to F9 This is what it should say when the number in cell I24 shows 1:

Name	ID	Date Joined	Texture	Plant
aaaa	489	1/1/2013	soft	grass

When the number in cell I24 says 5:

Name	ID	Date Joined	Texture	Plant
eeee	138	6/5/2013	wooden	flower

Exercise for you to do

Since Combo Boxes and Scroll Bars are rather more complex that data validation, try these exercises.

1. Use your Combo Box to create an output table like this:

Name	aaaa	**ID**	100
Date Joined	1/1/2013	**Texture**	soft
Plant	grass		

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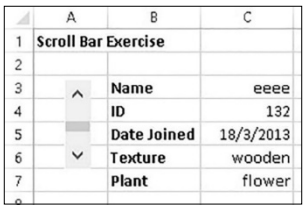
2. Use your Scroll Bar to create the following table ON A NEW WORKSHEET, call the worksheet forms_2.



	A	B	C
1	Scroll Bar Exercise		
2			
3		Name	eeee
4		ID	132
5		Date Joined	18/3/2013
6		Texture	wooden
7		Plant	flower

To complete this exercise you should use an **ARRAY ENTERED TRANSPOSE** formula to create the headings in column B and you should use additional column heading controls in your VLOOKUP() formula. Make the **Page Change** value in the Scroll Bar dialogue box equal to 3. Add some **Alt text**: make it clear and understandable! Finally, to avoid conflict with your other Scroll Bar in this work book, make **forms!I25** your cell link.

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4.6.1 For you to Explore

What follows are the instructions for creating two more Form Controls

- List Box
- Check Box

Follow the instructions and then check your results in the *data_validation.xlsx* file, **forms_3** tab

4.7 List Box

This List Box uses a list of days of the week, or any list for that matter, which you then use to create an output cell or range of cells. As before we have kept the example simple so that you learn the technique rather than worry about any complications. The data you need to enter are as follows: days of the week and a route number

	A	B
9	**Day**	**Route**
10	Monday	6
1	Tuesday	10
12	Wednesday	15
13	Thursday	11
14	Friday	3
15	Saturday	12
16	Sunday	9

Table 2 Inputs for Setting up a List Box

4.8 List Boxes Control and Instructions

Figure 9 List Box in Action

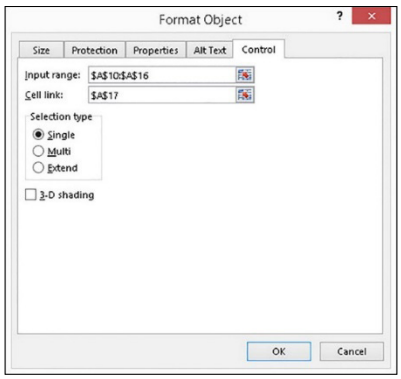

Figure 10 Setting up a List Box

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- Developer tab…insert List Box Form Control Button
- Click on the sheet in cell D10 and resize…it can be any size you want and the one shown here is 3 rows tall and about one and a half columns wide
- Right click the List Box and set the input range as A10:A16 and cell link at A17
- In cell D5 ARRAY enter the following =INDEX(A10:A16,B17,1)
- In cell E5 enter the following =VLOOKUP(D5,$A$10:$B$16,2,FALSE)

4.9 Check Box Control and Instructions

The Check Box is really an on/off switch and here are the instructions of how to use one.

	A	B	C	D	E
1	Check Boxes				
2					
3	Sales			5th largest	5th smallest
4	525			953	590
5	667				
6	556			☑ TURN FORMATTING ON AND OFF	
7	988				
8	723			TRUE	
9	731				
10	605				
11	787				
12	967				
13	890				
14	593				
15	590				

Figure 11 Check Box in Action

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In a new work sheet called **forms_4**, create some **Sales data** in the range A5:A28: use RANDBETWEEN(500,1000) to make your life simple.

Create outputs for the fifth largest and the fifth smallest values in the Sales column (or 6th or 3rd or 10th…):
In cell D5 enter the formula =LARGE(A5:A28,5)…5th largest
In cell E5 enter the formula =SMALL(A5:A28,5)…5th smallest

Create two Conditional Formatting conditions/formulas:
=AND($D$9,A5<=$E$5)…format this to have dark green font and light green background
=AND($D$9,A5>=$D$5)…format this to have dark red font and light red background

Note: D9 is the Cell link in the Check Box and when the box is checked, D9 says TRUE and conditional formatting is turned on. When the Box is unchecked, conditional formatting is turned off as D9 says FALSE.

To set up the Check Box:

- Developer Tab…Check Box (Form Control) third from left top row
- Choose Checked
- Cell link in this case is D9…so you can see it: you might want to hide it if you use it more formally
- Click OK

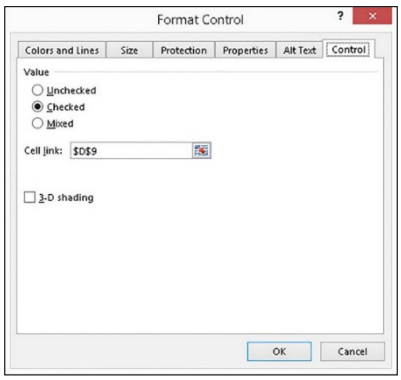

Figure 12 Setting up the Check Box

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Conclusions

This chapter probably contains a lot of new information for you and we hope you have not only found it useful but you will use it. We know from our years of experience that errors creep into spreadsheets, people always think they know best and make changes to spreadsheets when they shouldn't. And so on; and people make mistakes: the work in this chapter will help you to eliminate some of these errors.

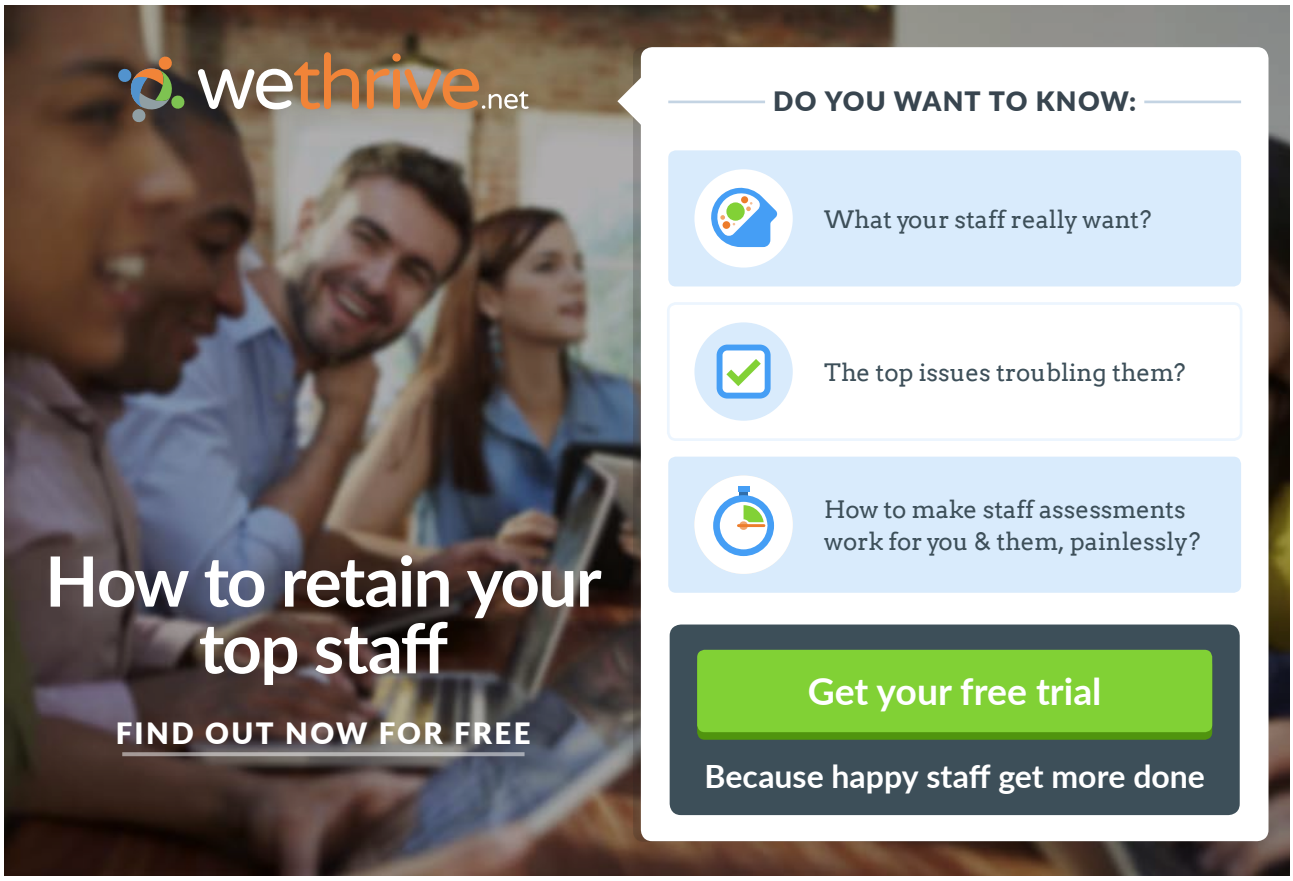
Secondly, why reinvent the wheel, especially when you are building templates? For example, how many days of the week are there? What are the names of the days of the week? How many people are there in Department A and what are their names? These are all known and predictable.

Using Data Validation and Form Controls helps you to streamline your work at the same time as making it that bit more secure and professional looking: use them as much as is necessary.

Reference: Wayne L. Winston *Excel 2010: data analysis and business modelling*

Excel Files Available

All of the Excel files mentioned in this book can be found on this book's page at:
http://bookboon.com/en/excel-solutions-for-accountants-book-2-ebook



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5 Ratio Analysis 2: Statistical Analysis

Introduction

The purpose of this chapter is to review the ratio analysis work of the previous chapter, **Ratio Analysis 1** and consider how reliable the ratios are **statistically speaking**. After all, we can draft tables, draw graphs and so on and feel happy with what we see. However, just taking a basic look at means, medians and modes, correlation and so on will enhance your understanding of the data and their analysis. In addition, this statistical review of your data will improve the quality of any decisions you might take when based on your ratio analysis.

At this stage, then, we will show you a few things to do to analyse your data in more detail than just by looking at some ratios and graphs. In this section we will:

- Reorganise some data
- Generate what are called **descriptive statistics**
- Use Trendline analysis and review the function of a straight line in the form Y = a + bX
- Consider correlation analysis

What we are trying to do here is to understand how the data are behaving:

- Rising
- Falling
- Straight lines or curved lines
- Simple relationships or more complex

Once we know these things we can take better decisions.

5.1 Reorganise some data

We will initially analyse just a few of the variables in our amazon.com data set and if anything interesting comes to light we might sub analyse some of the variables:

- Total revenues
- Net income
- Total current assets
- Total assets
- Total liabilities
- Total Equity

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For the work we will do on trendlines and so on, we need to reorganise some of our data in a particular way to get a table that looks like this on the **statistica**l worksheet.

The first part of the new worksheet looks like this and you can see that we have taken everything from the *ratio_analysis.xlsx* file **data_working** tab, including the name of the company we are analysing and this table is found on the **statistical** tab:

Year	Total revenues	Net income	Total current assets	Total assets	Total liabilities	Total equity
1	34,204	1,152	13,747	18,797	11,933	6,864
2	48,077	631	17,490	25,278	17,521	7,757
3	61,093	-39	21,296	32,555	24,363	8,192
4	74,452	273	24,625	40,159	30,413	9,746
5	88,988	-241	31,327	54,505	43,764	10,741

Table 1 amazon.com Summary Data

Here is the Total Revenues column again with the formulas you need:

Year	Total Revenues
1	=data_working!$F$8
2	=data_working!$E$8
3	=data_working!$D$8
4	=data_working!$C$8
5	=data_working!$B$8

Repeat this process for the other five variables: Net income to Total equity.

5.2 Generate what are Called Descriptive Statistics

We need to use the **Data Analysis ToolPak** for this step and we do that by using an Excel Add-In which we must install. To install this Add-In do this:

- File
- Options
- Manage Excel Add-Ins
- Go
- Select Analysis ToolPak ONLY
- OK

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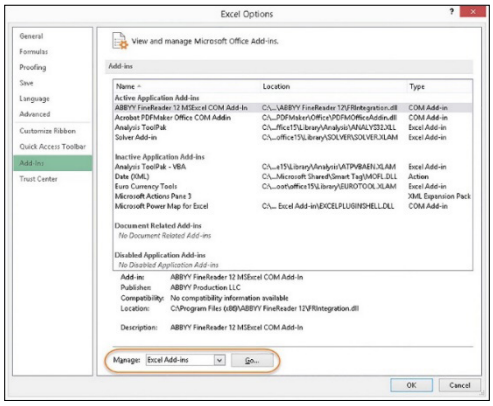

Figure 1 Installing the Data Analysis ToolPak 1

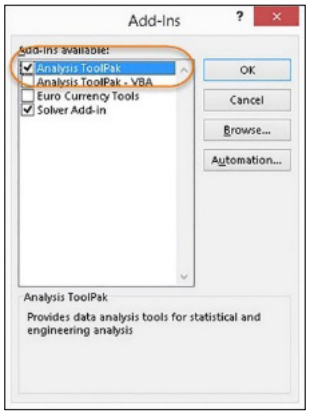

Figure 2 Installing the Data Analysis ToolPak 2

This Add-In will install now either slowly or quickly!

Once you have installed the Add-In you MIGHT have to close and reopen Excel. You will find the **Data Analysis** icon here now: on the Data tab in the far right corner, Figure 3, below:

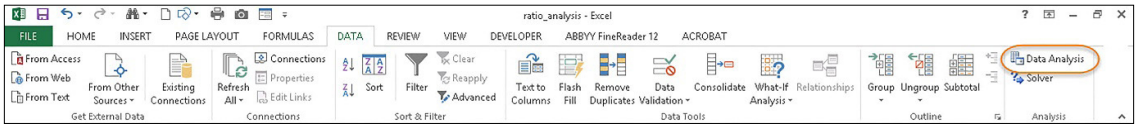

Figure 3 Locating the Data Analysis Add-In

Click on Data Analysis now to open this Dialogue Box and then
Click on **Descriptive Statistics**

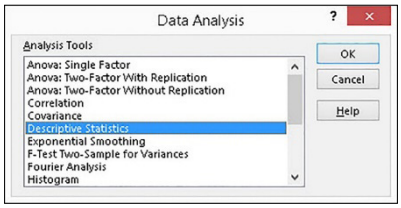

Figure 4 Data Analysis Dialogue Box

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OK

Then set up the new Dialogue box as follows:

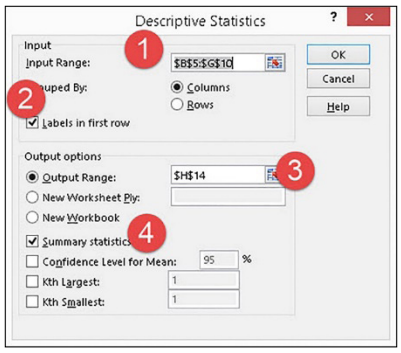

Figure 5 Descriptive Statistics Set up

1. data range: all data points INCLUDING the column headers
2. Check to say your data range includes the headers
3. Click to select the output starting cell…be careful because Excel moves the cursor so make sure you click this option carefully
4. Check to make sure Excel calculates the Descriptive Statistics
   OK

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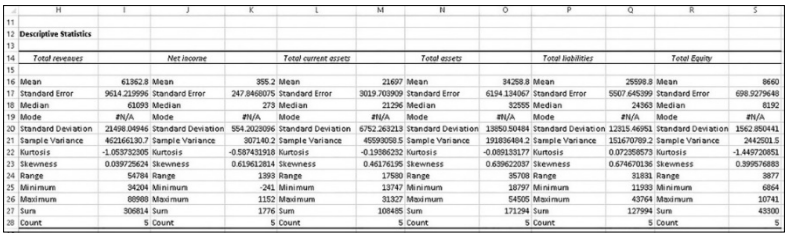
You should find this now, which is what we asked for but we need to move a couple of things around:



	H	I	J	K	L	M	N	O	P	Q	R	S
11												
12	**Descriptive Statistics**											
13												
14	*Total revenues*		*Net income*		*Total current assets*		*Total assets*		*Total liabilities*		*Total Equity*	
15												
16	Mean	61362.8	Mean	355.2	Mean	21697	Mean	34258.8	Mean	25598.8	Mean	8660
17	Standard Error	9614.219996	Standard Error	247.8468075	Standard Error	3019.703909	Standard Error	6194.134067	Standard Error	5507.645399	Standard Error	698.9279648
18	Median	61093	Median	273	Median	21296	Median	32555	Median	24363	Median	8192
19	Mode	#N/A	Mode	#N/A	Mode	#N/A	Mode	#N/A	Mode	#N/A	Mode	#N/A
20	Standard Deviation	21498.04946	Standard Deviation	554.2023096	Standard Deviation	6752.263213	Standard Deviation	13850.50484	Standard Deviation	12315.46951	Standard Deviation	1562.850441
21	Sample Variance	462166130.7	Sample Variance	307140.2	Sample Variance	45593058.5	Sample Variance	191836484.2	Sample Variance	151670789.2	Sample Variance	2442501.5
22	Kurtosis	-1.053732305	Kurtosis	-0.587431918	Kurtosis	-0.19386232	Kurtosis	-0.089133177	Kurtosis	0.072358573	Kurtosis	-1.449720851
23	Skewness	0.039725624	Skewness	0.619612814	Skewness	0.46176195	Skewness	0.639622037	Skewness	0.674670136	Skewness	0.399576883
24	Range	54784	Range	1393	Range	17580	Range	35708	Range	31831	Range	3877
25	Minimum	34204	Minimum	-241	Minimum	13747	Minimum	18797	Minimum	11933	Minimum	6864
26	Maximum	88988	Maximum	1152	Maximum	31327	Maximum	54505	Maximum	43764	Maximum	10741
27	Sum	306814	Sum	1776	Sum	108485	Sum	171294	Sum	127994	Sum	43300
28	Count	5	Count	5	Count	5	Count	5	Count	5	Count	5

Figure 6 Output: Descriptive Statistics

Firstly move all of the column headings ONE COLUMN to the right: that is, Total Revenues, Net Income …

Then, **apart from** the first column, delete all of the columns, J, L, N, P, R, that say

- Mean
- Standard Error
- Median
- …

Delete them because they are repeated so many times and we only need them once. Your descriptive statistics table should look like this now, including having formatted the values to make them all look the same as each other:

	H	I	J	K	L	M	N
11							
12	**Descriptive Statistics**						
13							
14		*Total revenues*	*Net income*	*Total current asset*	*Total assets*	*Total liabilities*	*Total Equity*
15							
16	Mean	61,362.80	355.20	21,697.00	34,258.80	25,598.80	8,660.00
17	Standard Error	9,614.22	247.85	3,019.70	6,194.13	5,507.65	698.93
18	Median	61,093.00	273.00	21,296.00	32,555.00	24,363.00	8,192.00
19	Mode	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
20	Standard Deviation	21,498.05	554.20	6,752.26	13,850.50	12,315.47	1,562.85
21	Sample Variance	462,166,130.70	307,140.20	45,593,058.50	191,836,484.20	151,670,789.20	2,442,501.50
22	Kurtosis	(1.05)	(0.59)	(0.19)	(0.09)	0.07	(1.45)
23	Skewness	0.04	0.62	0.46	0.64	0.67	0.40
24	Range	54,784.00	1,393.00	17,580.00	35,708.00	31,831.00	3,877.00
25	Minimum	34,204.00	(241.00)	13,747.00	18,797.00	11,933.00	6,864.00
26	Maximum	88,988.00	1,152.00	31,327.00	54,505.00	43,764.00	10,741.00
27	Sum	306,814.00	1,776.00	108,485.00	171,294.00	127,994.00	43,300.00
28	Count	5.00	5.00	5.00	5.00	5.00	5.00

Figure 7 Improved Descriptive Statistics Output

5.2.1 What do These Numbers Mean?

The better known statistics first of all:

- The mean, median and mode and generally known by everyone and are what we generally call
  - The mean is the average: total of all values divided by the number of all values
  - The median = the middle value or number in a list of numbers
  - The mode = the number occurring most often in a list of numbers: in this data set there is no repetition of numbers so there is no mode so it says #N/A

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- The standard deviation = the average dispersion around the mean; and the sample variance is the square of the standard deviation
- The maximum = the largest number in the data set
- The minimum = the smallest number in the data set
- The range = the difference between the maximum and minimum values in the data set
- The sum = the total of all of the values in the data set
- The count = the number of numbers in the data set

Now the less well known ones

- The Standard Error = the average deviation of the actual values in the data set from Excel's predictions of values in the data set: we will look at this in the Forecasting chapter
- The Kurtosis tells us how tall or flat the curve of the data is: if data are normally distributed this value will be 3
- The Skewness = how far the data set is away from being symmetrical: skewness can be negative or positive according to which way the data curve slopes.

We can see the **general picture** with amazon.com: because of kurtosis and skewness we can see that their data are not normally distributed; because of the standard deviations and standard errors we can see that the data seem to vary in size quite a bit from year to year. We can check all of this against the graphs we have drawn, of course, as the values confirm what we can see there.

Look at **Net Income** for example:

The standard deviation is about 1.4 times the average net income and the standard error is about two thirds of the average net income: look at the graph of net income on the **graphics** tab. Kurtosis is small and negative and the skewness result is small and positive: suggesting a lack of normality. Normality isn't the only thing to worry about but it's a start.

Look at **Total Assets** now and then **Total Revenue**. Revenue is interesting for amazon.com because the company has had ever increasing sales since the birth of the company over 20 years ago.

5.3 Trendline Analysis

Trendlines are also known as **lines of best fit** or the **regression line**: they are drawn on a graph and they are a first introduction to correlation and regression analysis because they give us the R^2 value and the function of the curve or data we are analysing. Here is an example from the graphs we have already prepared, Figure 8 below.

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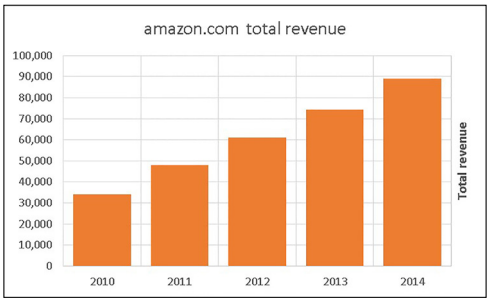

Figure 8 amazon.com Total Revenue Column Graph

The graphs with Trendlines are on the **graphs_2** tab and this is how to add one to a graph:

- Right click on the curve or line or column or bar you want to analyse: just right click anywhere on the line or on any bar or column
- Select Add Trendline and you will see this, Figure 9, below:

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Figure 9 Adding a Trendline to a Graph

By default, Excel draws a LINEAR trendline but you can see there are six options available but for now we will concentrate on Linear:

- Exponential
- Linear
- Logarithmic
- Polynomial
- Power
- Moving Average

Scroll down in the Format Trendline section on the right hand side now until you see what you see in Figure 10

- Display Equation on Chart…check it
- Display R-Squared Value on Chart…check it

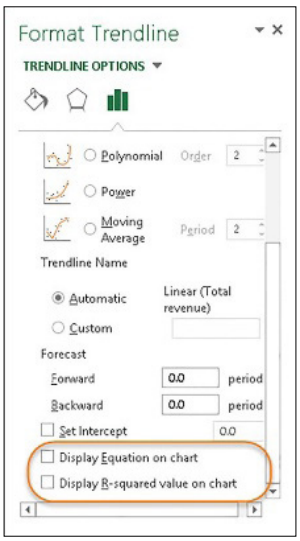

Figure 10 Add the Equation and the R Squared Value

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Your chart will look like this now, although we increased the size of the font of the equation and R^2 just to make it easier to see…you will probably need to move the equation too by left clicking and dragging it to where you want it. You might want to make the trendline more visible too by changing style, weight and colour.

Figure 11 shows the graph with the trendline, equation and R^2 included:

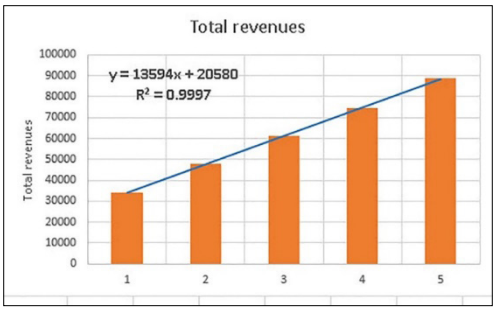

Figure 11 Graph with Trendline, Equation, R Squared

To edit the function and formula just select it and change the font size…we made it bold too

To format the trendline, just click on it or right click on it to open up the editing area and do this:

1) Choose Trendline Options, Line and click Solid line
2) Choose the colour you want
3) Change the width to the with you want
4) Change the dash type…we chose solid line

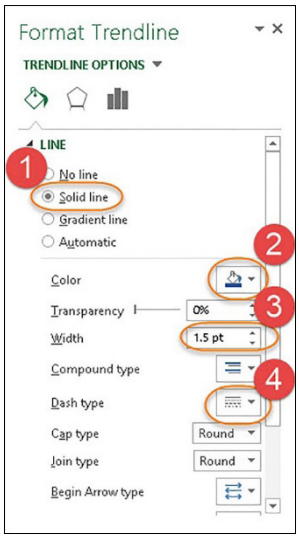

Figure 12 How to format the Trendline

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5.4 Review the Function of a Straight Line in the Form Y = a + bX

First of all notice that instead of 2010, 2011…2014 we have used **year numbers** where year 1 is 2010 and year 5 is 2014: if you don't do this your results may be unusual and unusable. This is a general rule, by the way, where it is best to use year numbers and not years.

The linear function or equation is in the form Y = a + bX where

- a = the **intercept** or fixed term
- b = the **coefficient of X** and is a variable amount

Sometimes you might think the value of 'a' looks wild and meaningless: take it easy because it is what it is and you shouldn't necessarily try to interpret it by itself every time.

The value of 'b' tells us the rate of change or the slope of the curve: for every increase in X the value of the total cost or revenue or Y will change by the value of 'b'.

R^2 is formally known as the **Coefficient of Determination** and is the correlation coefficient of the whole model or formula: in this case and R^2 of 0.9997 tells us that X explains 99.97% of the behaviour of Y. Clearly such a result is excellent. Our personal cut off is that if R^2 is less than 0.65 to 0.70 we start to think the overall relationship is not so good.

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Please note: for some reason Excel always presents the trendline function this way: Y = bX + a: we will change that round as we discuss it here. In this case we are interpreting the Total Revenue function of amazon.com where the function is

Y = 20,580 + 13,594X

So, amazon.com's sales have a fixed, intercept, element of $20,580 million and every year they increase on average at the rate of $13,594 million. The following table, Table 2, shows how we can use the function as part of our assessment of the trendline:

	J	K	L
4	**Using the Trendline**		
5	**Year No**	**TR**	**TR Predict**	**TR Predict**
6	1	34,204	34,174	= 13594*J6 + 20580
7	2	48,077	47,768	= 13594*J7 + 20580
8	3	61,093	61,362	= 13594*J8 + 20580
9	4	74,452	74,956	= 13594*J9 + 20580
10	5	88,988	88,550	= 13594*J10 + 20580

Table 2 amazon.com Setting up the Trendline Predictions

We can see in Table 3, below, that the trendline function does a good job, but not a perfect job, of predicting the Total revenue for amazon.com. Here is the final table that shows those differences, which statisticians call **residuals** and accountants call **variances**:

	J	K	L
4	**Using the Trendline**		
5	**Year No**	**TR**	**TR Predict**	**Residuals**
6	1	34,204	34,174	30
7	2	48,077	47,768	309
8	3	61,093	61,362	(269)
9	4	74,452	74,956	(504)
10	5	88,988	88,550	438

Table 3 amazon.com Actual, Predictions and Residuals

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5.4.1 Analysis of Residuals

Residuals are important because they often contain hidden information and one way to use them to help us to tell if our analysis is useful is to plot them on their own graph against X, Year Numbers, in this case. See Figure 13 that follows:

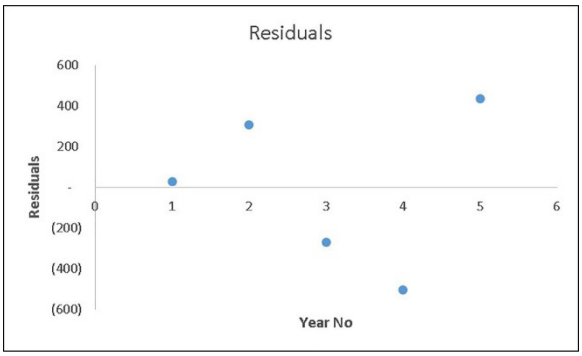

Figure 13 X Variable, Year Number, v Residuals

What we see here is that the residuals seem to increase as the year number increases: whether positive or negative the values are getting bigger and bigger. Such a result tells us that even though R^2 is excellent, there might be something else we need to look at in this example. We will discuss these things when we look at regression analysis in more detail in the Forecasting Chapter.

The **best arrangements of the residuals** would be random: no line, no curve, no pattern, just like white noise on a television screen.

Exercises for you to do

There are five further amazon.com variables to analyse on the **statistical** tab of the *ratio_analysis.xlsx* workbook. Create graphs, add trendlines, apply the trendline function, make predictions, find the residuals and analyse your results.

If you do two more of these and feel confident that you can make sense of everything then you are doing well. If not, do one or two more. Then graduate onto larger data sets: your own data sets preferably.

All the graphs, trendlines and using the trendline tables have already been prepared as have the residuals graphs. Just make sure your answers are the same and then carry out your interpretation.

5.5 Consider Correlation Analysis

An additional level of analysis is to consider r which is the **coefficient of correlation**. R^2 is the coefficient of determination for the entire model and r comes when we compare any two variables.

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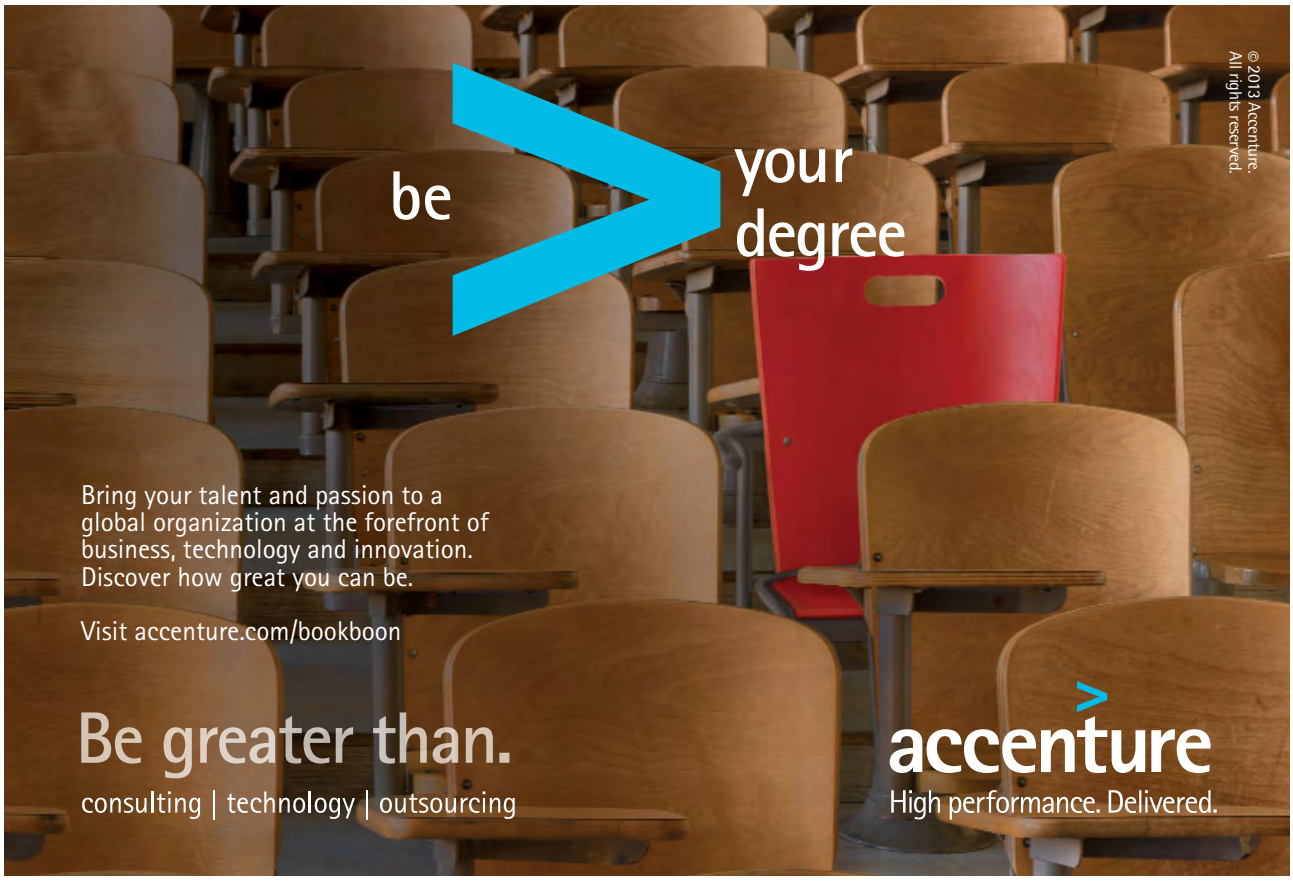
There is a correlation function =**CORREL(array1,array2…)**. For example, go to the **statistical** tab and enter =CORREL(B6:B10,C6:C10) in any empty cell. It will give you the answer -0.8969…formatting the cell to four decimal places.

What we have done is find r for Total Revenue v Net Income and the answer is -0.8969 which means that

- There is a negative relationship between the two variables meaning that as we increase total Revenues Net Income falls
- The value is high since r can only range from -1 to +1 so -0.8969 is very highly negative
- The relationship between the two variables is strong because r is so high

By the way, you must ask yourself: is it good that Net Income falls as Total Revenues rise? Of course the answer is no; but this is what is happening to amazon.com

In another empty cell enter =CORREL(B6:B10,D6:D10) which is the correlation between Total Revenues and Total liabilities. r = 0.9925 which is extremely high and positive which means that as Total Revenues increase Total Liabilities increase at virtually the same rate.



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We can carry on doing that cell by cell and variable by variable. Alternatively, we can use the ToolPak since it has a correlation utility built into it:

- Clear the cells with the r values in them
- Data Tab
- Data Analysis
- Correlation
- OK

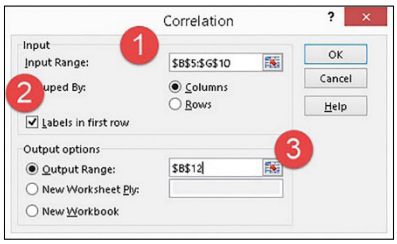

Figure 14 Correlation Analysis using the Data Analysis ToolPak

1) Select the range, including the header row…you don't have to select the header row but it is much better if you do.
2) Check to say you have included the header row
3) Click to select the output range upper left most cell

Click OK

That will give you the result you see in Figure 15, a **correlation matrix** in the range A12:G18, which we have tidied a little bit by formatting all cells with an r value in them to four decimal places.

	A	B	C	D	E	F	G
1	**amazon.com**						
2							
3	**Statistical Analysis**						
4							
5	**Year**	**Total revenues**	**Net income**	**Total current assets**	**Total assets**	**Total liabilities**	**Total Equity**
6	1	34,204	1,152	13,747	18,797	11,933	6,864
7	2	48,077	631	17,490	25,278	17,521	7,757
8	3	61,093	-39	21,296	32,555	24,363	8,192
9	4	74,452	273	24,625	40,159	30,413	9,746
10	5	88,988	-241	31,327	54,505	43,764	10,741
11							
12		*Total revenues*	*Net income*	*Total current assets*	*Total assets*	*Total liabilities*	*Total Equity*
13	Total revenues	1					
14	Net income	(0.8969)	1				
15	Total current assets	0.9925	(0.8898)	1			
16	Total assets	0.9876	(0.8690)	0.9988	1		
17	Total liabilities	0.9855	(0.8738)	0.9986	0.9997	1	
18	Total Equity	0.9867	(0.8156)	0.9828	0.9842	0.9800	1

Figure 15 A Correlation Matrix

We can see here that Total Revenues correlate well with everything: all positive, too, except Net Income. The best relationship, ie the strongest positive, is between Total Assets and Total Liabilities at 0.9997. The worst relationship is between Net Income and Total Equity at -0.8156: negative and still quite high but the weakest relationship from the entire correlation matrix.

We should ask questions now such as: what relationships should we expect from these results?

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We already asked, should there be a negative relationship between Net Income and Total Revenues? Remember this correlates all five years' worth of data not just the final year. The answer is no! There should be a positive relationship for a profitable company…amazon.com is hardly a profitable company and nor has it ever been.

Do you think Total Equity should grow as Total Assets grow? Yes, we think so and there is a positive and high relationship between the two here.

Conclusions

That concludes our two part review of ratio analysis and you now have a much greater insight into the way that a ratio analysis template might be constructed and you have been given greater insights into the arithmetical, graphical and statistical analysis of our ratio findings.

We will return to ratio analysis in the Dashboarding chapter when we consider using our template to analyse other companies and when we come to create dashboards and so on.

Excel Files Available

All of the Excel files mentioned in this book can be found on this book's page at:
http://bookboon.com/en/excel-solutions-for-accountants-book-2-ebook

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6 Graphs 2

Introduction

This is the second of two chapters concerned with preparing graphs in Excel. In **Graphs 1** we looked at twelve different graphs or graphing techniques and we did so both for the sake of learning how to draw a variety of graphs and to lead us into creating effective dashboards.

In this chapter we will add Panel Graphs, Graphs driven by Spinner Controls, Gantt Charts, percentage and value Waterfall Graphs but we will begin where we left off in **Graphs 1**, with Sparklines.

All of these graphs and more have their place in a dashboard and we will see more of them in the **Dashboarding** chapter.

6.1 Sparklines

At the end of the **Graphs 1** chapter, we left you with this very simple but not very effective graphic, Figure 1, of three grouped Sparklines:

Figure 1 Three Grouped Sparklines

Let's look at Sparklines properly now; and all we need is some data that goes down a column or across a row. We can have one Sparkline chart by itself or we can group two or more Sparklines together. We can start with two or more grouped Sparklines and then we can split them apart. Finally, there are three styles of Sparkline:

- Line
- Column
- Win/loss

We will look at all three of them.

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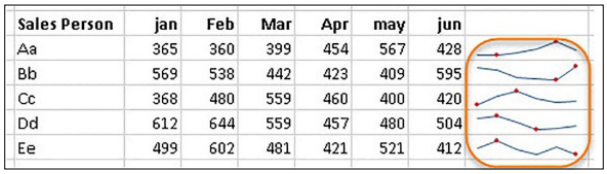
6.1.1 Line Sparkline

Open the file *graphs_2.xlsx* **sparks_1** tab. What we want to do here is to create a Sparkline for each Sales Person: Aa, Bb…that will summarise their progress over the first half of a year. Do this:

- Select the range I8:I12
- Insert tab…Sparklines…Line
- In the dialogue box that now opens enter the range C8:H12
- OK



Sales Person	jan	Feb	Mar	Apr	may	jun
Aa	365	360	399	454	567	428
Bb	569	538	442	423	409	595
Cc	368	480	559	460	400	420
Dd	612	644	559	457	480	504
Ee	499	602	481	421	521	412

Figure 2 Line Sparklines

6.1.2 Column Sparkline

Your first Sparklines in Figure 2 are grouped! Change them from a Line Sparkline to a Column Sparkline:

- Click on any of the cells in the Sparkline group
- Sparkline Tools Tab…Design…Type…Column: see Figure 3, below

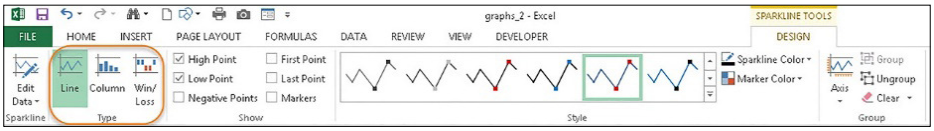


Figure 3 Click Column Type to Change from Line to Column Sparkline

Step Two: imagine these sales people have a target that they have to reach of 500 units per month and we want our Sparklines to reflect the achievements of each Sales Person. Working with a new table now, as you can see in the screenshot below, Figure 4, we put the target in cell I15 and in cell C17, having copied the column and row headers from the previous example, we enter the formula =C8-$I$15 which says, from Aa's January sales achieved, subtract the target of 500: if the answer is positive it means Aa beat the target and if it's negative he didn't. An answer of 0 means he sold exactly the target amount.

Again we have chosen a Line Sparkline but you can change it to a Column Sparkline as we have already described. In addition, we have added a horizontal axis that allows us to see very easily who is above and below their target.

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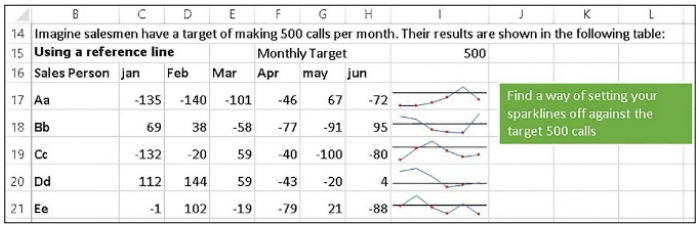

	B	C	D	E	F	G	H	I	J	K	L
14	Imagine salesmen have a target of making 500 calls per month. Their results are shown in the following table:										
15	**Using a reference line**				Monthly Target			500			
16	**Sales Person**	**jan**	**Feb**	**Mar**	**Apr**	**may**	**jun**				
17	Aa	-135	-140	-101	-46	67	-72				
18	Bb	69	38	-58	-77	-91	95				
19	Cc	-132	-20	59	-40	-100	-80				
20	Dd	112	144	59	-43	-20	4				
21	Ee	-1	102	-19	-79	21	-88				

Figure 4 Line Sparklines with a Horizontal Axis

To insert the axis, select the Sparklines

- Sparkline Tools Tab…Design…Type…Axis and click Show Axis: see Figure 5 below

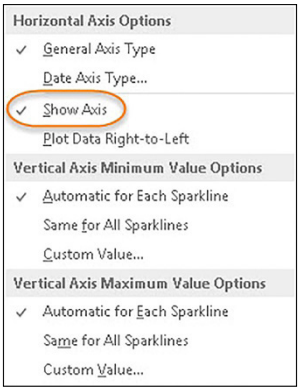

Figure 5 How to add an Axis to a Sparkline

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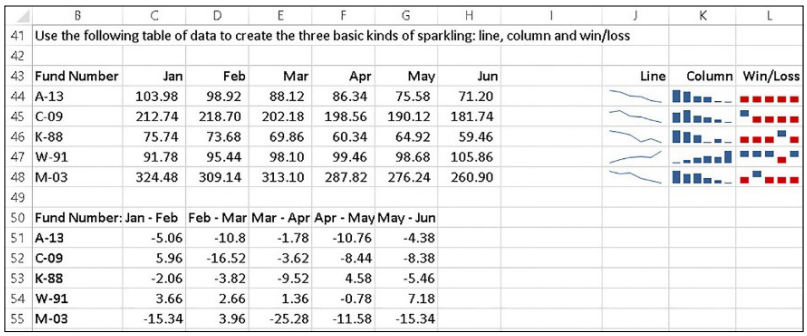
Feel free to change or update the target as you need and if you look again at Figure 3 you will see other formatting options for Sparklines, including High Point, Low Point, Negative Point and so on: we have clicked all three of them but there are more to experiment with.

6.1.3 Win/Loss Sparklines

Take a look at Figure 6 and see what we did to create Win/Loss Sparklines:



	B	C	D	E	F	G	H	I	J	K	L
41	Use the following table of data to create the three basic kinds of sparkling: line, column and win/loss										
42											
43	Fund Number	Jan	Feb	Mar	Apr	May	Jun		Line	Column	Win/Loss
44	A-13	103.98	98.92	88.12	86.34	75.58	71.20				
45	C-09	212.74	218.70	202.18	198.56	190.12	181.74				
46	K-88	75.74	73.68	69.86	60.34	64.92	59.46				
47	W-91	91.78	95.44	98.10	99.46	98.68	105.86				
48	M-03	324.48	309.14	313.10	287.82	276.24	260.90				
49											
50	Fund Number:	Jan - Feb	Feb - Mar	Mar - Apr	Apr - May	May - Jun					
51	A-13	-5.06	-10.8	-1.78	-10.76	-4.38					
52	C-09	5.96	-16.52	-3.62	-8.44	-8.38					
53	K-88	-2.06	-3.82	-9.52	4.58	-5.46					
54	W-91	3.66	2.66	1.36	-0.78	7.18					
55	M-03	-15.34	3.96	-25.28	-11.58	-15.34					

Figure 6 Creating a Win/Loss Sparkline

In this example, we set up a table of returns on a Hedge Fund in the range B43:H48 including all headings. We then set up Line and Column Sparklines in columns J and K for each fund Number: A-13 to M-03. You know how to create these Sparklines now.

The **Win/Loss Sparkline** requires a new table, found in the range B50:H55. Look at the formula in cell C51 which says =D44-C44. That is, we are comparing the change (win or lose) between January and February; and the change is either positive or negative or even zero. We can now prepare a Win/Loss Sparkline from this new table.

6.1.4 Sparklines can go Anywhere

Notice from Figure 6 that our Sparklines are all together and not necessarily next to the data on which they are based. In a sense you can put your Sparklines anywhere!

Finally, there is a Sparkline with the horizontal axis formatted by date but not shown here: take a look at how you might do that on the **spark_1** tab

6.2 Panel Graphs

Panel Graphs are not new but they can be very effective: we just need to demonstrate how to prepare two graphs and you will see how effective they can be. To do this we will use the Volume and Value example from the **Graphs 1** chapter which is repeated in the *graphs_2.xlsx* file, **panel** tab. Here's a basic example of a **Panel Graph**.

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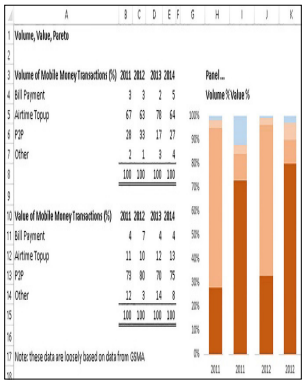

Figure 7 Very Basic Panel Graph

The process for creating Panel Graphs is set out with the help of Figure 8, below.

- Either create or copy one of the 2D Column graphs for volume and one for value from the **vol_val** tab of the *graphs_1.xlsx* file. Delete all but the 2011 data from both of your graphs so that you have a single column in each graph.
- Keep the vertical access in the volume graph and put that graph on top of cell G5
- **Delete the vertical axis from the value graph** and slide and align that graph next to your volume graph
- Make the graphs as narrow as you like
- **Copy** each of these graphs and change the data from 2011 to 2012 in your new graphs in the usual way: **delete the vertical axis from this second volume graph**
- **Arrange** all of the graphs as you see in Figure 8. We have put Volume % then Value % then Volume % and so on. Feel free to arrange them in your own way.
- Carry on and **create and align** the other graphs, for 2013 and 2014.
- **Delete any border and any formatting** that shows that these are separate graphs because you are trying to create the impression that this is all one graph!

	A	B	C	D	E	F	G	H	I	J	K
1	**Volume, Value, Pareto**										
2											
3	**Volume of Mobile Money Transactions (%)**	**2011**	**2012**	**2013**	**2014**			**Panel ...**			
4	Bill Payment	3	3	2	5			**Volume % Value %**			
5	Airtime Topup	67	63	78	64						
6	P2P	28	33	17	27						
7	Other	2	1	3	4						
8		100	100	100	100						
9											
10	**Value of Mobile Money Transactions (%)**	**2011**	**2012**	**2013**	**2014**						
11	Bill Payment	4	7	4	4						
12	Airtime Topup	11	10	12	13						
13	P2P	73	80	70	75						
14	Other	12	3	14	8						
15		100	100	100	100						
16											
17	Note: these data are loosely based on data from GSMA										
18											

Figure 8 The Source and the Finished Panel Graphs: 2011–2012

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6.3 Quadrant Graph

You have probably never heard of quadrant graphs: we might not be the original inventor of these graphs but we did create them for ourselves! Imagine you have a graph like this, based on the financial results of 200 companies, see Figure 9:

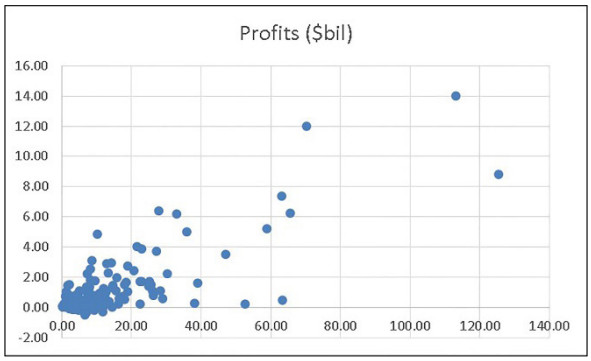

Figure 9 200 Companies' Financial Results

Now imagine that you want to know how many of the data points you see on that graph might be **outliers**: values that are too far away from the rest of the data to be helpful in any analysis you might be trying to carry out. There are definitions of what an outlier is but in this case we will use our own, based on the **=PERCENTILE()** function in Excel. This is how we have turned Figure 9 into what we call a **Quadrant Graph**. We are working in the **quadrant** tab from the *graph_2b.xlsx*

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	A	B	C	D	E	F	G	H
1	The Global 2000 - Forbes.com							
2	Table starts at http://www.forbes.com/lists/2007/18/biz_07forbes2000_The-Global-2000_Rank.html							
3								
4					Sales percentile	0.95	38.273	
5					Profits percentile	0.95	4.0615	
6	Year	Company	Country	Industry	Sales ($b)	Profits ($b)	Profits Per	Sales Per
7	2008	3i Group	United Kingdom	Diversified Financials	1.68	1.48	4.0615	38.2730
8	2008	3M	United States	Conglomerates	22.92	3.85	4.0615	38.2730
9	2008	77 Bank	Japan	Banking	0.98	0.08	4.0615	38.2730
10	2008	Aareal Bank	Germany	Banking	2.28	-0.07	4.0615	38.2730
11	2008	ABB	Switzerland	Capital Goods	24.91	1.42	4.0615	38.2730
12	1992	ABB Asea Brown Boveri	Switzerland	Industrial and farm equipment	28.88	0.59	4.0615	38.2730
13	2008	Abbott Laboratories	United States	Drugs & Biotechnology	22.48	1.72	4.0615	38.2730
14	1992	Abbott Laboratories	United States	Drugs & Biotechnology	6.92	1.09	4.0615	38.2730
15	2008	Abercrombie & Fitch	United States	Retailing	3.32	0.42	4.0615	38.2730
16	2008	Abertis	Spain	Transportation	4.40	0.70	4.0615	38.2730
17	2008	Abitibi Consolidated	Canada	Materials	4.17	0.05	4.0615	38.2730
18	2008	ABN Amro Holding	Netherlands	Banking	65.59	6.22	4.0615	38.2730
19	2008	Accenture	Bermuda	Business Services & Supplies	18.85	1.04	4.0615	38.2730
20	2008	Acciona	Spain	Construction	8.27	1.81	4.0615	38.2730

Figure 10 How to Set up the Quadrant Lines

Figure 10, above, shows the raw data in the form of an Excel Table and in the rows above it some additional data including the sales and profits percentiles: in this screenshot we have set the percentiles at 0.95: that is, we want to find which values comprise the top 95% of all sales and profits data…alternatively, we are highlighting the 5% that is outside the top 95% of all values, the outliers.

We can change the percentile values simply by changing them: in cells F4 and/or F5 just type 0.9 or 0.8995 or 0.75…as you wish.

The percentile data are then fed into columns G and H in this way G7=$G$5 and H7 =$G$4. These two cells are then filled down to the end of the table and they are the Profits Percentile and Sales Percentile figures respectively. We now amend the graph by putting the two percentile values on the graph and that makes them look like Figure 11.

This is what a Quadrant Graph looks like and this is how we interpret the Quadrants, see Figure 11:

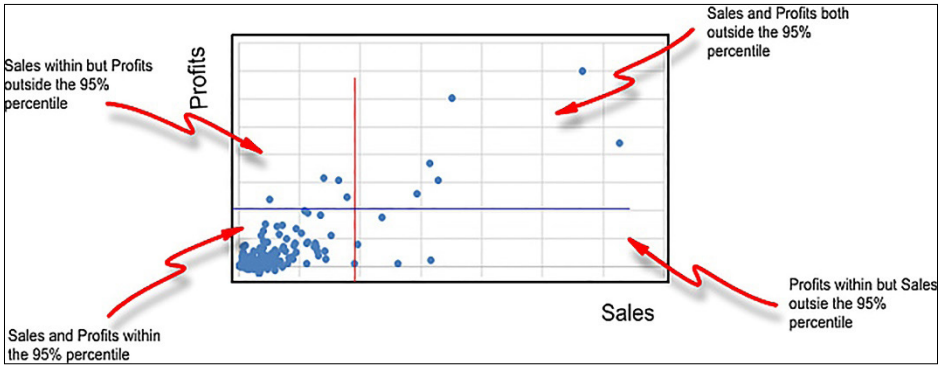

Figure 11

These quadrants are useful in the simplest way possible in that we can see and count how many of the 200 data points on Figure 11 are outside the 95% Sales and Profits boundaries: there are 14 of them.

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6.4 Quadrant Graph with Scroll Bars

We all know scroll bars these days: we use them in Excel, Word and in our Web Browsers every day. Excel can easily be made to add a **Scroll Bar** for help with drawing the Quadrant Chart we created in the previous section. Let's use the same data, layout and graph as with the previous section: to do that copy the **quadrant** tab from the *graph_2b.xlsx* and call the new tab **quad_scroll**.

Because we have already discussed **Combo Boxes** and so on in the **Data Validation** chapter, you will find adding Scroll Bars to a graph pretty straightforward. Like this:

- Developer Tab…Controls…Insert…Scroll Bar (second row third from the left)
- Click on that icon and draw the bar horizontally above the graph you will find there
- Create another scroll bar in the same sheet and draw that vertically and to the left of the graph that is there.
- Right click the horizontal bar which we have created to cover the range K6:M6, Format Control
  - Minimum value 0
  - Maximum value 100
  - Incremental change1
  - Page change 1
  - Cell link N6

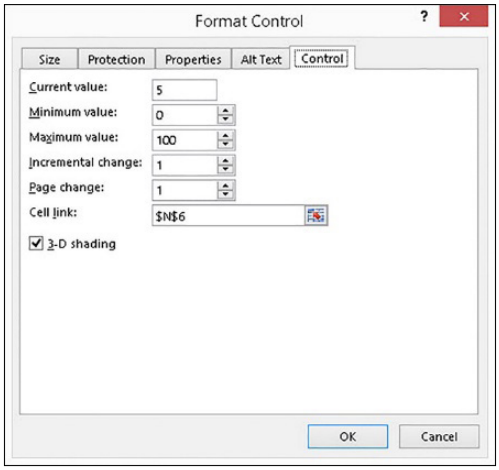

Figure 12 Setting up the Horizontal Scroll Bar

We can use Figure 12 for the vertical Scroll Bar, which covers the range J9:J15, with exactly the same values except that the Cell link in this case is J16:

- Click cell F4 and enter =1-(N6/100) .. this refers to the Sales Percentile
- Click cell F5 and enter =1-(J16/100) .. this refers to the Profits Percentile

We must have these formulas in cells F4 and F5 because we cannot put fractional cells in a Form Control like Scroll Bars so we need the **helper cells** of N6 and J16.

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Click on the Scroll Bars now and you will see the Percentile Bars moving 1% at a time each: if you want them to move faster, change the **Incremental** and **Page Change** figures to 5 or 10 or whatever number you like.

Figure 13 shows three thumbnails of three Quadrant Graphs with varying values of the percentiles.

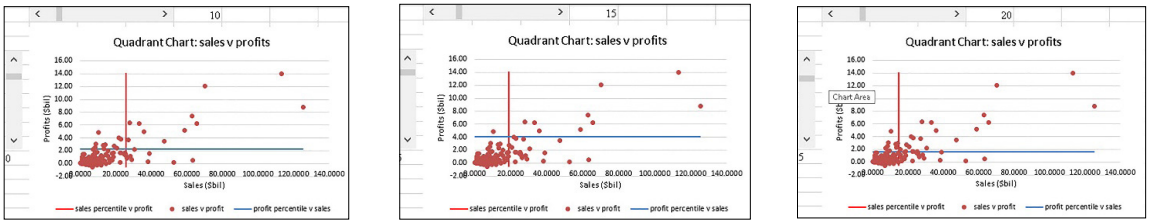

Figure 13 Quadrant Graphs Showing Varying Values of Percentiles

Sales 90% and Profits 90% **Sales 85% and Profits 95%** **Sales 80% and Profits 85%**

6.5 Gantt Chart

Anyone who works on or with projects knows a **Gantt Chart**: Gantt charts show by means of a timeline and bars who is doing what where and when. From an Excel point of View, Gantt Charts contain a feature well worth knowing: in addition to the graph itself of course.

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We are working in the *graphs_2b.xlsx* file, **gantt** tab where you will see the table of events, dates and durations in Figure 14, below:

	A	B	C	D
1	**Gantt Chart**			
2				
3				
4				
5	**task**	**start date**	**duration**	**end date**
6	planning meeting	29/12/2015	1	29/12/2015
7	develop questionnaire	30/12/2015	11	9/1/2016
8	print and mail questionnaire	13/1/2016	9	21/1/2016
9	receive responses	16/1/2016	15	30/1/2016
10	data entry	16/1/2016	18	2/2/2016
11	data analysis	3/2/2016	4	6/2/2016
12	write report	9/2/2016	12	20/2/2016
13	distribute draft report	23/2/2016	1	23/2/2016
14	solicit comments	24/2/2016	4	27/2/2016
15	finalise report	2/3/2016	5	6/3/2016
16	distribute to board	9/3/2016	1	9/3/2016
17	board meeting	17/3/2016	1	17/3/2016

Figure 14 Project Diary or Schedule

A Gantt Chart turns this information into a graphic format that is usually very easy to read, see Figure 15: tasks or jobs are placed according to when they will happen and the length of the bar tells us how long it will take. Notice that the Gantt Chart shows when jobs are being done consecutively and concurrently.

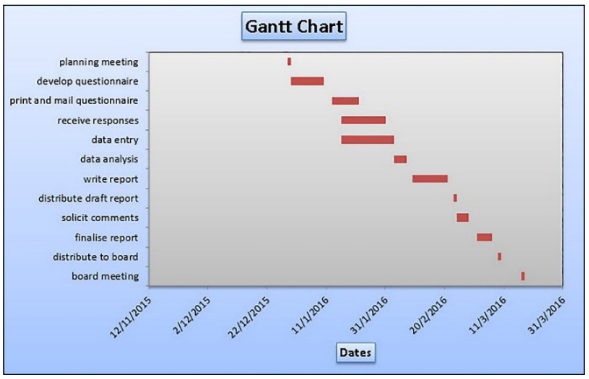

Figure 15 Gantt Chart: when and for how Long

The process of creation of a Gantt hart is a little involved and one of the key questions is: how do we get those bars to stay (float) in the middle of the graph? Read on!

- In the list to the left, the formula in cell D6 (end date), which is filled down to D17, is =B6+C6-1 AND please note, **the end date column is NOT used in the chart** but is for information to support it
- To create a chart select the range A6:C17 then click Insert and create a **stacked bar chart**… use the **second subtype**, which is labelled **Stacked Bar**.
- Notice that Excel incorrectly uses the first two columns as the Category axis labels.

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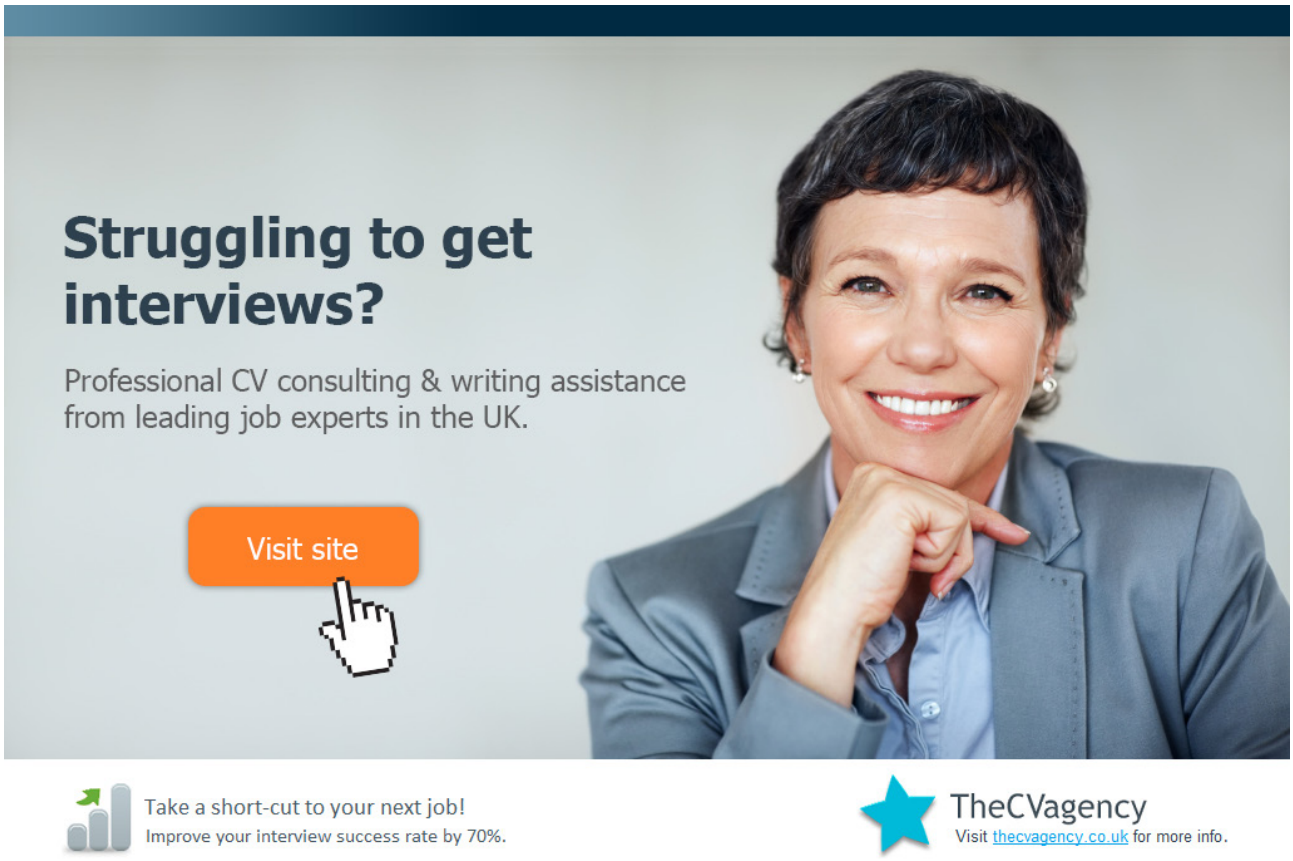
- Right click the chart and click on **Select Data** to open the **chart wizard**. Now, set the chart's series to the following:
    - Series 1: B6:B17
    - Series 2: C6:C17
    - Category (x) axis labels: A6:A17
- Click OK to leave the chart wizard
- Delete the **legend** if one was created
- Create or amend the **title** and add the **horizontal axis label** :call it dates or duration or days and duration as you wish…there is no real need for a **vertical axis label** but feel free to add **Task** if you wish.
- **Format the horizontal axis Minimum and Maximum scale values to correspond to the earliest and latest dates** in the data by entering the earliest and last starting dates in the Minimum or Maximum edit box). You might also want to change the date format for the axis labels.
- **Right click** the vertical axis and select Axis options check ***Categories in reverse order*** and also select the option labelled **Horizontal axis crosses at maximum category**.
- Right click the first data series and select **Format Data Series**. In the **Fill section**, set fill to **No fill and Border Colour to no line**. This makes the first data series invisible and is the key to this chart.
- Apply other formatting, as desired.



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6.6 Waterfall Graph: Values

Figure 16 gives us a view of the aptly named **Waterfall Graph** and here is a **value Waterfall Graph** next to a **% Waterfall Graph**. We will prepare both of them:

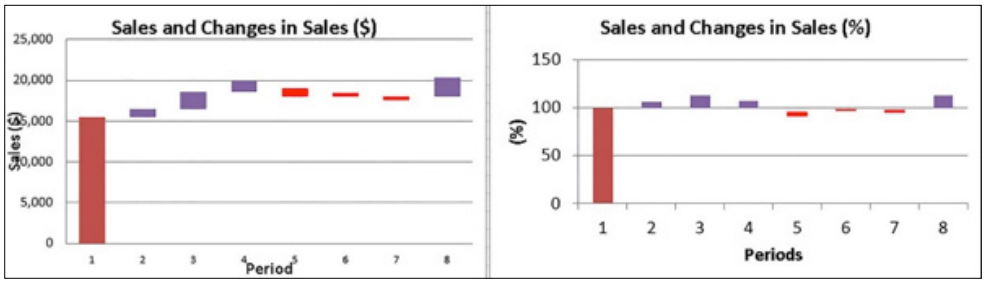

Figure 16 Value and % Waterfall Graphs

Open the file *graph_2b.xlsx* **water** tab

The Waterfall Graphs in Figure 16 are based on these sales Data:

	Basic Data	
Period	Sales ($)_a	Sales ($)_b
1	15450	
2		16448
3		18591
4		19944
5		18976
6		18486
7		18028
8		20376

Figure 17 Original Sales Data

We have split the data into the two columns you see in Figure 17 as part of the graph drawing process.

We need to allow for the Sales data, in this case, to increase as well as decrease over time. For that reason, we need to build the following table, Figure 18:

	A	B	C	D	E	F
1	Waterfall Chart					
2	Use the following data to prepare a Waterfall Chart					
3						
4						
5		Basic Data		For Chart		
6	Period	Sales ($)_a	Sales ($)_b	Sales ($)_b_2	Change ($)_1	Change ($) _2
7	1	15450				
8	2		16448	15450	998	0
9	3		18591	16448	2143	0
10	4		19944	18591	1353	0
11	5		18976	18008	0	968
12	6		18486	17996	0	490
13	7		18028	17570	0	458
14	8		20376	18028	2348	0

Figure 18 Setting up the Table for the Waterfall Graph

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In the **For Chart** section of the table, columns D:F we start in cell D8 with the Period 1 sales, D9 contains Period 2 sales and D14 contains Period 13 sales which is NOT the final Period's sales.
Columns E and F are splitting out the positive changes from the negative changes. For example,

- in cell E8 we see this formula =IF($C8-$B7<0,0,$C8-$B7) and in
- cell F8 we see this formula =IF($C8-$B7>0,0,-($C8-$B7))

We fill down those formulas to E14 and F14 respectively. All of our data are in place now.

Building the Graph: right clicking on the graph we have already prepared shows how we build the Waterfall Graph, see Figure 19:

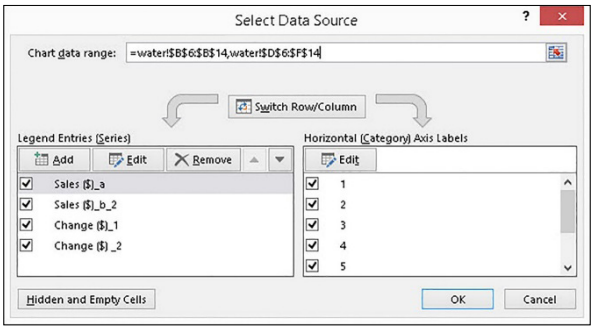

Figure 19 Select Data Source Dialogue Box

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We Select B6:B14 and D6:F14 as the contents of the graph
That gives us four series as you can see in the section **Legend Entries (Series)** which correspond to the headings in row 6, columns B, D, E and F
We know what you're thinking: we can only see three series on the graph but you have selected four of them! Remember the Gantt Chart where we made the first series of bars invisible? Well, we do the same with the series **Sales ($)_b_2**: that series is on the graph but we tell Excel no fill and no line. Figure 20 shows the before (left hand graph) and after (right hand graph) of what we have just said:

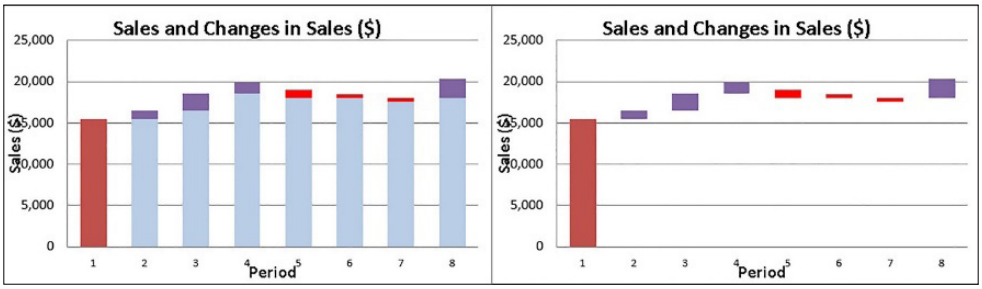

Figure 20 Before and After Hiding some of the Columns

6.7 Waterfall Graph %

The **percentage Waterfall Graph** looks exactly like the value Waterfall Graph except that it is based on % rather than £. Here is the finished graph and the table that goes with it, Figures 21 and 22:

	H	I	J	K	L	M
6	Period	Sales as %	Sales_b as %_1	Sales_b as %_2	Change (%)_1	Change (%)_2
7	1	100				
8	2		106.46	100	6.46	0
9	3		113.03	100	13.03	0
10	4		107.28	100	7.28	0
11	5		95.15	92.01	0	3.14
12	6		97.42	97.35	0	0.07
13	7		97.52	95.15	0	2.37
14	8		113.02	100	13.02	0

Figure 21 The Data for the % Waterfall Graph

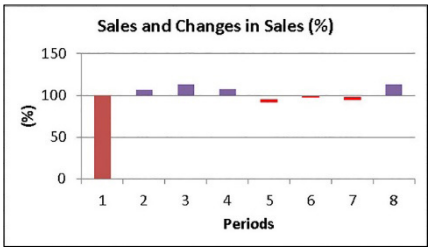

Figure 22 The % Waterfall Graph

The **Base Period** for the percentages is Period 1 and the formulas you need here are:

- I7 =ROUND(B7/B7*100,2)
- J8 =ROUND(C8/$B$7*100,2)
- K8 =IF(L8=0,J8-M8,J8-L8)
- L8 =IF(ROUND((C8-$B$7)/$B$7*100,2)>0,ROUND((C8-$B$7)/$B$7*100,2),0)
- M8 =IF(ROUND((D8-$B$7)/$B$7*100,2)<0,-ROUND((D8-$B$7)/$B$7*100,2),0)
- The formulas in columns J to M are filled down to row 14
- Column L picks up the positive changes and column M picks up the negative changes
- Column K is the invisible, disappearing series on the graph.

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Conclusions

In this chapter we have demonstrated seven more graphs or graphing techniques as we finish our march towards creating dashboards: from Sparklines to percentage Waterfall Graphs via Panel Graphs, Quadrant Graphs and the Gantt Chart. That is, we have created some relatively complex graphs in this chapter and believe that all of them are of great interest to the accountant.

All of these graphs and more have their place in a dashboard and we will see that in the Dashboarding chapter.

Excel Files Available

All of the Excel files mentioned in this book can be found on this book's page at:
http://bookboon.com/en/excel-solutions-for-accountants-book-2-ebook

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7 Pivot Tables 2

Introduction

In this second of three chapters on Pivot Tables (PTs), we will pick up where we left off in the previous chapter **Pivot Tables 1** and we will work on, among other things:

- Sales report
- Profit report
- Calculated Fields
- Value As
- Grouping

Whilst we are leading you step by step through the ins and outs of PTs, you will still need to practise using them and further enhancing you learning as you apply PTs to your own data and situation.

7.1 Review

In the previous chapter, **Pivot Tables 1**, we started to create and use Pivot Tables from scratch: assuming no knowledge of them at all. However, now you know what they are and some of how to create and use them. We know that a Pivot Table (PT) summarises data in a flash: it takes a list or, preferably, an Excel Table and organises it and reorganises it in almost any way you care to name. For example, we saw simple lists of sales transactions and records of the results of some of the world's largest companies and we analysed the data in myriad ways using a PT. Look back at **Pivot Tables 1** if you have forgotten anything or want to review what we did there.

7.2 Sales Report

We are going to prepare the report that follows, using the *pivot_tables.xlsx* file again but let's start by creating a copy of our final PT from **Pivot Tables 1** and creating something different:

Right Click the **table_3_pivot** tab and create a copy of it, calling it **table_4_pivot**

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Year	2006

Industry	No Companies	Tot Sales ($bil)	Ave Sales ($bil)	StdDev Sales ($bil)
Aerospace & Defense	1	2.01	2.01	#DIV/0!
Banking	11	103.79	9.44	12.91
Business Services & Supplies	6	40.70	6.78	5.75
Capital Goods	4	44.07	11.02	6.02
Chemicals	5	60.85	12.17	16.04
…	…	…	…	…
Transportation	2	12.18	6.09	0.20
Utilities	5	28.52	5.70	5.97
Grand Total	**100**	**1,593.40**	**15.93**	**27.54**

Table 1 Extract from Pivot Table

Firstly, note that we have used the Sales ($bil) data FOUR times for this PT

Secondly, note the #DIV/0! Error in the first row.

Thirdly, this is what we are looking at:

- Sales…VALUES
- Industry…ROWS
- Year…FILTERS

To use a variable multiple times in the VALUES area, drag it from the fields list and drop it in the VALUES area: drag and drop it there again and again and again: four times altogether.

Now format each of these four:

- Left click
- Value Field Settings
  - COUNT for the first one
  - SUM for the second one
  - AVERAGE for the third one
  - STDEV for the fourth one
- Format the numbers: we almost always use Number 2 decimal places, thousands separator
- Change the titles:
  - No Companies (COUNT)
  - Total Sales ($bil) (SUM)

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- Ave Sales ($bil) (AVERAGE)
- StDev Sales ($bil) (STDEV)
- OK

You should now have the same report as us. Change the Year from 2006 to 1992 and/or 2008. Make a report for ALL Years.

7.3 StDev #DIV/0!

This is unfortunate but we included the error so that when you face it yourself you know what it is. **Standard Deviations** are a statistical measure that we have discussed in the **Tables** and **Ratio Analysis 2** chapters. We will always get the divide by zero error, **#DIV/0!** When there is only one company in the row where we see the error. Look at the 2006 Sales Report…the number of companies in the first row is 1…#DIV/0! In the 1992 Sales Report, there are four #DIV/0! Errors and all in which the number of companies is one.

Our advice? If there are too many #DIV/0! Errors, don't report on Standard Deviations in your PT but include them in another way if you have to: in a summary or in a filtered version of your PT.

Bottom line: this will happen and now you know about it!

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7.4 Profit Report

- Copy the table_4_pivot tab and call the new one table_5_pivot
- Create a **Profit Report** showing
- No of companies
  - Total Profits ($bil)
  - Average Profits ($bil)
  - Maximum Profits ($bil)
  - Minimum Profits ($bil)

- Change the **Field names** as you wish
- **Format** the numbers as you wish

- Choose Country or Industry or both
- Anything else you think is important, try that too: how about colour schemes, Grand Totals, Layout, Subtotals?

If you still need practise, create an Assets Report and then a Market Values report too.

7.5 Ratio Analysis: calculated fields

This book is for accountants but we haven't mentioned ratio analysis with our PTs yet and we have been looking at databases filled with numbers. Let's put that right now by looking at what are called **calculated fields**. In essence this means doing calculations in the PT itself rather than in the original database. There are reasons to do this and there are reasons against doing it: however, let's learn the technique and then evaluate it.

Still using the **forbes_200** table either create a new PT or use one that you have already prepared.

We will make it look like this:

Year	2008

Industry	Tot Sales ($bil)	Tot Profits ($bil)	Ave Sales ($bil)	Ave Profits ($bil)	Ave Profit Margin	Ave Asset Turn
Aerospace & Defense	4.77	0.53	4.77	0.53	11.11%	0.99
Banking	223.93	38.30	13.17	2.25	17.10%	0.05
Capital Goods	18.11	1.73	18.11	1.73	9.55%	0.75
Chemicals	23.67	1.66	7.89	0.55	7.01%	0.76
Conglomerates	27.87	4.34	13.94	2.17	15.57%	0.92
Construction	24.18	0.83	6.05	0.21	3.43%	0.88
Consumer Durables	8.26	0.82	8.26	0.82	9.93%	0.56
Diversified Financials	48.40	4.26	16.13	1.42	8.80%	0.08

Table 2 Forbes 200 Pivot Table

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Here are the first eight entries of the 2008 report. We have used the Calculated Fields method to find

- Average Profit Margin
- Average Asset Turnover

Here is how we do that:

- Click somewhere in the PT
- Pivot Table Tools tab in the Ribbon…Analyse
- Click Fields, Items & Sets
- Select Calculated Field and this dialogue box will open

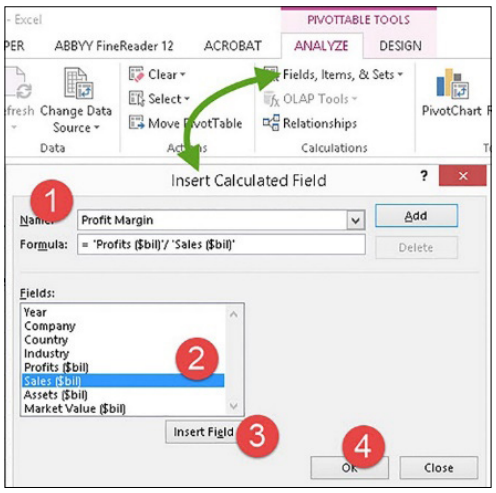

Figure 1 Calculated Field Dialogue Box

Give your formula a name: Profit Margin in this case

You can see the formula and to create it

- Double click Profits in the Fields list
- Type / in the Formula bar
- Double click Sales in the Fields list
- If you want add *100…we tend to leave that out and format as a percentage in the PT itself
- OK

You will see your new field in your PT and it says **Sum of Profit Margin**…well, it isn't! **Calculated Fields are only ever averages** and that's why we have changed the field to Average…Average of…formatted the number as a Percentage to two decimal places

Create the Asset Turnover ratio now: Sales/Total Assets and it's NOT a percentage but just a number, times turned over…Value Field Settings to make it Average…

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7.6 Any Calculated Field you Like

You really can create a wide range of calculated fields and why no try this?

If you use the Trendline technique you can find the values of Y = a + bX for Profit (Y) and Sales (X):

a = 0.02844
b = 0.05822

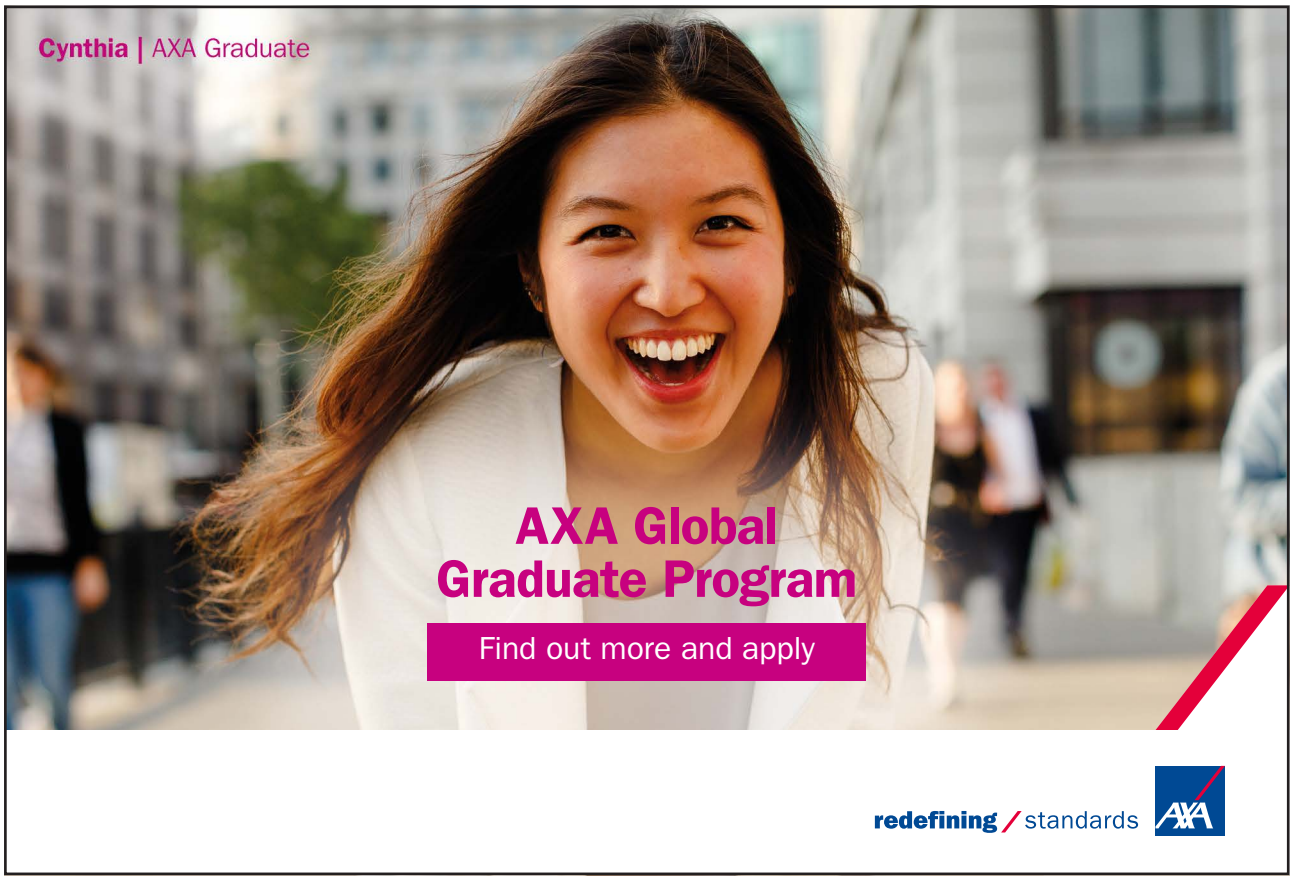
We can use these in a calculated field by creating the **Predict Profit Formula**:

=0.02844 + 0.05822*Sales ($bil)

Try that and see what you get.

You could then create a calculated field to find the **difference between the Actual Profit and your Predict Profit**:

=Profit ($bil)-Predict Profit (you will find this field name in the list in the Calculated Field dialogue box once you have created it.)



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7.6.1 Calculated Field Warnings

1) We know Excel users who say there is no need for Calculated Fields…just create what you want in the database and use it from there.
2) The Calculated Field is only ever the average and nothing else: you an change Sum to Count to Average…but it doesn't change anything apart from the heading or field name
3) If your database has many variables or fields, the calculated field formula might not work

Responses to the Warnings

1) Up to you! We tend to want to keep our database as raw data inputs and not mix calculations and outputs with them
2) This is true but now you know it you can live with it…or don't use it!
3) This is also true and it did cause us problems once but we know about it now and we are careful or we don't use it!

That concludes our review of Calculated Fields and work through everything yourself as the CAN be useful for you. On the other hand, if you don't like them, find another way of doing your arithmetic!

7.7 Value As

Without pointing it out, when we created our PTs and using SUM, COUNT, AVERAGE and so on, we automatically used the **Value By** approach. Let's extend that now and use the **Value As** approach.

As an accountant you will probably find this section especially useful for reporting.

From the tab **list_3** create a new PT and call the tab **list_3_pivot_b**
Make your PT look like this:

Row Labels	Total Amt (£)	Sum of Amount (£)
January	4,044,876	4044876
February	2,613,750	2613750
March	3,421,320	3421320
…	…	…
November	648,010	648010
December	1,119,089	1119089
Grand Total	**18,434,395**	**18434395**

Table 3 Extract Monthly Pivot Table…

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7.8 Running Totals

We are happy with the monthly data in the **Total Amt (£)** column that has been formatted
Let's make the **Sum of Amount (£)** column contain a Running Total:

Click on Sum of Amount (£) in the VALUES area…Value Field Settings…
Click on the Show Value As tab

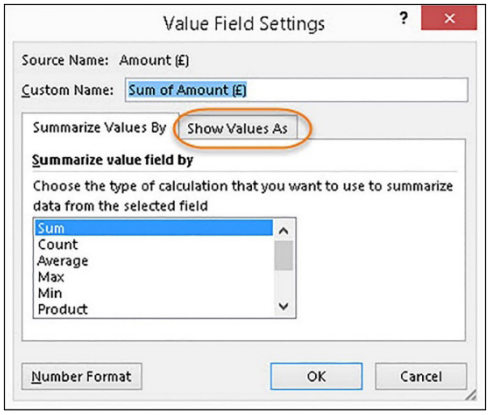

Figure 2 Summarise Values As…

Now make your selections as follows

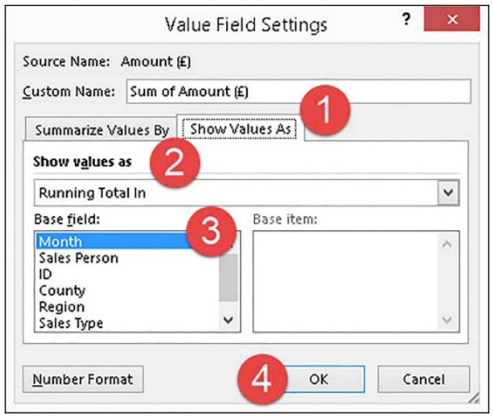

Figure 3 Summarise Values as…Base Field

- Show Values As
- Choose Running Total In
- Choose the Month as the Base Field and Format Number as you wish
- Change the Custom Name as you wish
- OK

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This gives you:

Row Labels	Total Amt (£)	Cum Amt (£)
January	4,044,876	4,044,876
February	2,613,750	6,658,626
March	3,421,320	10,079,946
…	…	…
November	648,010	17,315,306
December	1,119,089	18,434,395
Grand Total	**18,434,395**	

Table 4 Cumulative Sales…Value As

7.9 Difference From

Let's look at another **Show Value As** example now, **Difference From**:

- Drag Amount (£) to the VALUES area again, for the third time
- Click on it…Value Field Settings

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Follow through steps 1–7 from Figure 4 below and ensure that your PT look like the one that follows Figure 4:

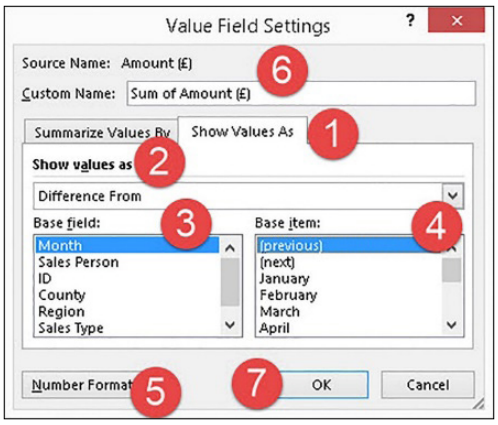

Figure 4 Field Settings…Difference From

Notice the Heading of the final column and the formatting selection we made:

Row Labels	Total Amt (£)	Cum Amt (£)	Diff Prev Month (£)
January	4,044,876	4,044,876	
February	2,613,750	6,658,626	(1,431,126)
March	3,421,320	10,079,946	807,570
…	…	…	…
November	648,010	17,315,306	123,570
December	1,119,089	18,434,395	471,079
Grand Total	**18,434,395**		

Table 5 Difference From PT

As you can see from the dialogue box, we chose difference from the previous month but we could have chosen difference from:

- Next month
- January
- February
- And so on

There are fourteen choices in the Values As drop down box and then many variations when you take into account the Base Period.

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Exercise for you to do

- Add Amount (£) to the VALUES area one more time
- Click it…Value Field Settings
- Show Value As
- % of Grand Total
- Format Number…it should be formatted as a % for you
- Custom Name: Amt % of Total or Amt % of Year
- OK

You should get this:

Row Labels	Total Amt (£)	Cum Amt (£)	Diff Prev Month (£)	Amt % of Year
January	4,044,876	4,044,876		21.94%
February	2,613,750	6,658,626	(1,431,126)	14.18%
March	3,421,320	10,079,946	807,570	18.56%
April	2,757,515	12,837,461	(663,805)	14.96%
May	553,956	13,391,417	(2,203,559)	3.01%
June	397,900	13,789,317	(156,056)	2.16%
July	1,307,629	15,096,946	909,729	7.09%
August	681,830	15,778,776	(625,799)	3.70%
September	364,080	16,142,856	(317,750)	1.98%
October	524,440	16,667,296	160,360	2.84%
November	648,010	17,315,306	123,570	3.52%
December	1,119,089	18,434,395	471,079	6.07%
Grand Total	**18,434,395**			**100.00%**

Table 6 Full PT: Differences, Cumulative…

In **table_5** you will find a large database taken from the records of a large retail organisation. Initially, we encourage you to create one or more PTs to practise as much as possible of what we have done in this chapter. Be creative, be careful and start with a backup of that worksheet!

Then let's see how to group our data.

7.10 Grouping Data in a Pivot Table

You can group data in a PT on values, dates, times, text and so on. In this example we will work on dates.

Create this PT from the data on the **table_5** tab.

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With Order Date and Products in the ROWS area and Sales USD in the VALUES area:

	A	B	C
1			
2			
3	ORDER DAT	PRODUCTS	Sum of SALES USD
4	5/1/2014	Curtains	181620
5	7/1/2014	Tables	16425
6	11/1/2014	Curtains	87360
7	18/1/2014	Tables	75901
8	25/1/2014	Chairs	228730
9	31/1/2014	Chairs	80487
10	15/2/2014	Chairs	38602
11		Tables	81486
12	16/2/2014	Tables	18896
13	23/2/2014	Tables	71776
14	25/2/2014	Rugs	32566
15	26/2/2014	Chairs	71370
16	28/2/2014	Tables	21987
17	8/3/2014	Tables	72127
18	9/3/2014	Tables	44723
19	10/3/2014	Chairs	24805
20	1/4/2014	Chairs	186133
21		Curtains	82903
22		Rugs	858530
23	4/4/2014	Rugs	96978

... table_2 table_3 table_3_pivot

Figure 5 Date Ordered PT

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This table contains data from all 576 fields in the database but still, it is a bit long at 388 rows so **grouping by dates** in this case could be a good idea!

- Right click on any cell in the **Order Date Column**
- Click Group…
- Click both Months and Years…use the Ctrl key as necessary to select the two choices
- OK

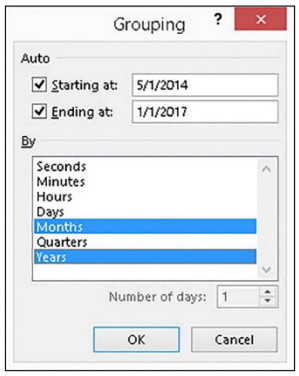

Figure 6 Grouping a PT

Now you will find:

- Year in the ROWS area as well as Order Date and Products
- Drag Year to the COLUMNS area

Now you should see this, a much shorter table although we have shown only part of the table here:

Sum of SALES USD		Years		
ORDER DATE	PRODUCTS	2014	2015	2016
Jan	Chairs	309217	24843	149223
	Curtains	268980	74746	162493
	Rugs		157016	195634
	Tables	92326	46788	41118
Feb	Chairs	109972	90799	327079
	Curtains		35366	88575
	Rugs	32566	98452	88701
	Tables	194145	245405	108006
Mar	Chairs	24805	282195	206405
	Rugs		89464	98023
	Tables	116850	177430	58514

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Apr	Chairs	213293	38668	455648
	Curtains	186011	10090	321619
	Rugs	955508	75474	653526
	Tables	75154	222469	90029
Grand Total		**10592523**	**10388606**	**11018124**

Table 15 Sales by Date and Product

Format your PT for numbers and Custom Names…

Conclusions

We have seen a great deal as we have developed our knowledge of Pivot Tables to a relatively high level. We saw these topics in this chapter:

- Sales report
- Profit report
- Calculated Fields
- Value As
- Grouping

You need to practise using them and further enhance your learning as you apply PTs to your own data and situation.

The third chapter in this series on Pivot Tables, in *Excel Solutions for Accountants Book 3* will take us through the communications aspects of using Pivot Tables and in that chapter we will work on:

- Slicers
- Timelines
- Conditional Formatting
- Pivot Charts

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