



Excel 2007-2016 for Windows*

Introductory to Intermediate to Advanced

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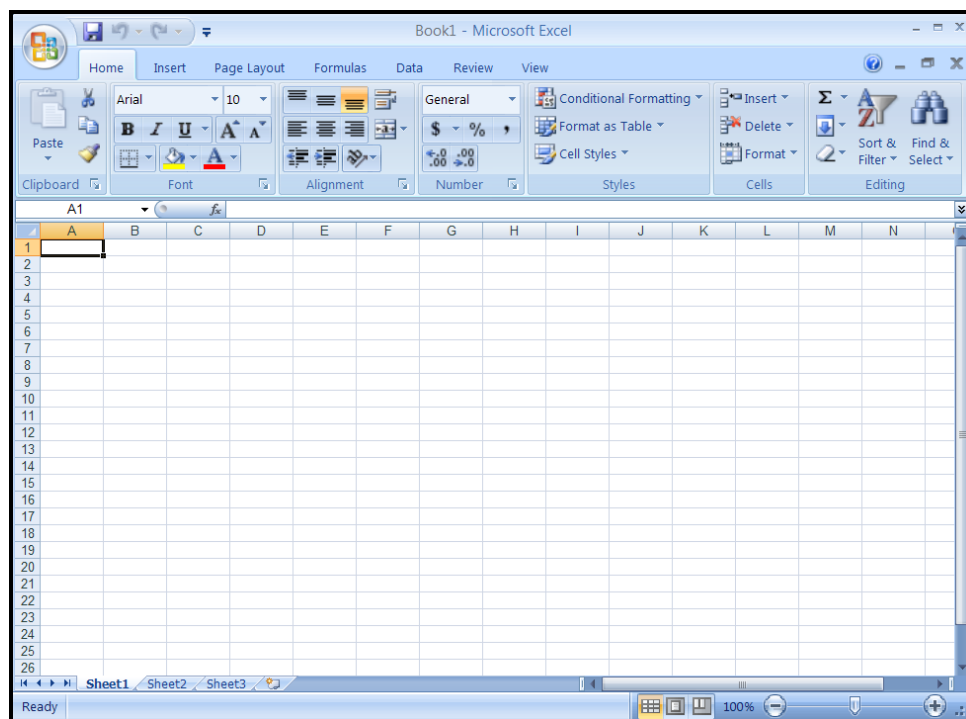
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* Most of this will work in Mac OS, but the Mac version usually lacks some features.

Part 1: Introductory Excel

- Once you start Excel, you will see a blank worksheet (see below). If you do not see a blank worksheet, you can create a new one by pressing **(Ctrl)-N**.
 - A typical (XGA or SXGA) screen might provide a dozen or so columns and three dozen rows. The icon placement also changes with your screen size/resolution.
 - There are actually over 17 billion cells (16,384 columns by 1,048,576 rows). The screen window is just that—a small window into that large work space. Excel 2003 “only” had 15 million cells, so this is a thousand-fold increase.
 - The horizontal white bar with heavy black border is the "cursor" that points to the current cell. You can move it with the arrow keys.
 - Whatever you type goes into the current cell, and shows up in an editing area, just above the column letters (which become their names).



- You can type values (formulas or numbers) or labels in those cells.
 - **Values** are entered with an = sign in front (some Excel versions allow a + sign).
 - **Labels** usually begin with a letter or a quote mark.
 - If you type a value that Excel interprets as a label (for example, 2+3, which actually shows up as the label “2+3” not 5!), you can double-click on that cell and place an equal sign in front of it. This makes it into a value (and displays the answer, 5).

Entering Titles and Formulas

- Type titles and numbers by entering them into any cell.
- Type formulas with = at the beginning. For example, instead of just typing **2+3**, you would type **=2+3**
- Refer to other elements with column letter and row number. For example, to add the value in column B, row 4 and column B, row 5, you would move somewhere (such as B6) where you want the result, and enter **=B4+B5** into that cell.

Our Goal

- Our situation: With a \$500 (think of millions or billions if you'd like) investment, we have some revenue and cost projections to analyze.
- Our task is to create a projected income statement for 2015 through 2018, including summary statistics and a graph.
- The final product will look like this:

	A	B	C	D	E	F	G
1	Sales Projections						
2			2015	2016	2017	2018	Total
3	Sales		\$ 1,100.00	\$ 1,320.00	\$ 1,584.00	\$ 1,900.80	\$ 5,904.80
4	Cost of Sales		385.00	462.00	554.40	665.28	2,066.68
5	Gross Profit		715.00	858.00	1,029.60	1,235.52	3,838.12
6	Fixed Costs		500.00	500.00	500.00	500.00	2,000.00
7	Profit Before Taxes		215.00	358.00	529.60	735.52	1,838.12
8	Taxes		71.25	100.50	148.04	237.50	557.29
9	Net Profit	\$ (500.00)	\$ 143.75	\$ 257.50	\$ 381.56	\$ 498.02	\$ 1,280.83
10		(investment)					
11							
12	Statistics						
13	Maximum		\$ 498.02				
14	Minimum		\$ 143.75				
15	Average		\$ 320.21				
16	Standard Deviation		\$ 153.24				
17	Net Present Value		\$ 580.75				
18	Internal Rate of Return		40.30%				
19							
20							

The Task

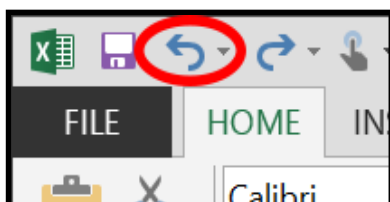
- We will build this “from scratch,” step by step. Don't type anything yet until Step 1!
- Press **[Enter]** at the end of each formula you type.

Step 1: Enter Titles and Fixed Numbers

1. Move to C1 and type 2015 (then don't forget to press **[Enter]**)
2. Move the tip of the mouse pointer arrow again to C1 and click and release the mouse button. A rectangle will appear around the 2015. Then move to the bottom corner of cell C1. The pointer should become a thin plus sign. Hold down the **[Ctrl]** key while you click and drag from the bottom corner of C1 to F1. Let go of the mouse button. The area you dragged is a "range" and you just entered 2015, 2016, 2017, and 2018 without typing them.

Step 2: Enter formulas for 2015

1. Move to A2 then type each label down to A15, then each formula in C2 through C8, as shown in the tables below. In cells C3, C4, C6, C7, and C8, the answer will "pop" into the cell after you press **[Enter]**. If you make an error, usually the undo/redo icons way at the top left of the screen will fix it (see them below—Excel 2016 is the image on the right). The undo icon is the one circled. Next to each undo icon is a “redo” icon—with an arrow pointing in the other direction.



← Excel 2013

Excel 2016 →



Enter labels	
in Cell	Type
A2	Sales
A3	Cost of Sales
A4	Gross Profit
A5	Fixed Costs
A6	Profit before taxes
A7	Taxes
A8	Net profit

Enter labels	
in Cell	Type
A9	Statistics
A10	Maximum
A11	Minimum
A12	Average
A13	Standard Deviation
A14	Net present value
A15	Internal rate of return

Enter formulas	
in Cell	Type
C2	1000
C3	=c2 * .35
C4	=c2 - c3
C5	500
C6	=c4 - c5
C7	=c6 * .35
C8	=c6 - c7

2. Type investment in B9
3. Place -500 in B8

Step 3: Shortcuts for entering formulas for 2016 through 2018

1. In cell D2, type =c2*1.2 and press **[Enter]**
4. There are two models in this spreadsheet. One is a model of sales growth (20% increase per year), and the other is a model of income and costs. We will first copy the sales growth model across to the other years by using the following procedure:
5. Make sure the mouse pointer is inside cell D2. Click on D2 and let go.
6. Point to the bottom right of D2 and make sure the cursor becomes a bold but thin plus sign (**not** a north-south-east-west set of arrows).
7. Click and hold the mouse button, then click the **[Ctrl]** key, then drag to F2, let go of all buttons and keys. The results in the first two rows will appear as below:

	A	B	C	D	E	F
1			2015	2016	2017	2018
2	Sales		1000	1200	1440	1728

8. Finally, copy the entire income statement model to 2016 through 2018 like so:
 - a. Click/drag to highlight the range C3 to C8, then let go of the button.
 - b. Move the pointer to the bottom right of C8, and the cursor should turn into a bold, thin plus sign as before.
 - c. Hold the **[Ctrl]** key, and click and hold the mouse button. Then drag to cell F8. The screen should look like the following (and don't worry about the small triangles in the corners of some cells, not shown below):

	A	B	C	D	E	F
1			2015	2016	2017	2018
2	Sales		1000	1200	1440	1728
3	Cost of Sales		350	420	504	604.8
4	Gross Profit		650	780	936	1123.2
5	Fixed Costs		500	500	500	500
6	Profit Before Tax		150	280	436	623.2
7	Taxes		52.5	98	152.6	218.12
8	Net Profit	-500.00	97.5	182	283.4	405.08

Step 4: Insert the Totals

1. Move the cursor to cell G1; Type Total and press **Enter**.
2. If the cursor is not on cell G2, click on cell G2.
3. Press the AUTOSUM toolbar icon. It's a sigma sign (Σ). Then press **Enter**. It will automatically create and compute a sum formula, as follows: =sum(C2:F2). The total in G2 becomes 5368.
4. Click on G3 (not G2) and drag to G8. Let go of the button.
5. Click on the AUTOSUM icon and this time all six sums will be entered at once:

Total
5368
1878.8
3489.2
2000
1489.2
521.22
967.98

Step 5: Compute the Statistics (analysis of the years, not including the total column)

1. Move to cell C10
2. Don't press **Enter** at the end of this: Type the following five characters: =max(
3. Click on C8 and drag to F8 (NOT G8!)
4. Let go of the mouse button and press **Enter**. If you move back up to C10 and look at the formula, you might notice that Excel quite kindly furnished the right parenthesis.
5. Repeat the same steps (go to the cell, type the formula, click & drag C8 to F8, let go, **Enter**) with the following functions in the following cells:

in cell	start with
C11	=min(

in cell	start with
C12	=average(

in cell	Start with
C13	=stdev(

6. Go to C14. Type =npv(.05,b8:f8) and press **Enter**. You'll go to C15. Type =irr(B8:F8,.5) and press **Enter**. You could have clicked and dragged B8 to F8 instead of typing the range, as you did above, but in the last case, rather than press **Enter** you would have pressed a comma and the .5 then **Enter**. Even though formatting is not as you might like it (decimal places, dollar signs, etc.), all of your work should now agree with the numbers shown below. Formatting comes after we show you how to save your work, below.

	A	B	C	D	E	F	G
1			2015	2016	2017	2018	Total
2	Sales		1000	1200	1440	1728	5368
3	Cost of Sales		350	420	504	604.8	1878.8
4	Gross Profit		650	780	936	1123.2	3489.2
5	Fixed Costs		500	500	500	500	2000
6	Profit Before Tax		150	280	436	623.2	1489.2
7	Taxes		52.5	98	152.6	218.12	521.22
8	Net Profit	-500.00	97.5	182	283.4	405.08	967.98
9	Statistics	(investment)					
10	Maximum		405.08				
11	Minimum		97.5				
12	Average		241.995				
13	Standard Deviation		132.6515				
14	Net present Value		\$320.01				
15	Internal Rate of Return		25%				

Step 6: Save your work

1. The quickest way to save your work is to press **Ctrl+S**. Other ways are to click on the floppy disk icon (the 2nd small icon at the top left corner of the screen). What's a floppy disk, you ask? Ask someone who is at least 40 years old! The first time you save, it comes up as "SAVE AS" and you need to decide where to save it, and what name to use, as in most applications. This workbook will assume you are familiar with your particular operating system and will not provide detailed instructions for loading and saving.
2. Close the file by clicking **FILE** at the top left corner just under the floppy disk icon and clicking on Close.
3. Open the same file immediately by using the **FILE** pull down menu and then your particular operating system's instructions for opening recent files.


Step 7: Print your work (Do not do this in class)

1. Put your name in cell A1.
2. If you're going to print, make sure your printer is connected properly.
3. If you want to adjust the page setup (for example, if you want to force the entire spreadsheet to fit on one page, or change its appearance (grids, color, titles, etc.):
 - Click on **FILE** then choose Print.
 - If you want to change the orientation (portrait vs landscape), margins, or other options, click on the option you want.
 - Then look for No scaling at the bottom of the Print panel, and click it.
 - The drop-down list will show an option Fit Sheet on One Page.
 - You'll see an instant preview in the right window as you change the options.
 - If you're connected to a printer, click the large **Print** icon. You might have to scroll up a little to see it again.
 - Press **Esc** to get back to your spreadsheet.

Making it Look Good

Step 1: Dress up the numbers; fix column widths

1. Click "Home" at the top, next to **FILE**.
2. Go to B2. Click and drag from B2 to G14.
3. Find and click the \$ icon on the "Number" segment.

- Click on cell C15. This has automatically been selected to be a percent. If it had not, then you would simply click on the % icon near the \$. To change the number of decimal places, use the  buttons. The left one increases the number of decimal places, and the right one decreases the number of decimal places. While watching the effect on the number in C15, click 3 times on the left one, then click once on the right one to arrive at 2 decimal places. You should see 25.49% in C15.

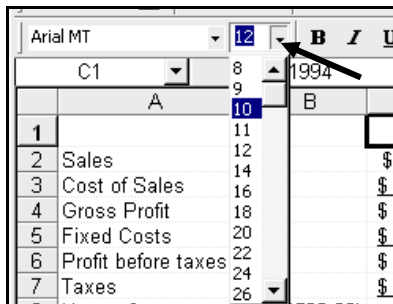
Step 2: Dress up the headings

Click and drag from C1 to G1.

Click the **B** toolbar icon near the left in the Font segment for bold (or press **Ctrl**-B).

While the range is still selected, click the **U** icon for underlining (or press **Ctrl** -U).


Enlarge the headings by clicking on the arrow just to the right of the font size 10 or 11 near the **B** toolbar icon (see below). Click on the 14 in the list.

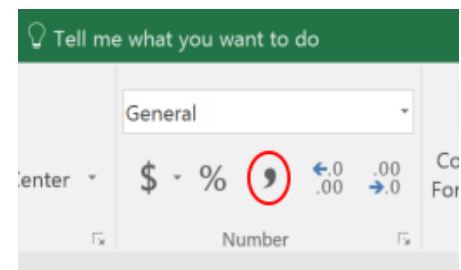


Step 3: Fix up the spacing by moving things around a bit:

- Drag the range A9 to A15
- Move the mouse pointer to either the top or bottom edge of the range, making sure it turns into a skinny cross with arrows in 4 directions (not the wide normal cursor). While it remains the 4-way arrow, click and hold the mouse button, drag the range down two lines, and let go of the mouse button.
- Repeat this with the range C10 to C15 (move it down two lines)
- Move the cursor to C12 and look at the formula in the edit window...even though you moved the formula down from C10, the formula still points to the correct cells C8:F8.
- Make the word "Statistics" stand out a little better as a heading:
 - Click on cell A11 (which should now contain the word "Statistics")
 - Click the **B** formatting toolbar icon and the **I** icon (or press **Ctrl**B then **Ctrl**I).
 - Click on the down arrow to the right of the font size. Select 14 as the new size.

Step 4: Format the numbers to look like a business analysis

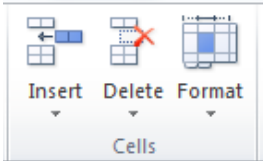
- Move to cell C3
- Click on the toolbar icon that looks like a big comma [see the image to the right]. The \$ sign will then disappear.
- "Paint" the other cells in that way, as follows:
 - Click on the paintbrush (top left, circled) → 
 - Click and drag cells C3 to G7
 - Let go of the mouse button and all of those cells will be formatted like cell C3
- Include underlines as follows:



- Click and drag from C3 to G3
- Click on the **U** icon
- Repeat for ranges C5:G5, C7:G7, C8:G8

Step 5: Add a title

1. Click on the row number (left margin of rows) 1, then drag down to 2. Rows 1 and 2 will become highlighted all the way across to indicate that they are selected.
2. Click on the Home tab.
3. Look for the Cells panel towards the right and then click on the Insert icon (to do it in one click, just click the picture portion—not the small black down-pointed triangle).



4. The entire spreadsheet will move down by two lines.
5. Click on various formulas and look at the formula bar to discover that they have all become adjusted properly.
6. Now there is room for a title. Click on cell A1 (now a blank cell). Type **Sales Projections**.
7. Move down to cell A2. Type 2015 to 2018
8. We will now center the title on the page. First, we must mark the width: Move to cell A1, to the middle of the cell. The pointer should still be a wide-outlined plus-sign. Press the mouse button and drag across to G2, marking the range A1 to G2.
9. Then, we'll center the text across the columns. Click on the down arrow under the **Format** icon in the Cells panel (see above). Then choose Format Cells. Click on the **Alignment** tab. In the **Horizontal** pull-down list, click Center across selection. Click .
10. Now change the size to 18 as you did before (next to the font name).
11. Click on the B icon (or use control-B). Keep the selection—don't move the cursor!

Step 6: Place a border around the title, change colors

1. Make sure you're in cell A1 as instructed above.
2. There are three icons we'll use. The first changes the border around selected cells; the second changes the background color; the third changes the font color:



3. Click on the first and select any pattern you wish from the dozen you see.
4. Click on the second and select any color.
5. Click on the third and select a contrasting font color.
6. Click on any empty cell of the spreadsheet so you can see the color show up.

Step 7: Resize the spreadsheet view so you can see more on the screen

1. One final task in preparation for graphing...to save a little space, delete row 2 by doing the following:
 - a. Click on the left margin row number 2, and the entire row will become highlighted.
 - b. Click on the Delete icon in the Cells panel. Now the entire spreadsheet should approximately fit on the screen because the title only takes up one line.
2. To see just what you want, click the – to + slider at the bottom right corner of the spreadsheet window. Save the spreadsheet as “basic spreadsheet.”

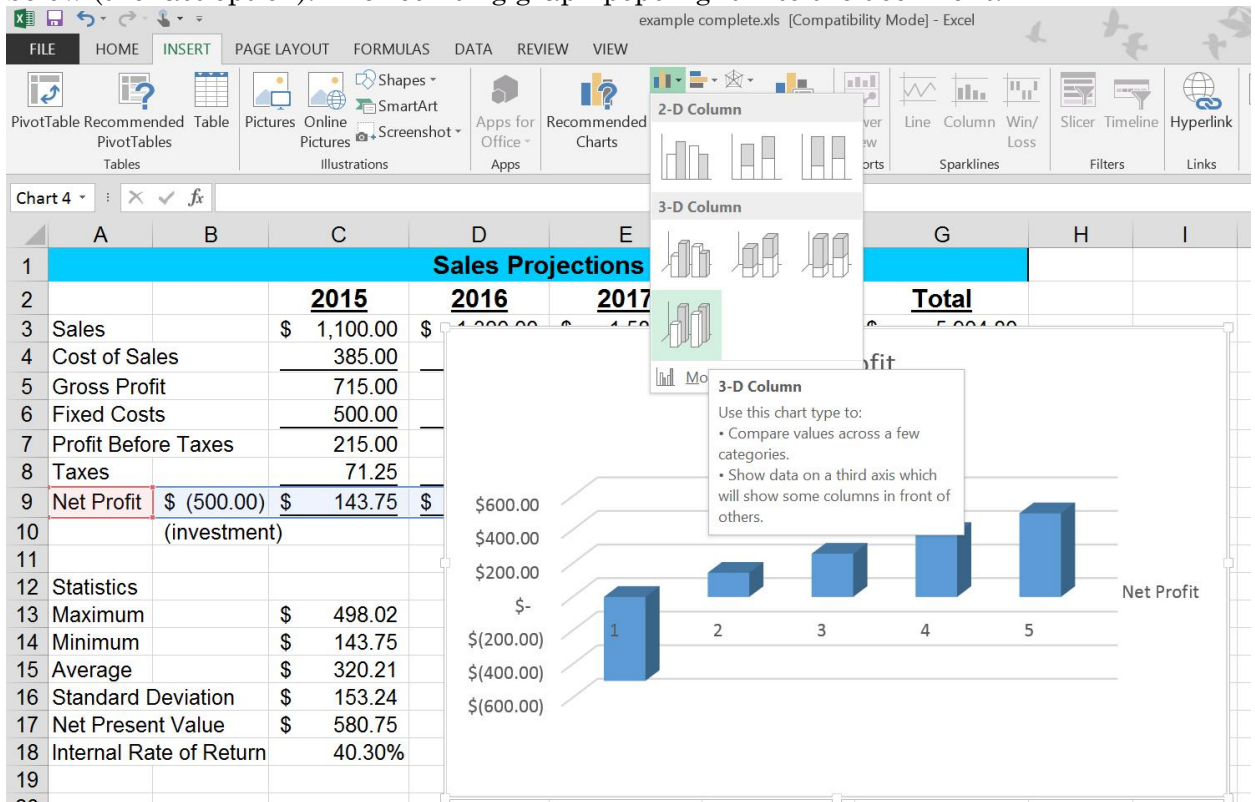
Graphics

Step 1: Create a Basic Chart

1. Click and drag cells **A9** to **F9** to select the words Net Profit and all of the profit numbers to the year 2018.
2. On the INSERT ribbon bar, click on the icon that looks like a bar graph (see picture→). It is the small one just up and to the right of the large icon “Recommended Charts.”



3. Some options will pop up as shown below. I chose the “3-D column chart” as shown below (the last option). The resulting graph pops right into the document.



4. The bar graph will appear, most likely in an odd place (perhaps overlapping your spreadsheet).
5. When the graph is selected, you can click and drag the graph into place.
6. You'll see tiny black squares at each corner and in the middle of each side. These are "grab bars." You can click and drag these to resize the graph if desired.
7. To experiment with other types of bar graphs, right-click the chart and select **Change Chart Type**.

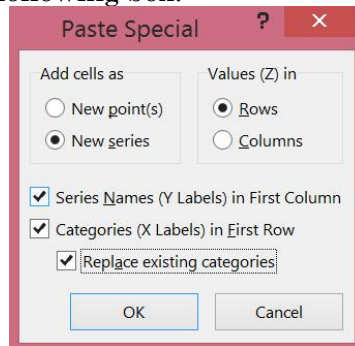
Step 2: Add other data to the chart.

1. Drag cells A3 through F3 (the word Sales through the sales for the year 2018).
2. Copy the range to the clipboard with **(Ctrl) -C**.
3. Click on the graphic and make sure the grab bars and graphic show up.
4. Paste in the sales information with **(Ctrl) -V**. Do it twice so you can learn how to remove a series from the graph.

- To remove the duplicate set of bars, click **once** on one of the 4 bars for sales in any **ONE** year. All sales bars will become selected (showing little circles at all corners).
- Press **[Del]** to remove the second set.

Step 3: Add axis labels

- Click in the empty white space near the edge of your chart so you can see grab bars. You should also see a green + along with a paint brush and a funnel on the right side of the graph. We will use them later. For this set of instructions, it is ok if multiple things inside have lines and grab bars, or only the entire image itself.
- Click on the green + and move the cursor to the word **Axes** and then to little black triangle that will appear to the right of **Axes**. Make sure only (for this task) the first two are selected (**Primary Horizontal** and **Primary Vertical**).
- Click on A2 and drag from **A2 to F2** to select the years (**and** the two blank cells before the years).
- Copy to the clipboard with **[Ctrl]-C**.
- Click once on the graph.
- On the Home icon ribbon, click on the small triangle under Paste and select **Paste Special**. You'll see the following box:



- Click on **Categories (X Labels) in First Row**, then click on **Replace Existing Categories** to remove the 1, 2, 3, and 4 that were there.
- In Excel 2016, the sales bars might disappear. Copy and paste again if necessary.
- You can enlarge or shrink the numbers: E.g., to shrink the years, click on any one of them and the entire set should be boxed in with lines around them. Then click the **A^v** button in the **Font** group or pick the **Font** tab and click on a different font size.
- You can also click and drag the graph to be bigger or smaller in any dimension.

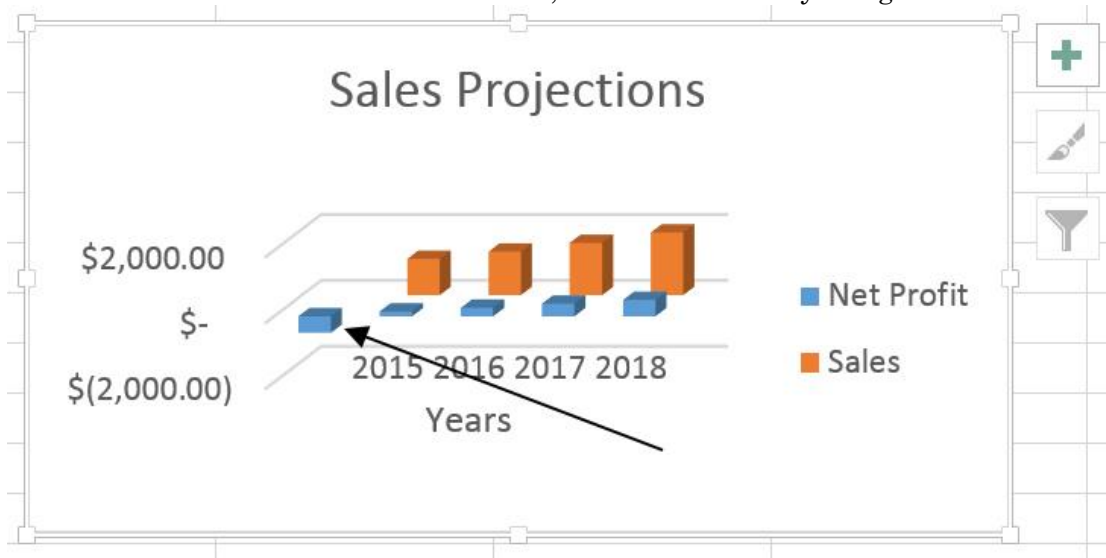
Step 4: Add a title and X axis label

- When the chart is selected, two new icon ribbons appear and are available to you. Chart tools: **DESIGN** and **FORMAT**.
- Click the **DESIGN** ribbon and the small **v** just after the name of the first icon **Add Chart Element**. A list of chart elements will pop up. Move the cursor down to the little triangle next to **Legend** then choose where you want the legend. The previous legend can be deleted. Just click on the one you don't want right in the chart and press the **DEL** key.
- To insert a title, just use the same **Add Chart Element v** pull down. Select the little triangle next to **Chart Title** and click where you want it.
- You can now click on the chart title and insert your own. I chose "Sales Projections"
- Again under **Add Chart Element v**, point to the little triangle next to **Axis Titles** and choose **Primary Horizontal**
- To label the X axis, just type the title you want right there. I chose "Year."

Step 5: Annotate the chart

The first bar (the negative one) is problematic. It might be useful to annotate it so that the reader can understand why a loss appears to be there. There are several drawing tools but we will only pick one as a sample because they all work identically. Nothing special has to be selected. So just get started.

1. Click on the **INSERT** icon ribbon and choose **Shapes** in the **Illustrations** block of icons (the second group).
2. Pick the arrow under the **LINES** group.
3. Draw the arrow as shown below. I know, this won't win any design awards.



4. Still on the **Insert** icon ribbon, select **Text Box**.
5. Click on the graph in the blank area at the source of the arrow (bottom right).
6. Type “(investment)” (without the quotation marks) in the text box.
7. Click the word “(investment)” that you just entered, and in the **FORMAT** icon ribbon, you can choose different styles for lines, shape, fill, and effects. Enjoy!
8. Resize the box if needed.
9. Feel free to save this spreadsheet as before, with **Ctrl+S** or click on the floppy disk icon (the 2nd small icon at the top of the screen).

Intermediate Excel

Three Tips for Good Spreadsheet Design

- Minimize the numbers you enter directly into formulas. It is best to separate any numbers that can possibly change, for example an inflation rate. Put such numbers into separate cells and insert their cell addresses into your formula. Although you might not plan to change them when you build the spreadsheet, someone might say “what if the inflation rate increases?”
- Also, beware of any hidden assumptions. For example, sales could increase because of higher prices and also because of higher demand. A forecast of demand increases should be separated too.
 - Click the following address right on this PDF (or open a browser, then type the following address) to download the spreadsheet shown below:
www.pitt.edu/~galletta/excel/amateurs1.xls

Amateurs, Inc. Liquidity Analysis					
	2015	2016	2017	2018	2019
Beginning Balance	15,025	13,025	12,145	12,470	14,090
Cash Receipts					
Sales	80,000	84,000	88,200	92,610	97,241
Scheduled Loan Receipts	42,000	42,000	42,000	42,000	42,000
Total Receipts	122,000	126,000	130,200	134,610	139,241
Cash Payouts					
Cash Expenses	72,000	74,880	77,875	80,990	84,230
Payments on Debts	52,000	52,000	52,000	52,000	52,000
Total Payouts	124,000	126,880	129,875	132,990	136,230
Ending Balance	13,025	12,145	12,470	14,090	17,100
Assumptions:					
Price increases per year	5%				
Inflation rate	4%				
Demand increase	0%				

Professionals, Inc. Liquidity Analysis					
	2015	2016	2017	2018	2019
Beginning Balance	15,025	13,025	12,145	12,470	14,090
Cash Receipts					
Sales	80,000	84,000	88,200	92,610	97,241
Scheduled Loan Receipts	42,000	42,000	42,000	42,000	42,000
Total Receipts	122,000	126,000	130,200	134,610	139,241
Cash Payouts					
Cash Expenses	72,000	74,880	77,875	80,990	84,230
Payments on Debts	52,000	52,000	52,000	52,000	52,000
Total Payouts	124,000	126,880	129,875	132,990	136,230
Ending Balance	13,025	12,145	12,470	14,090	17,100
Assumptions:					
Price increases per year	5%				
Inflation rate	4%				
Demand increase	0%				

- Notice that the price increases and inflation rate are more easily changed in the bottom example. What would you have to do to change those assumptions in the upper example? That’s right, you would waste valuable time.
- Prevent disasters! Put separate analyses into separate worksheets or diagonally. In the example below, if you transfer your money from Toaster Bank to Greedy Bank, and wish to delete the row with Toaster Bank, you will also delete all of your forecasted loan receipts. This file is available at
www.pitt.edu/~galletta/excel/amateurs2.xls

	A	B	C	D	E	F	G	H	I	J
1										
2		Bank Accounts			Amateurs, Inc. Liquidity Analysis					
3						2015	2016	2017	2018	2019
4		Green Bank	2,355		Beginning Balance	15,025	13,025	12,145	12,470	14,090
5		Safe Bank	1,019		Cash Receipts					
6		Greedy Bank	1,508		Sales	80,000	84,000	88,200	92,610	97,241
7		Risky Bank	3,005		Scheduled Loan Receipts	42,000	42,000	42,000	42,000	42,000
8		Rupt Bank	2,122		Total Receipts	122,000	126,000	130,200	134,610	139,241
9		Toaster Bank	2,605		Cash Payouts					
10		Free Bank	905		Cash Expenses	72,000	74,880	77,875	80,990	84,230
11		Right Bank	53		Payments on Debts	52,000	52,000	52,000	52,000	52,000
12		Left Bank	29		Total Payouts	124,000	126,880	129,875	132,990	136,230
13		East Bank	1,305		Ending Balance	13,025	12,145	12,470	14,090	17,100
14		West Bank	102		Assumptions:					
15		Nowhere Bank	17		Price increases per year	5%				
16		Total	15,025		Inflation rate	4%				
17					Demand increase	0%				
18										
19										
20										
21										
22										
23										

- A better way to handle this would be to move the liquidity analysis to a different worksheet or diagonally as shown below in www.pitt.edu/~galletta/excel/amateurs3.xls. Removing Toaster Bank will then be no problem.

	A	B	C	D	E	F	G	H	I	J
1										
2		Bank Accounts								
3										
4		Green Bank	2,355							
5		Safe Bank	1,019							
6		Greedy Bank	1,508							
7		Risky Bank	3,005							
8		Rupt Bank	2,122							
9		Toaster Bank	2,605							
10		Free Bank	905							
11		Right Bank	53							
12		Left Bank	29							
13		East Bank	1,305							
14		West Bank	102							
15		Nowhere Bank	17							
16		Total	15,025							
17										
18										
19										
20					Amateurs, Inc. Liquidity Analysis					
21						2015	2016	2017	2018	2019
22					Beginning Balance	15,025	13,025	12,145	12,470	14,090
23					Cash Receipts					
24					Sales	80,000	84,000	88,200	92,610	97,241
25					Scheduled Loan Receipts	42,000	42,000	42,000	42,000	42,000
26					Total Receipts	122,000	126,000	130,200	134,610	139,241
27					Cash Payouts					
28					Cash Expenses	72,000	74,880	77,875	80,990	84,230
29					Payments on Debts	52,000	52,000	52,000	52,000	52,000
30					Total Payouts	124,000	126,880	129,875	132,990	136,230
31					Ending Balance	13,025	12,145	12,470	14,090	17,100
32					Assumptions:					
33					Price increases per year	5%				
34					Inflation rate	4%				
35					Demand increase	0%				
36										
37										
38										
39										
40										

Copying and Handy Extrapolations

- You can copy cells using many different tools. Quickly copy or extrapolate the results from one cell to others by clicking on the + that appears when you point to the bottom right of any selected cell. There are automatic adjustments to certain text or numeric items (eg., January, Quarter 1, or 1). You can see what copying will be done in a small grey box while you copy, and you can adjust it by holding the **[Ctrl]** key to force the item to be extrapolated (incremented) if it is being copied exactly, or to force the item to be copied exactly if it is being extrapolated..
- Extrapolating is very useful. It works with months, days of the week, quarters, or even any text that is followed with a number. Here's how it works:

1. Close the sheet and open a blank one. In B1, type the month January, the day Monday, or anything followed by a number such as “Week 1” “Machine1” or “Anything 1” (even without spaces).
2. Click on that cell and point to the bottom right of the cell so you can see the + sign in the corner. Click on the + sign and drag to the right.

	A	B	C	D	E	F
1		January				
2						
3						
4						
5						
6						

3. As you drag to the right, you will see a small window with the values to be copied. You will see February, March, etc., as shown below.

	A	B	C	D	E	F
1		January				
2						
3						
4						
5						
6						

4. The result is a big savings of typing. You can put off carpal tunnel syndrome for another few years. Here is what it looks like:

	A	B	C	D	E	F
1		January	February	March		
2						
3						
4						
5						
6						
7						

5. Note that you don't have to extrapolate. If you would prefer to have copied “January” to the right, you can hold the **Ctrl** key while dragging to the right.

- Formulas can be copied, too, and they can be relative or absolute.
 - When a relative formula is copied, the copied operations point to cells that are in positions relative to the current formula.
 - All formulas are relative unless you make them absolute with \$ (see below).
 - When an absolute formula is copied, the copied operations point to absolutely the same row and/or absolute column.
 - A column reference is made absolute by placing a dollar sign \$ in front of the column letter. Example: \$B2 will always point to column B
 - A row reference is made absolute by placing a dollar sign \$ in front of the row number. Example: B\$2 will always point to row 2.
 - Both can be made absolute: \$B\$2 always points to cell B2.
 - Here is an example, using an absolute column reference only.
 - Assume you want to point to the cost of sales % that is fixed in B2 and the income tax rate that is fixed in B3.
 - You would refer to B2 as \$B2 and B3 as \$B3. The way you would enter the formulas is shown below.

	A	B	C
1	Assumptions		
2	Cost of Sales %	0.3	
3	Tax Rate	0.25	
4			
5			
6	Income Statement	2015	2016
7	Sales	1000	1200
8	Cost of Sales	=B7*\$B2	
9	Gross Margin	=B7-B8	
10	Fixed Costs	400	
11	Profit Before Tax	=B9-B10	
12	Taxes	=B3*B11	
13	Net Income	=B11-B12	
14			

- When you copy the formulas, you see what occurs below. Beware: the 401 is probably not what is desired. You can fix that by pressing on the **Ctrl** key while you drag to the right.

	A	B	C
1	Assumptions		
2	Cost of Sales %	30%	
3	Tax Rate	25%	
4			
5			
6	Income Statement	2015	2016
7	Sales	1000	1200
8	Cost of Sales	300	
9	Gross Margin	700	
10	Fixed Costs	400	
11	Profit Before Tax	300	
12	Taxes	75	
13	Net Income	225	
14			401

- The result you desired is shown below. Notice how the relative (regular) cell references have changed and the absolute ones (\$) have stayed the same. By the way, if you placed a different cost of sales% and tax rate for each year, then you do not need to use absolute references.

	A	B	C
1	Assumptions		
2	Cost of Sales %	0.3	
3	Tax Rate	0.25	
4			
5			
6	Income Statement	2015	2016
7	Sales	1000	1200
8	Cost of Sales	=B7*\$B2	=C7*\$B2
9	Gross Margin	=B7-B8	=C7-C8
10	Fixed Costs	400	400
11	Profit Before Tax	=B9-B10	=C9-C10
12	Taxes	=B3*B11	=B3*C11
13	Net Income	=B11-B12	=C11-C12

- Once you enter a formula, you can move to the cell, press F2 to edit the formula, then move to each cell reference and press F4 to toggle between \$row and \$column. (B2 becomes \$B\$2 then B\$2 then \$B2 then B2 again).
- The file www.pitt.edu/~galletta/excel/absolutecopy.xlsx provides the following example so you can open it and see how it works.

	A	B	C	D	E	F	G
1	Assumptions				Assumptions		
2	Cost of Sales %	30%			Cost of Sales %	30%	32%
3	Tax Rate	25%			Tax Rate	25%	27%
4							
5							
6	Income Statement	2015	2016		Income Statement	2015	2016
7	Sales	1000	1200		Sales	1000	1200
8	Cost of Sales	300	360		Cost of Sales	300	384
9	Gross Margin	700	840		Gross Margin	700	816
10	Fixed Costs	400	400		Fixed Costs	400	400
11	Profit Before Tax	300	440		Profit Before Tax	300	416
12	Taxes	75	110		Taxes	75	112.32
13	Net Income	225	330		Net Income	225	303.68
14							
15	Absolute Reference Needed				Relative Reference Needed		
16							

Summing, Copying, and Extrapolating: Example

- Download and open www.pitt.edu/~galletta/excel/StoreInventory1.xls. It's an antique home theater store.
 - Click on cell A2
 - Point to the *bottom right corner of cell A2* so you see the plus sign +
 - Click and drag down. As you drag, you will see a small box that says 101
 - Press on the **[Ctrl]** key while you continue dragging. The box will count up from 101 to 118
 - Release and the product numbers will be filled in.

	A	B	C	D	E	F	G	H	I	J
1	ItemNum	Item	Category	Type	Availability	OnHand	CostEach	RetailEach	Total Cost	
2	101	Velodyne R-15 Subwoofer	Subwoofers	Audio	Special Order	1	1250	1595	1250	
3		Samsung CD Player	CD Players	Audio	Stock	12	15	20		
4		Toshiba HD DVD player	DVD Players	Video	Special Order	1	400	500		
5		USB Audio Converter	Accessories	Audio	Stock	25	39	55		
6		Xbox 360 Premium	Consoles	Games	Stock	20	275	399		
7		Stereo Wires	Accessories	Audio	Stock	125	6	10		
8		Audio/Video Wires	Accessories	Video	Stock	85	8	20		
9		Sony Blu Ray DVD player	DVD Players	Video	Special Order	1	725	1000		
10		Xbox	Consoles	Games	Discontinued	30	155	75		
11		Sony XBR HD Rear Projection TV	Televisions	Video	Stock	9	1800	3200		
12		Sony Fancy VCR	VCRs	Video	Discontinued	4	85	40		
13		InFocus HD Front Projector	Projector	Video	Special Order	1	4200	5000		
14		Console Hi Fi	Obsolete	Audio	Discontinued	0	750	0		
15		Sennheiser Headphones Model H	Headphones	Audio	Stock	7	42	75		
16		JBL L-5 Subwoofer	Subwoofers	Audio	Stock	5	220	320		
17		Playstation 2	Consoles	Games	Stock	5	120	140		
18		Bravo DVD Player	DVD Players	Audio	Stock	2	165	249		
19		TIVO single tuner DVR	Accessories	Video	Discontinued	100	350	200		
20										

- In contrast, do the same with the Total Cost field (starting at i2) but do not hold down the **[Ctrl]** key. (SHORTCUT! You can just double-click the + sign this time!)
- The result appears as follows. You can save this as “StoreInventory1b”

	A	B	C	D	E	F	G	H	I
1	ItemNum	Item	Category	Type	Availability	OnHand	CostEach	RetailEach	Total Cost
2	101	Velodyne R-15 Subwoofer	Subwoofers	Audio	Special Order	1	1250	1595	1250
3	102	Samsung CD Player	CD Players	Audio	Stock	12	15	20	180
4	103	Toshiba HD DVD player	DVD Players	Video	Special Order	1	400	500	400
5	104	USB Audio Converter	Accessories	Audio	Stock	25	39	55	975
6	105	Xbox 360 Premium	Consoles	Games	Stock	20	275	399	5500
7	106	Stereo Wires	Accessories	Audio	Stock	125	6	10	750
8	107	Audio/Video Wires	Accessories	Video	Stock	85	8	20	680
9	108	Sony Blu Ray DVD player	DVD Players	Video	Special Order	1	725	1000	725
10	109	Xbox	Consoles	Games	Discontinued	30	155	75	4650
11	110	Sony XBR HD Rear Projection TV	Televisions	Video	Stock	9	1800	3200	16200
12	111	Sony Fancy VCR	VCRs	Video	Discontinued	4	85	40	340
13	112	InFocus HD Front Projector	Projector	Video	Special Order	1	4200	5000	4200
14	113	Console Hi Fi	Obsolete	Audio	Discontinued	0	750	0	0
15	114	Sennheiser Headphones Model H	Headphones	Audio	Stock	7	42	75	294
16	115	JBL L-5 Subwoofer	Subwoofers	Audio	Stock	5	220	320	1100
17	116	Playstation 2	Consoles	Games	Stock	5	120	140	600
18	117	Bravo DVD Player	DVD Players	Audio	Stock	2	165	249	330
19	118	TIVO single tuner DVR	Accessories	Video	Discontinued	100	350	200	35000
20									
21									

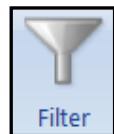
Working with all the Detail

The Store Inventory table from above (or available for you to load at <http://www.pitt.edu/~galletta/excel/StoreInventory1b.xls>) just cries out for sorting, summarizing, and analyzing. There are dozens of ways in which the information can be manipulated. We will cover filtering, sorting, subtotaling, grouping, and pivot tables.

Filtering

Filtering allows you to limit what you see on any spreadsheet, but is most applicable to a list of items such as the inventory table. This example will address a need to view a limited segment of inventory, which is useful when there are hundreds or even thousands of entries.

- First, select the entire range for which you want to view only selected records. In this case, drag the range from A1 to I19.
- From the **Data** ribbon menu, click the Filter funnel (pictured at right).
- You're done! You might not think much has happened, but note that the headings now have drop-down arrows as shown below.



	A	B	C	D	E	F	G	H	I
1	ItemNum	Item	Category	Type	Availability	OnHand	CostEa	RetailEa	Total C
2	101	Velodyne R-15 Subwoofer	Subwoofers	Audio	Special Order	1	1250	1595	1250
3	102	Samsung CD Player	CD Players	Audio	Stock	12	15	20	180

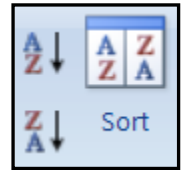
- Click on any of the drop-down arrows to choose how to limit what displays on the screen. For example, if you click on the Type drop-down arrow, you can select only Audio items. See below. There are many, many options you can select, all available when you click any drop-down arrow.

	A	B	C	D	E	F	G	H	I
1	ItemNum	Item	Category	Type	Availability	OnHand	CostEa	RetailEa	Total C
2	101	Velodyne R-15 Subwoofer	Subwoofers	Audio	Special Order	1	1250	1595	1250
3	102	Samsung CD Player	CD Players	Audio	Stock	12	15	20	180
5	104	USB Audio Converter	Accessories	Audio	Stock	25	39	55	975
7	106	Stereo Wires	Accessories	Audio	Stock	125	6	10	750
14	113	Console Hi Fi	Obsolete	Audio	Discontinued	0	750	0	0
15	114	Sennheiser Headphones Model H	Headphones	Audio	Stock	7	42	75	294
16	115	JBL L-5 Subwoofer	Subwoofers	Audio	Stock	5	220	320	1100
18	117	Bravo DVD Player	DVD Players	Audio	Stock	2	165	249	330
20									

To turn this off, just once again click the funnel (It is active if it is as follows: Excel 2016: **Gray**; Excel 2013: **Green**; Excel 2007-2010: **Orange**).

Sorting

Sorting is quite useful. For example, you can view inventory sorted by any of the fields either alphabetically or numerically, ascending or descending, and even sorted by multiple categories (for example, by number on hand, within type, within category). We will pursue this example.



We will use the Data ribbon, and the Sort window pictured at the right. Notice the automatic A to Z and automatic Z to A options, as well as the full-featured table icon

- Select all items including (or not including) the headings. Any totals at the bottom should not be included. At long last, these modern versions of Excel omit headings automatically.
- Click the **Data** ribbon menu and the **Sort** table icon. You will see a sort box pop up with an entry area already set up. Fill in the areas by choosing a field and choosing which way to sort.

	A	B	C	D	E	F	G	H	I
1	ItemNum	Item	Category	Type	Availability	OnHand	CostEach	RetailEach	Total Cost
2	101	Velodyne R-15 Subwoofer	Subwoofers	Audio	Special Order	1	1250	1595	1250
3	102	Samsung CD Player	CD Players	Audio	Stock	12	15	20	180
4	103	Toshiba HD DVD player	DVD Players	Video	Special Order	1	400	500	400
5	104	USB Audio Converter	Accessories	Audio	Stock	25	39	55	975
6	105	Xbox						399	5500
7	106	Stere						10	750
8	107	Audio						20	680
9	108	Sony						000	725
10	109	Xbox						75	4650
11	110	Sony						200	16200
12	111	Sony						40	340
13	112	InFoc						000	4200
14	113	Conso						0	0
15	114	Senni						75	294
16	115	JBL L						320	1100
17	116	Plays						140	600
18	117	Bravo						249	330
19	118	TIVO						200	35000
20									
21									
22									

Sort

My data has headers

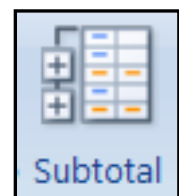
Column: Sort On: Order:

** Then Add level and choose "Type"

- If you want to do a multi-level sort (for example, type within category), just click the **Add Level** button and specify the next level. In this example, choose Type as a 2nd level.
- We do not need to click the **Options** button this time, but you might find it a lifesaver if you wish to sort UPPER CASE and lower case separately, or to sort from side to side instead of up and down.
- After clicking , the items are sorted as desired.

Summaries and Outlining

- After sorting, the table is now ready for summarizing/outlining.
- We wish to obtain totals by category. From the **Data** ribbon menu, choose the **Subtotal** icon (pictured at right). A simple window will pop up, asking for which change to trigger the function, which function, and which items require subtotals. Select **Category** as the change trigger, leave **Sum** as the function, then click the boxes for **Total Cost** and **Onhand**. The only two checkmarks should be **Replace current subtotals** and **Summary bellow data**. Click . All of this is shown on the next page.



	A	B	C	D	E	F	G	H	I
1	ItemNum	Item	Category	Type	Availability	OnHand	CostEach	RetailEach	Total Cost
2		104 USB Audio Converter	Accessories	Audio	Stock	25	39	55	975
3		106 Stereo Wires	Accessories	Audio	Stock	125	6	10	750
4		107 Audio/Video Wires				85	8	20	680
5		118 TiVO single tuner DVR				100	350	200	35000
6		102 Samsung CD Player				12	15	20	180
7		105 Xbox 360 Premium				20	275	399	5500
8		109 Xbox				30	155	75	4650
9		116 Playstation 2				5	120	140	600
10		117 Bravo DVD Player				2	165	249	330
11		103 Toshiba HD DVD player				1	400	500	400
12		108 Sony Blu Ray DVD player				1	725	1000	725
13		114 Sennheiser Headphones Mode				7	42	75	294
14		113 Console Hi Fi				0	750	0	0
15		112 InFocus HD Front Projector				1	4200	5000	4200
16		101 Velodyne R-15 Subwoofer				1	1250	1595	1250
17		115 JBL L-5 Subwoofer				5	220	320	1100
18		110 Sony XBR HD Rear Projection				9	1800	3200	16200
19		111 Sony Fancy VCR				4	85	40	340

Subtotal

At each change in:

Category: ▼

Use function:

Sum: ▼

Add subtotal to:

Type

Availability

OnHand

CostEach

RetailEach

Total Cost

Replace current subtotals

Page break between groups

Summary below data

Remove All
OK
Cancel

- Besides the subtotals requested, the result of this summarizing also has a bonus: A set of brackets in the left column. You can see just to the left of the column letters a small set of numbers 1 2 3. These numbers allow you to choose the level of detail you want in the list. Click on 2 and you see only the subtotals as shown below. Click 3 to see all detail.

1 2 3	A	B	C	D	E	F	G	H	I
1	ItemNum	Item	Category	Type	Availability	OnHand	CostEach	RetailEach	Total Cost
6			Accessories Total			335			37405
8			CD Players Total			12			180
12			Consoles Total			55			10750
16			DVD Players Total			4			1455
18			Headphones Total			7			294
20			Obsolete Total			0			0
22			Projector Total			1			4200
25			Subwoofers Total			6			2350
27			Televisions Total			9			16200
29			VCRs Total			4			340
30			Grand Total			433			73174

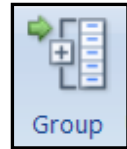
- Click on the small plus and minus signs along the left margin to see detail only for selected categories. If you click on the plus sign for Subwoofers and DVD Players, for instance, you see the following:

1 2 3	A	B	C	D	E	F	G	H	I
1	ItemNum	Item	Category	Type	Availability	OnHand	CostEach	RetailEach	Total Cost
6			Accessories Total			335			37405
8			CD Players Total			12			180
12			Consoles Total			55			10750
13		117 Bravo DVD Player	DVD Players	Audio	Stock	2	165	249	330
14		103 Toshiba HD DVD player	DVD Players	Video	Special Order	1	400	500	400
15		108 Sony Blu Ray DVD player	DVD Players	Video	Special Order	1	725	1000	725
16			DVD Players Total			4			1455
18			Headphones Total			7			294
20			Obsolete Total			0			0
22			Projector Total			1			4200
23		115 JBL L-5 Subwoofer	Subwoofers	Audio	Stock	5	220	320	1100
24		101 Velodyne R-15 Subwoofer	Subwoofers	Audio	Special Order	1	1250	1595	1250
25			Subwoofers Total			6			2350
27			Televisions Total			9			16200
29			VCRs Total			4			340
30			Grand Total			433			73174

- What has been created is an outline for the rows. You can see the benefit of hiding groups of data from view.
- You can remove all subtotals by pulling up the Subtotal window again and then clicking the button **Remove all**.

Column grouping: While the **Hide/Unhide** menu items (Under the **View** ribbon menu) or column width adjustment are **very** popular ways of seeing or hiding selected columns of very wide spreadsheets, a more useful way to accomplish this is by using column grouping. This gives you the same functions as the “bonus” in the step on the previous page.

- Let’s say it is always useful to see the Itemnumber and Item name. You can make Category, Type, and Availability one group and CostEach, RetailEach, and Total Cost another.
 - Click on any cell in column C and drag to column E.
 - On the **Data** ribbon, click the **Group** icon (pictured at right). Choose Columns and click .
 - Repeat the last step after clicking in column G and dragging to columns G, H, and I. If you drag the column letters, you don’t have to choose Columns & click .
 - This results in bars at the top of the columns that allow you to hide and unhide as groups, shown below.
 - Just click on and you will see only item number, item name, and number on hand. Click on for all detail. Finally, click on any bar to hide that group, and click on the plus sign to return that group.

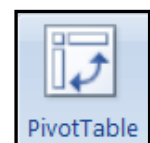


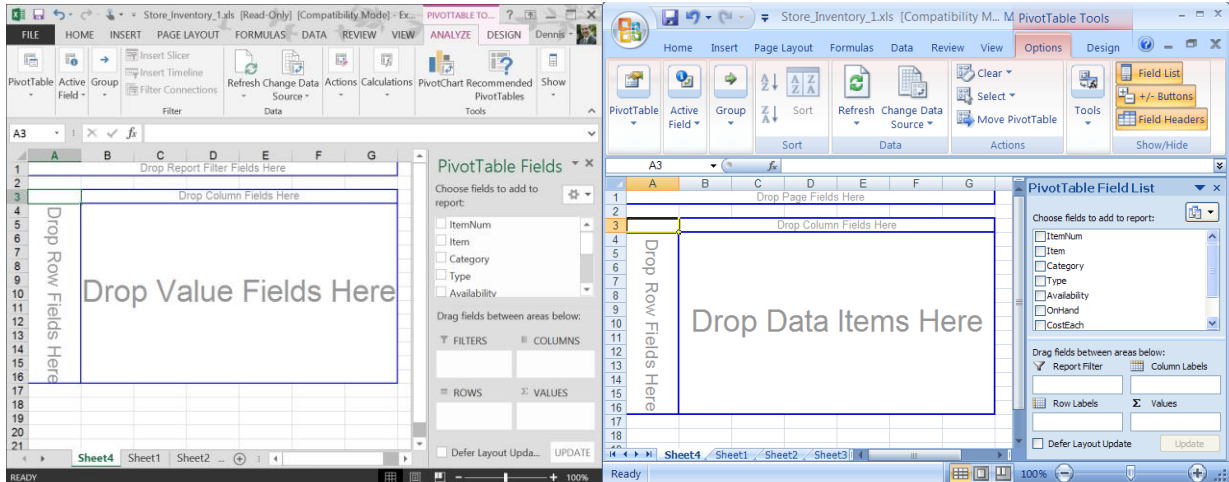
	A	B	C	D	E	F	G	H	I	J
1	ItemNum	Item	Category	Type	Availability	OnHand	CostEach	RetailEach	Total Cost	
2	106	Stereo Wires	Accessories	Audio	Stock	125	6	10	750	
3	104	USB Audio Converter	Accessories	Audio	Stock	25	39	55	975	
4	118	TiVO single tuner DVR	Accessories	Video	Discontinued	100	350	200	35000	
5	107	Audio/Video Wires	Accessories	Video	Stock	85	8	20	680	
6		Accessories Total				335			37405	
7	102	Samsung CD Player	CD Players	Audio	Stock	12	15	20	180	
8		CD Players Total				12			180	
9	109	Xbox	Consoles	Games	Discontinued	30	155	75	4650	
10	105	Xbox 360 Premium	Consoles	Games	Stock	20	275	399	5500	
11	116	Playstation 2	Consoles	Games	Stock	5	120	140	600	
12		Consoles Total				55			10750	
13	117	Bravo DVD Player	DVD Players	Audio	Stock	2	165	249	330	
14	103	Toshiba HD DVD player	DVD Players	Video	Special Order	1	400	500	400	
15	108	Sony Blu Ray DVD player	DVD Players	Video	Special Order	1	725	1000	725	
16		DVD Players Total				4			1455	
17	114	Sennheiser Headphones Model H	Headphones	Audio	Stock	7	42	75	294	
18		Headphones Total				7			294	
19	113	Console Hi Fi	Obsolete	Audio	Discontinued	0	750	0	0	
20		Obsolete Total				0			0	
21	112	InFocus HD Front Projector	Projector	Video	Special Order	1	4200	5000	4200	
22		Projector Total				1			4200	
23	115	JBL L-5 Subwoofer	Subwoofers	Audio	Stock	5	220	320	1100	
24	101	Velodyne R-15 Subwoofer	Subwoofers	Audio	Special Order	1	1250	1595	1250	
25		Subwoofers Total				6			2350	
26	110	Sony XBR HD Rear Projection TV	Televisions	Video	Stock	9	1800	3200	16200	
27		Televisions Total				9			16200	
28	111	Sony Fancy VCR	VCRs	Video	Discontinued	4	85	40	340	
29		VCRs Total				4			340	
30		Grand Total				433			73174	

Pivot Tables

A seldom-used but very useful feature is found in Pivot Tables. An entire book can be written about pivot tables so this will only scratch the surface. What kind of a spreadsheet is appropriate for Pivot Tables? The same example of inventory records is very useful. Pivot Tables really get useful when you have hundreds of records and many categories (such as the fields in this Store Inventory example: “category,” “type,” and “available”).

- All subtotals must be removed. Highlight the entire set of data, then from the **Data** ribbon, click the **Subtotal** icon as before. On the small window click the button **Remove All**.
- Then select only the records, not the headings (**drag from A2 to I19**)
- Click the **Insert** ribbon menu and click the Pivot Table icon shown at right. We’ll accept the defaults shown on the pop-up box and click .
- Note that a new sheet is created (**Sheet4**). The resultant design pad is shown below.





Excel 2013, 2016

Excel 2007, 2010

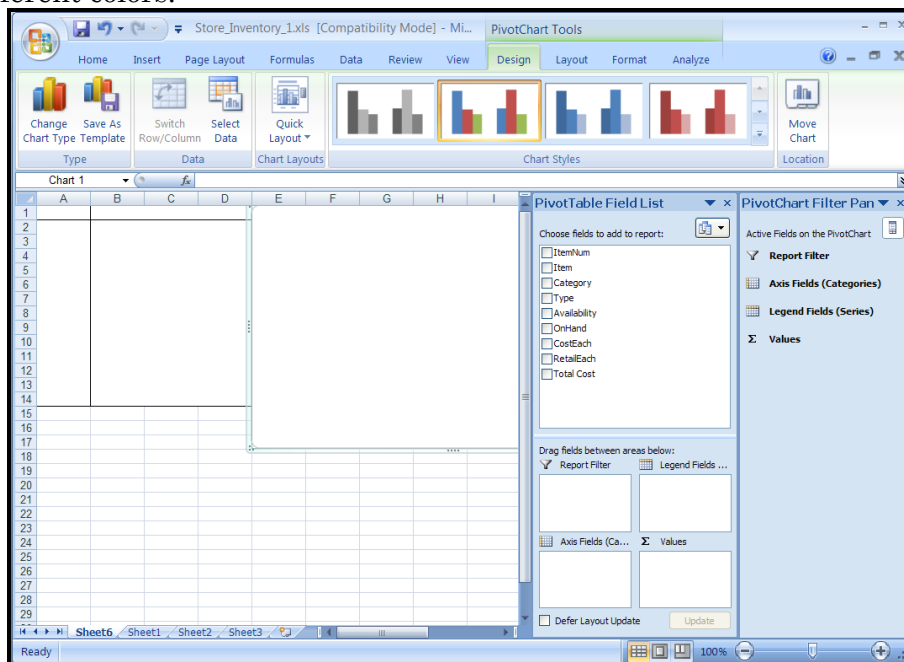
- Click, drag and drop the fields you want onto the proper place in the pivot table. (You don't have to click the boxes). Use larger lists as rows and smaller lists as columns.
 - Click and drag the **Category** field to the left edge marked "Drop Row Fields Here."
 - Click and drag the **Type** field to the top edge of the big area marked "Drop Column Fields Here."
 - Click and drag the **Total Cost** field to the large empty area. In Excel 2013, it is marked "Drop Value Fields Here. In Excel 2007-2010 the large area is marked "Drop Data Items Here."
 - Click and drag the **Availability** field to the very top area for dropping items. In Excel 2013-2016, it is marked "Drop Report Filter Fields Here." In Excel 2007-2010 it is marked "Drop Page Fields Here."
 - On the **Availability** column heading, click the pull-down arrow. Select **stock**.
 - The resulting report is shown below.

	A	B	C	D	E
1	Availability	Stock			
2					
3	Sum of Total Cost	Type			
4	Category	Audio	Games	Video	Grand Total
5	Accessories	1725		680	2405
6	CD Players	180			180
7	Consoles		6100		6100
8	DVD Players	330			330
9	Headphones	294			294
10	Subwoofers	1100			1100
11	Televisions			16200	16200
12	Grand Total	3629	6100	16880	26609
13					

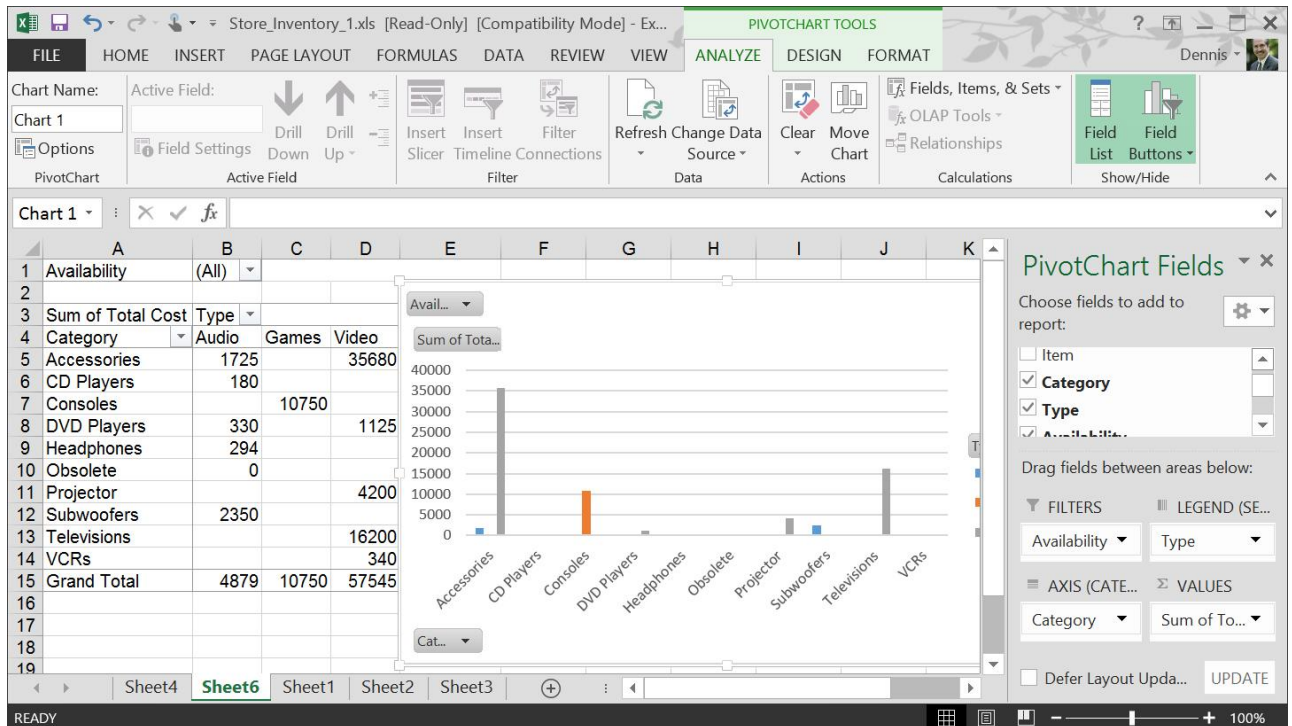
- If you click on the drop-down arrow next to any of the other fields, you can filter the records further.
- You can also drag additional items to the report. Click and drag the **OnHand** item to the large data area and you will see that there are two rows for each item.
- You can drag the fields from columns to rows to page fields (or even back to the field list) and you will see totals and subtotals change immediately. You can unclick the little boxes to do the same as dragging back to the field list. It is also easy to mess up the report, so you can unclick all the boxes or delete the sheet and start over again!

Pivot Charts

- You can create Pivot Charts that graph the data with the same drag and drop ease as Pivot Tables.
 - Return to Sheet 1. (Click the **Sheet 1** tab at the bottom of the current sheet)
 - If needed, select all of the data (not column headings) in the table by clicking and dragging it all from A2 to I19 again. Actually, Excel 2013 and 2016 will figure it out if you select headings too.
 - From the Insert ribbon, click the small triangle **under the PivotTable icon**. Then choose **PivotChart**. You'll see a box showing the range. Just click . You will see the empty chart as shown below. Excel 2013 and 2016 show some additional icons in the large area and the icon ribbons differ as well. The Excel 2007-2010 window is shown below. See next page for the Excel 2013 window (with selections completed). Excel 2016 looks much like Excel 2013 but with different colors.



- Notice that there is an empty (and unlabeled) pivot table to the left of a large empty window. The window will contain the chart.
- Drag the **Category** field either to the left column of the pivot table, or to the right-hand panel, at the small bottom window marked **Axis Fields**.
- Drag the field **Type** either to the column area of the pivot table or to **Legend Fields**
- In Excel 2007-2010, drag the field **Availability** to **Report Filter**.
- In Excel 2013, drag the field **Availability** to **FILTERS**.
- Drag the field **Total Cost** to the large empty part of the pivot table, or to Σ **Values**
- The chart appears as follows:



- Some noteworthy items:
 - In Excel 2016, I had to drag **Total Cost** down to the VALUES area on the right; it didn't work to drag it to the values field.
 - A table is also created, which feeds the chart. It's to the left.
 - Note that new sheets are created for each table and chart.
 - You can drag fields onto and off of the table and the chart will change.
 - If you click on the **Design** ribbon, you can switch the chart type. Try 3D!
 - If you click on an empty part of the pivot table spreadsheet, the right panels will disappear. Get them back by clicking on the pivot table itself—anywhere in the report. This is a very useful tip to remember!
 - We can always go back to the main spreadsheet by clicking on the **Sheet1** tab near the bottom left corner of the screen.

Advanced Excel

Functions

- There are built-in functions in Excel that offer common and frequently-needed formulas.
 - The hard but fast way for experts: Enter the equal sign, followed by the function name, followed by a set of parentheses with parameters for the function. You are helpfully prompted for the parameters but you might need more help.
 - You can view a complete list by clicking on f_x just to the left of the formula bar. It will prompt you through all of the functions with quite complete explanations.
 - The **Formulas** ribbon bar has some you can access quickly by icon.
- I would recommend working with the original Store Inventory spreadsheet (after the totals were computed). If you don't have it, you can load it from:
www.pitt.edu/~galletta/excel/StoreInventory1b.xls.

Basic Functions

- Here are some examples of basic, useful functions, assuming that there are meaningful numbers in cells I2 through I19 back on **Sheet 1**. To do this, you must enter these functions into an empty cell (I will use I21 through i26 for these examples).
- Commonly-needed items are as follows:
 - **=sum(i2.i19)** will compute the sum of all of the cells from i2 to i19. A summation icon (Σ) (we used it earlier) sums automatically a range of cells. The icon works both vertically and horizontally, but some empty cells might provide an unanticipated result. Check out the formula after you use the summation icon! Move to i21 and press Σ . That will provide an automatic sum for Total Cost, \$73,174. One difference: The SUM formula will include i2.i20 as the range.
 - **=average(i2.i19)** obviously, finds their average, or 4065.222 in this spreadsheet.
 - **=count(i2.i19)** counts the number of cells in that range that have *numbers* (text or blanks do not get counted). The count should be 18.
 - **=max(i2.i19)** finds the maximum, which is 35000 in this spreadsheet.
 - **=min(i2.i19)** obviously, finds the minimum, or 0 in this sheet.
 - **=stdev(i2.i19)** computes the standard deviation of those numbers=8628.342.

Advanced Functions

- **Statistical Functions**
 - **Conditional Counting**
 - **=countif(range, criteria)** will count all of the items matching a particular criterion. The “criteria” parameter can be some text in quotes or a cell reference.
 - Example 1: move to cell c21 and type **=countif(c2.c19,“DVD Players”)** to obtain **3** as an answer to the function (the number of different items with “DVD players” in the Category column). This does not tell how many DVD players there are, but only how many different products have that category.
 - To provide better labeling:
 - Move to cell B21 and type “DVD Players” in that cell.
 - Move to C21 and replace the formula provided above with: **=countif(c2.c19,b21)**. The total should be 3.
 - Now change what is in B21 to “VCRs” and the total will change to 1.

- If you want to know how many are in stock, move to F21 and enter: **=sumif(c2.c19,b21,f2.f19)**. Note that this will hunt through the first range, c2 to c19, then compare each value in that range to what is in B21 (currently VCRs), then sum the items in the second range, f2.f19.
- Then type any other category into B21 (for example, **Accessories**), then note that the total in C21 changes to 4 and F21 changes to 335. Go back to C21 and change the category to other items to see the new count in D21 and sum in F21 every time you change what is in C21. Make sure you understand the difference between the count in C21 (number of items in that category) and the sum in F21 (total number of items in inventory for that category).
- Conditional counting can be based on inequalities as well
 - Move to cell E22 and type “**Low stock items**” there. Move to cell F22 and type **=countif(f2.f19,”<20”)** to obtain the answer 12 (the number of items that have less than 20 in stock).
 - Move to cell E23 and type “**Mid Stock Items**” there. Then move to F23 and type **=countif(f2.f19,”>=20”)-countif(f2.f19,”>100”)** to find 5, the number of items between 20 and 100 in stock, including 20 but not including 100. Note that you can also use “<>” as “not equal” and “<=” as “less than or equal to.”
- **Frequencies**
 - Frequencies can do counting of a set of ranges at the same time. To do this manually, you would need to examine each cell in a range and place a hash mark in each “bucket” (“bin”) corresponding to that cell.
 - Assume you need to know how many items cost \$500 and under, \$500.01 to under \$1,000, \$1,000.01 to under \$2,500, \$2,500.01 to under \$5,000, \$5,000.01 to under \$10,000, and above \$10,000. That makes up 6 categories.
 - To provide a set of frequencies, you need to enter an “array formula” and use the **frequency** function. Set it up as follows with the following entries:

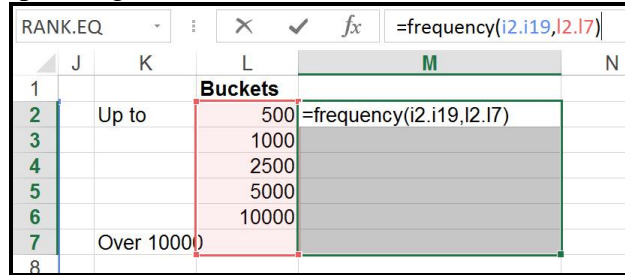
	J	K	L
1			Buckets
2		Up to	500
3			1000
4			2500
5			5000
6			10000
7		Over 10000	

- **Drag a selection from M2 to M7.** Without pressing any other keys, just enter the following formula, which will appear to go into M2. Important: **Do not press Enter↵ at the end.**

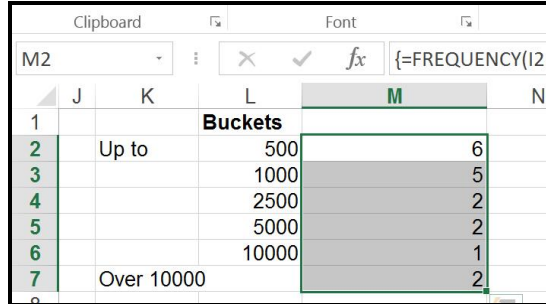
=FREQUENCY(I2:I19,L2:L7)

- **Instead of pressing Enter↵,** press **Ctrl ⇧ Shift Enter↵** at the **same time!** You will see the frequency table transform from the first picture below **before** pressing the three keys, to the second one that shows what you see **after** pressing the three keys (note: I’ve expanded the M column so you can see the entire formula right in the column):

Before pressing **Ctrl** **⇧** **Enter** at the same time, you see:



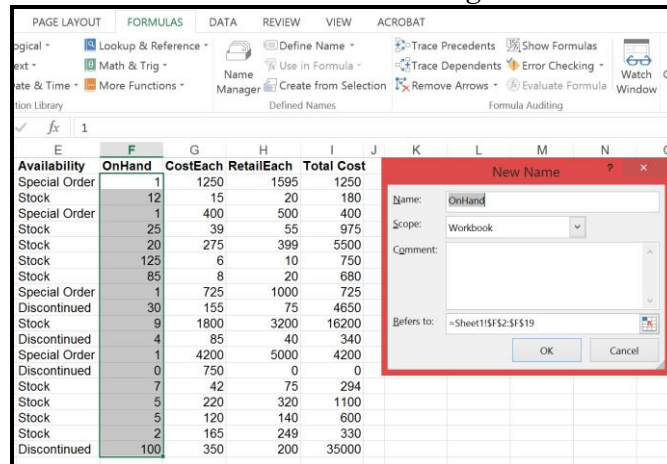
After pressing **Ctrl** **⇧** **Enter** at the same time, you will see:



- If you have any trouble, you can find the answer at www.pitt.edu/~galletta/excel/StoreInventory2.xls. But try to perfect the keystrokes above carefully and you'll get it.

○ **Naming Ranges (preparing for easier correlations and regressions)**

- It is helpful sometimes to name ranges as shorthand
- You can use, for example, the name “OnHand” instead of typing out “F2:F19” if you name the range.
- Here’s how:
 - Click and drag from F2 to F19.
 - In the **FORMULAS** ribbon menu, choose **Define Name** and you will see that it is already nearly done. Excel assumes you want to use the column heading as the name. See below:

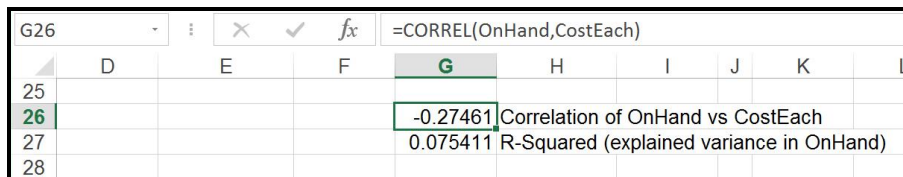


Then click **OK**.

- Now, “OnHand” will be equivalent to using “F2:F19” in a formula.
- Name **CostEach** and **RetailEach** in the same way for practice.

- **Correlations**

- Correlations are useful for analyzing how much effect one variable has on another. In this case, you might want to see if you can explain the quantity of each item’s inventory level by the cost. That is, you want to know if cheaper items (the G column shows the cost for each item) are held in greater quantity (the F column shows the quantity).
- Correlate the data in the F and G columns to find out.
- Move to cell G26 and enter the formula for the correlation:
`=CORREL(OnHand,CostEach)` if you have named the ranges, or
`=CORREL(F2:F19,G2:G19)` if you have not named the ranges
- You can see the formula in the screen shot below.



- The answer (“r”) is -.27, which suggests that they are negatively correlated. The shopkeeper is indeed keeping stocks low for expensive items.
- How wary is the shopkeeper? You can find out by squaring the r value in G26 ($=G26^2$) and you find 7.5%, the amount of explanation the causal variable has on the result (called r-squared or “r²” or the “coefficient of determination”). In this case, you can say that the cost seems to explain 7.5% of the variation in the number of items on hand.
- If you have trouble, the answer is kept in <http://www.pitt.edu/~galletta/excel/StoreInventory3.xls>
- **Simple and Multiple Regression:** Sometimes you might believe that multiple causes determine a result, such as the amount of items on hand AND the cost of each item. Continuing the example, the shopkeeper might not only be keeping inventory cost down, but also might be worried that highly-priced items should not be kept on hand in high quantities as well, given that they might sell more slowly. You can determine how much each contributes to the number of items kept on hand by using linear regression, the LINEST function.
 - There are many features of LINEST and we will make use of many of them in our compact example.
 - The LINEST function expects to be used in an array formula as we saw in the FREQUENCIES function above. The array should be 5 rows tall and the number of causal (independent) variables + 1 wide.
 - We will explain OnHand in two ways: by using CostEach alone, and using CostEach and RetailEach as multiple predictors.
- Simple bivariate (1 predictor) linear regression:
 - If it’s not already loaded, open the “StoreInventory3” example, available at <http://www.pitt.edu/~galletta/excel/StoreInventory3.xls>
 - In G29, type “Linear Regression (1 predictor)”
 - In D31 through D35, type the following:

D31	Beta for predictor
D32	Standard Error for predictor
D33	R-squared for predicting OnHand

D34	F value for the regression
D35	Sum of squares for the regression

- In I31 through I35, type the following:

I31	Constant
I32	Standard Error of the constant
I33	Standard Error of the estimated model
I34	Denominator degrees of freedom for the model
I35	Sum of squares for the residual

- With the long text entries, this leaves a 5 row by 2 column “hole” for the numbers you would want in a regression model. Remember, a regression with one predictor will report 5 rows by 2 columns of numbers (which will appear as a host of unlabeled gibberish unless you enter the labels above).
- The regression formula will be an **array formula** as you encountered in the frequency distribution example above.
- Here’s how:
 - Move to G31 and select a range from G31 to H35.
 - Leaving the whiter space (the range’s home cell) in G31, enter the following formula then press **(Ctrl) (⇧ Shift) (Enter) (↵)** simultaneously: **=LINEST(OnHand, CostEach, TRUE, TRUE)**
 - This provides a linear estimate of the dependent variable (listed first) by the independent variable (listed second). We also enter TRUE to calculate Beta normally, and again TRUE to report “additional” statistics.

The formula, labels, and results can be seen below:

25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
36											

- Notice that the R-Squared value of .075411 (or 7.5411%) is exactly the same as the one in cell G27 that we calculated with the **CORREL** function 2 .
- You would need 1 additional column for each additional regression predictor, as you will see below.
- Regression with two predictors
 - More complex regression is quite powerful, and Excel can do it! The results of a regression with two predictors will come out in an even more bewildering 5-row by 3-column format.
 - Here’s how to do it:
 - If is not already in front of you, load the bivariate example <http://www.pitt.edu/~galletta/excel/StoreInventory4.xls>.
 - In cell G37, type “Linear Regression (2 predictors)”
 - Highlight (drag) from D31 to D35 and COPY the range, to D39 and below, by

- pressing **Ctrl**-C, then move to D39 and press **Ctrl**-V.
- Highlight (drag) from I31 to I35 and COPY the range by pressing **Ctrl**-C.
- Move to J39 and press **Ctrl**-V.
- In cell G38 type “RetailEach” and in H38 type “CostEach”
- In cell I38 type “Intercept”
- With G39 to I43 selected, enter the following array formula, and remember to press **Ctrl**+**Shift**+**Enter** (not just **Shift**+**Enter**) at the end.
- =LINEST(OnHand, CostEach:RetailEach, TRUE, TRUE)**. If you see an error message, it is most likely that you either missed the colon between CostEach and RetailEach or forgot to press **Ctrl**+**Shift**+**Enter** simultaneously. You might need to retype from scratch after selecting the range G31 to I35.
- The results are more complicated but similar. See below.

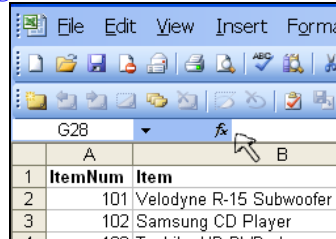
	C	D	E	F	G	H	I	J	K	L	M	
25												
26					-0.274611	Correlation of OnHand vs CostEach						
27					0.075411	R-Squared (explained variance in OnHand)						
28												
29						Linear Regression (1 predictor)						
30												
31		Beta for predictor			-0.010241	30.08916	Constant					
32		Standard error for predictor			0.008965	10.3544618	Standard error of the constant					
33		R-squared for predicting OnHand			0.075411	37.7853826	Standard error of the estimated model					
34		F value for the regression			1.304991	16	Denominator degrees of freedom					
35		Sum of squares for the regression			1863.182	22843.7623	Sum of squares for the residual					
36												
37						Linear Regression (2 predictors)						
38						RetailEach	CostEach	Intercept				
39		Beta for predictor			-0.002912	-0.0065674	30.01172	Constant				
40		Standard error for predictor			0.028103	0.03663621	10.7163	Standard error of the constant				
41		R-squared for predicting OnHand			0.076073	39.0106129	#N/A	Standard error of the estimated model				
42		F value for the regression			0.617522	15	#N/A	Denominator degrees of freedom				
43		Sum of squares for the regression			1879.526	22827.4188	#N/A	Sum of squares for the residual				

- R-squared has improved a little, but not much, at .076073.
- The beta and standard error values for the predictors are listed under the new titles in the first two rows (39 and 40).
- The last three rows describe the overall model. Ignore the #N/A values; they are meant to be empty.
 - The next row (41) provides the R-squared model and the standard error of the model.
 - Row 42 provides the F-value of the regression and the denominator degrees of freedom.
 - The last row (43) provides the Sum of squares for the regression (often called SSR) and the sum of squares of the error (residual) (often called SSE).
- If you have any trouble, the answer appears in <http://www.pitt.edu/~galletta/excel/StoreInventory4.xls>.

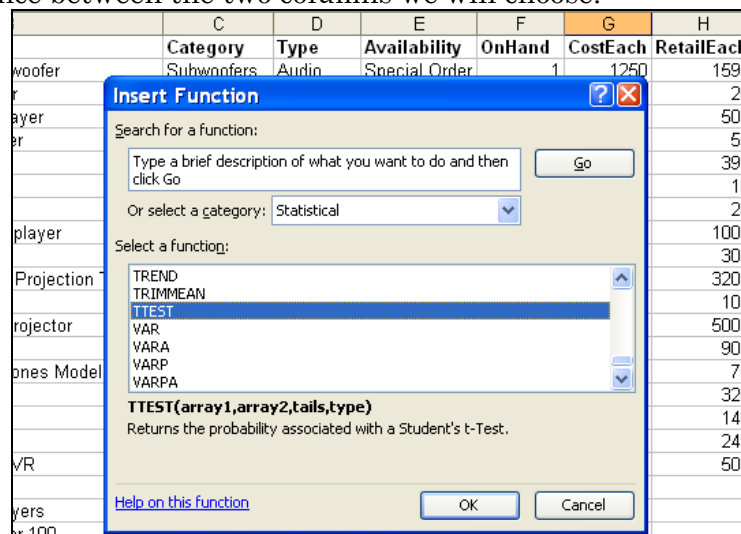
- **Testing for Differences**

- You can do a simple test to see how different the two columns are. This function is a bit more complicated and has several options. Therefore, it might be better to invoke this one with the wizard. Just go to a spare cell and click the **f(x)** button to the left of the text input area. You can use the current spreadsheet or load

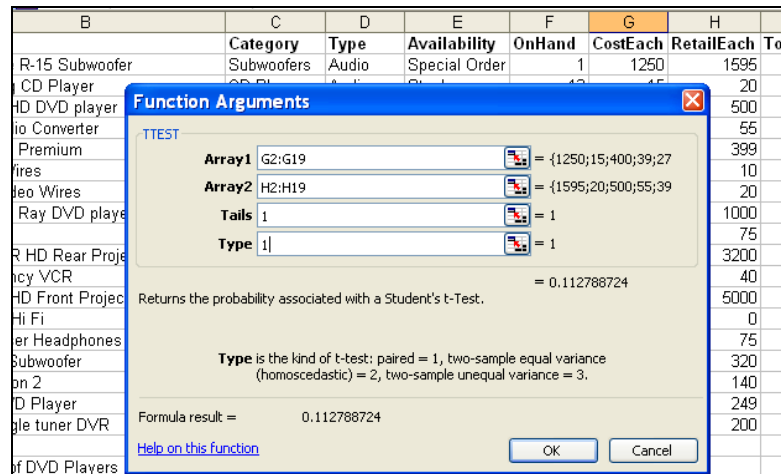
<http://www.pitt.edu/~galletta/excel/StoreInventory1.xls>.



- Then you can choose the category “Statistical” and find T.TEST (note: In older versions of Excel it is just TTEST). The explanation at the bottom tells us that it gives us the probability value associated with the student’s T distribution. For our purposes, it tells us the likelihood that there is a difference between the two columns we will choose.



- If we click , we see a screen to enter parameters for our test. We want to make sure there is a difference between the cost and retail values. To enter the arrays, you can either type them or click on the symbol at the right of the input window and click and drag the columns. It is a 1-tailed test because we hypothesize that retail is higher than cost. It would be a 2-tailed test if we did not predict a direction. It is a paired test because each cost is paired with each retail value. Statistics buffs: please assume this is a sample of a large store’s inventory.
- Our two arrays are the CostEach and RetailEach columns, G2:G19 and H2:H19. In the regression examples we named them but we will not assume names in this example. Therefore, for Array1 enter **G2:G19** and for Array2 enter **H2:H19**. For Tails enter **1** and for Type enter **1**.

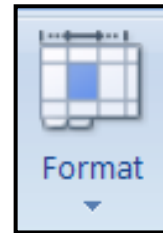


- We see the answer even before clicking (see the above wizard, toward the bottom, where it says “formula result”). We can see that the probability is 11% that we would be wrong in stating that the retail exceeds the cost. That suggests there is a problem. Look at the data and find several obsolete items where cost exceeds retail. If you enter values that comfortably exceed cost for those items, you will find the probability plunge to a very small number (perhaps 1%). Therefore, the retail for each item definitely seems to exceed the cost.
- **Financial Functions:** Financial functions can be entered directly with numbers as their parameters or as cell ranges as their parameters. Naturally, as discussed earlier, it would be best to place the parameters into cell locations. One thing to keep in mind is that the rate **MUST** match the period of time. If you have a monthly period, then make sure the number of periods are months, not years, and make sure the interest rate is expressed per month, not per year. Examples are:
 - **=PMT(rate,nper,pv,fv,type)** Computes the monthly payment on a loan. The rate, number of periods, amount of the loan (present value) are all required items. FV is the future value, or what you will pay the loan down to. Type is 0 if payment is made at the beginning of the month and 1 at the end of the month. Example: =pmt(.06/12,15*12,140000) calculates a monthly payment (negative) of 1181.40.
 - **=CUMIPMT(rate,nper,pv,start_period,end_period,type)**. Computes the amount of interest paid between “start_period” and “end_period,” The final item, “type,” must be 0 if payment is made at the beginning of the period and 1 if at the end. Example: =cumipmt(.05/12,360,140000,1,12,0) finds interest paid (negative number) during the first year of a 30-year \$140,000 mortgage, or \$6,953.09.
 - **=PV(rate,nper,pmt,[fv],[type])**. The great equalizer—Computes the present value of future regular flows. Money is worth more now than in the future, and this discounts future values based on the rate.
 - **=FV(rate,nper,pmt,[pv],[type])**. The opposite of PV—tells you how much investments or savings now will be worth in the future. The important thing with FV is that you **either** provide the payment (PMT) **or** the present value (PV), not both. If a payment, it assumes there are a string of them over the **nper** periods.
 - **=NPV(rate,values)** Computes the net present value of an investment (a negative number) along with inflows (positive numbers) given the cost of capital (rate). The string of values should have a negative number and several positive values in order of their receipt. See the example below.
 - **=IRR(values,guess)** is the other side of NPV, and computes the interest rate in a

string of payments. The rate is computed per period. The values can be situated on several columns or rows.

- Two examples will help make this more practical.
- **Example 1.** The first illustrates NPV and IRR and can be found in the file <http://www.pitt.edu/~galletta/excel/investments1.xls>

	A	B
1	Investment Analysis	
2		
3	Initial Investment	-1000
4	Income in Year 1	130
5	Income in Year 2	140
6	Income in Year 3	170
7	Income in Year 4	190
8	Income in Year 5	200
9	Income in Year 6	220
10	Income in Year 7	250
11	Income in Year 8	290
12	Income in Year 9	310
13	Income in Year 10	375
14		
15	Cost of Capital, annually	4%
16		
17	Internal Rate of Return	
18	Net Present Value	
19		



- First, let's center the title. Click on A1 and drag over to B1. From the **Home** ribbon, click on the **Format** icon (shown at the right), then **Format Cells**. Click on the **Alignment** tab. Click the drop down list for **Horizontal** and choose **Center Across Selection**. See below.

- Then we can insert the formulas that are needed:
 - At B17, insert =IRR(b3:b13)
 - At B18, insert =NPV(B15,B3:B13)
- Results are shown to the right.

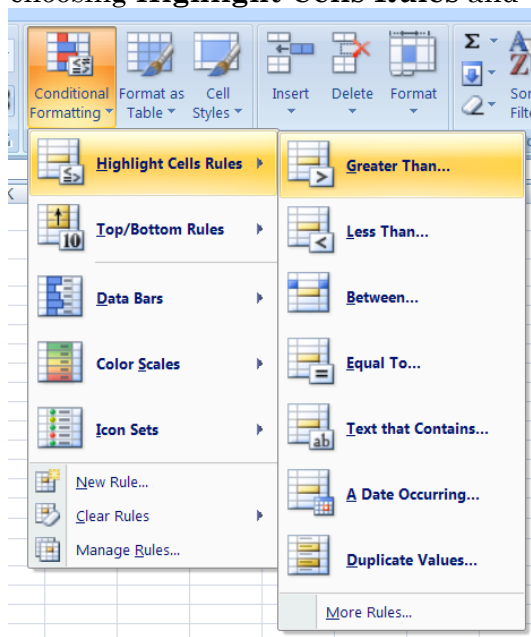
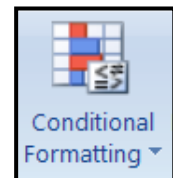
	A	B
1	Investment Analysis	
2		
3	Initial Investment	-1000
4	Income in Year 1	130
5	Income in Year 2	140
6	Income in Year 3	170
7	Income in Year 4	190
8	Income in Year 5	200
9	Income in Year 6	220
10	Income in Year 7	250
11	Income in Year 8	290
12	Income in Year 9	310
13	Income in Year 10	375
14		
15	Cost of Capital, annually	4%
16		
17	Internal Rate of Return	15%
18	Net Present Value	\$749.28
19		

- **Example 2.** The second example compares a 2-week time-share against spending money on 14 days worth of hotels each year over 15 years. Load the file <http://www.pitt.edu/~galletta/excel/timeshares.xls>

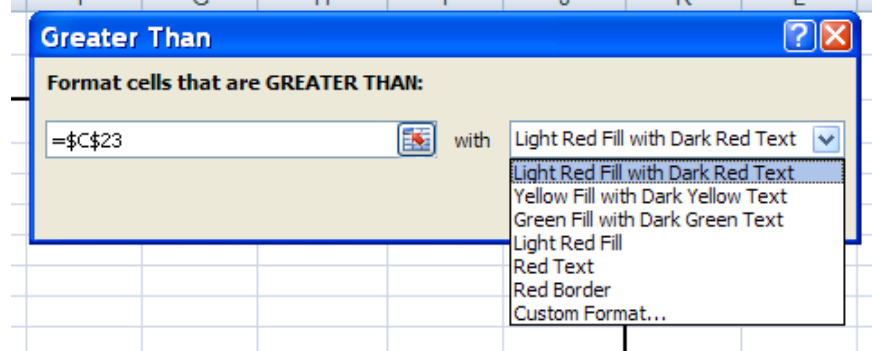
	A	B	C	D	E	F	G	H	I	J
1		Time Share versus Hotels								
2										
3		Time Share - Two Week Plan								
4		Purchase Price	20000							
5		Interest Rate	6%							
6		Number of years	15							
7		Annual Maintenance Fees	1750							
8		Down payment	2000							
9		Sale value after loan period	7000							
10										
11		Payments per month	(\$151.89)	plus maintenance fee		145.83	=	(\$297.73)	monthly payments	
12		Interest during first year	-964.41							
13		Future value of payments	(\$84,492.93)							
14		Present value of payments	(\$34,429.39)							
15										
16										
17		Hotel - Two Weeks Vacation Per Year								
18		Average daily hotel cost	220							
19		Cost of capital	6%	(taken from c5 or customize)						
20		Number of years	15	(taken from c6 or customize)						
21										
22		Future value of payments	(\$74,643.47)							
23		Present value of payments	(\$30,415.90)							
24										
25										
26										
27		PV Results:	Just use a hotel							
28										

- The assumptions are listed in each box.
- Some of the formulas might look a little complicated. But they are just combinations of simpler functions.
- The time share payments are based on the PMT function (payments per month). The formula is =PMT(C5/12,C6*12,C4-C8). The parameters are rate, periods, and sale price minus down payment.
- The maintenance fee is divided by 12 for the monthly amount and added to the monthly payment. Payment results from PMT are negative, so to add the maintenance fee would make an error. It is subtracted from the negative number to yield a larger negative number.
- Interest during the first year comes from the cumipmt function and is =CUMIPMT(C5/12,C6*12,C4-C8,1,12,1). The parameters are rate, total number of months, present value (sale price minus down payment), start payment number, end payment number, and type.
- Future value of time share payments is computed in three pieces given the cash flows. =FV(C5/12,C6*12,-H11)+C9+FV(C5/12,C6*12,,C8) provides three future values added together. The first is the monthly payment brought to the future (rate per period, number of periods, and the monthly payment). The second part is the expected sale price (already in the future). The third is another future value calculation, addressing the down payment required, which has the same rate and number of periods, but it skips the payment parameter and goes right to the down payment parameter.
- Future value of the hotel payments is one future value calculation: =FV(C19/12,C20*12,C18*14/12,) – Takes the cost of capital, number of periods, and payment per period.
- Present value of the time share payments is rounded to 2 decimal places for making

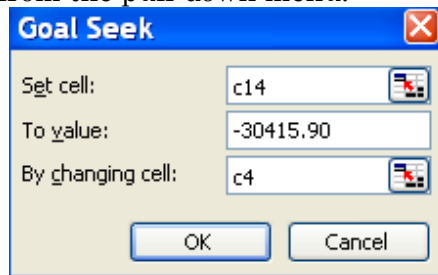
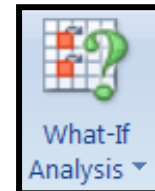
- a key comparison. Within the rounded calculation are three present values.
 $=\text{ROUND}(\text{PV}(\text{C}5/12,\text{C}6*12,-\text{H}11)-\text{PV}(\text{C}5/12,\text{C}6*12,\text{C}9),2)-\text{C}8$. The first is the string of payments made each month. The second is the sale price after the loan is finished. The third is the down payment required now, already at present value.
- Present value of the hotel payments is also one calculation, but rounded to 2 decimal places. The calculation $=\text{ROUND}(\text{PV}(\text{C}19/12,\text{C}20*12,\text{C}18*14/12),2)$ takes the present value of the monthly cost of capital, the number of payments, and the monthly cost of the hotel. The cost is first annualized (7 days * 2 weeks * nightly hotel room cost) then divided by 12 for a monthly cost.
 - There is a comparison in C27, where you will get a message that depends on a comparison between the two present values. We will omit the future values and focus only on present value.
 - The formula is a logical function, a double-IF statement. The format of an IF statement is **=if(condition, truevalue, falsevalue)**. The condition is most often an equality or inequality statement. The truevalue is what is to go into the cell if the condition is true. The falsevalue is what is to go into the cell if the condition is false. You can insert another IF statement into where the false value goes because there could also be a condition of when the two values are equal. Note that you need two parentheses at the end.
 - The function used is (all on one line):
=IF(C14<C23,"Just use a hotel",IF(C14>C23,"This time share is better","Both are the same"))
 - The spreadsheet also uses **conditional formatting**, so that the better option is colored in pale orange, has a square around it, and the text is bolded.
 - To do this, click in the cell you want to format conditionally. In this case, C14.
 - From the **Home** ribbon, click the **Conditional Formatting** icon (see the icon to the right of this text).
 - Choices will include the following shown below. In this case you want to format by highlighting whenever the cell value is greater than that of C23. So we begin by choosing **Highlight Cells Rules** and **Greater Than...**



- The following window will pop up.



- Refer to the cell for which you want a comparison (C23 in this case). You can click on the cell itself and it automatically fills in =\$C\$23. A default style shows up, but you can choose **Custom Format** then pick your own colors, fonts, etc.
- Do the same in C23, comparing it to see if it is greater than C14.
- Enter a very low value as the time share price, then a high value.
- Goal seeking
 - The next question will be, when are the two present values equal? Well, to answer this, you can manipulate all factors endlessly, but we will simplify and assume cheaper and cheaper time-shares.
 - Two ways to do this: trial-and-error, entering smaller and smaller values for the time-share until they become equal.
 - Another way to do this is to use Goal-Seeking:
 - From the **Data** ribbon, Click on the **What-If Analysis** icon (shown at the right) choose **Goal Seek** from the pull-down menu.



- The process is to try to get the present value of the time share (in C14) equal to the present value of the hotel payments (-30,415.90).
- The cell C4 is the one to experiment with in this analysis, so it goes into the third slot (By changing cell C4)
- Click and you will see 15,986.51 entered into C4. So much for trial-and-error!

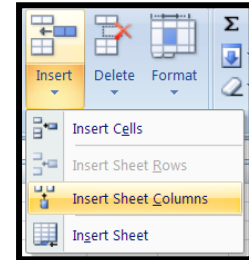
Mail-Merges from Excel Spreadsheets

1. You can tailor-make letters or emails with inserted text (names, addresses, and other information) that can be found in an Excel spreadsheet.
 - Example: Imagine a sheet with the following. You can find it at <http://www.pitt.edu/~galletta/excel/ResumeList.xls>
 - Notice that two records have a special sentence in column G that is tailored to the record that it is on. See below.
 - Note that email addresses are placed in column H but are not shown below.

	A	B	C	D	E	F	G
1	Greeting	Name	Company	Address	CityStateZip	SpecialText	Phone
2	Larry	Landis, Larry	Landis Mfg.	111 Landauer St.	Pittsburgh, PA 15010		412-555-1234
3	Ms. Louden	Lauden, Laurie	Brandis Products	21 Bandair St.	Erie, PA 16501	One thing I would like to	814-555-1235
4	Stevie	Jameson, Steve	JK Excavating	104 Hazel St.	Pittsburgh, PA 15002		412-555-1236
5	Mr. or Ms. Nugender	Nugender, Pat	Newage Mfg.	412 Broadway	New York, NY 10022	It has been my fantasy to	201-555-1237
6							
7							

- The goal is to create letters that insert the items into the spreadsheet and address envelopes for each item. The items are not quite in the form that is needed. We will fix that.
 - If you have enough for bulk mailing, you will need to sort by zip code. You would need to split the CityStateZip column like we will the First and Last names. This will not be illustrated here but will be a good exercise for you.

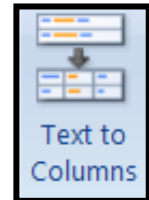
- The first step will be to split the Name field into two, first name and last name. We need to add two columns for this. Click on column C, drag to D, then click the **Insert** icon from the **Home** ribbon (see the icon to the right). Because columns C and D were chosen, Excel already knows you want to insert columns. If you want a little more control, you can also click the little triangle below the Insert icon and have other options. and you will see the options shown to the right.



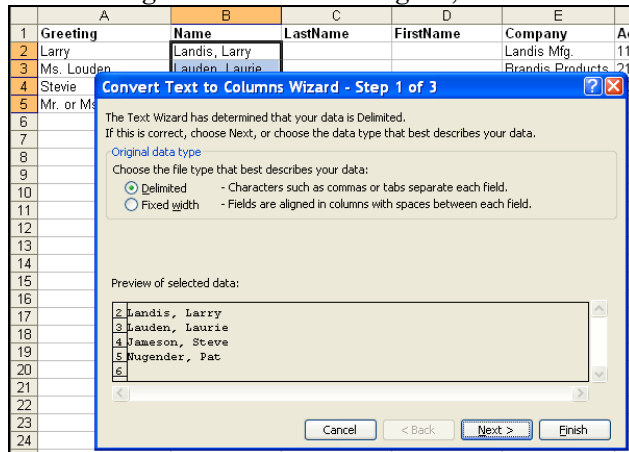
- After adding the columns, you will see this:

	A	B	C	D	E	F	G	H	I
1	Greeting	Name			Company	Address	CityStateZip	SpecialText	Phone
2	Larry	Landis, Larry			Landis Mfg.	111 Landauer St.	Pittsburgh, PA 15010		412-555-1234
3	Ms. Louden	Lauden, Laurie			Brandis Products	21 Bandair St.	Erie, PA 16501	One thing I would like to	814-555-1235
4	Stevie	Jameson, Steve			JK Excavating	104 Hazel St.	Pittsburgh, PA 15002		412-555-1236
5	Mr. or Ms. Nugender	Nugender, Pat			Newage Mfg.	412 Broadway	New York, NY 10022	It has been my fantasy to	201-555-1237
6									
7									

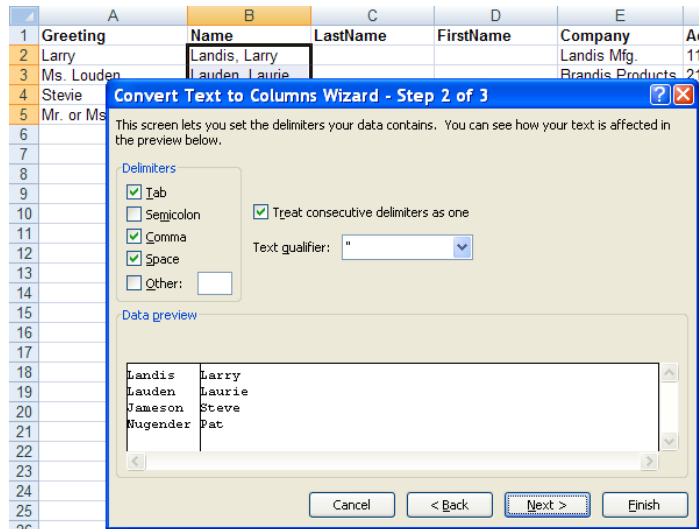
- You can click on the little paintbrush in the window that popped up over the word “Company” (top of column E) and elect to format the same as the cells to the left (with boldfaced first row). I will call these columns **LastName** and **FirstName**.



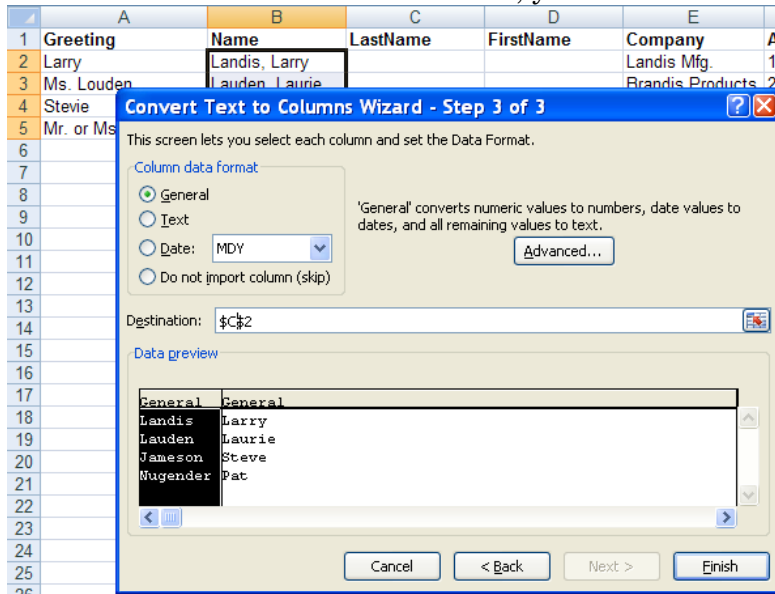
- Select all of the names. On the **Data** ribbon, click the **Text to Columns** icon (see it to the right. The wizard begins, as shown below.



- It is set to “Delimited,” which is the default and is what we want in this case. Click **Next**. The next screen allows you to choose the comma and space delimiters. When you choose the comma delimiter (see the checkmark below next to “comma,” the names split apart as desired but there is still a space before the first name. Also put a checkmark next to “space.” I’ve left the checkmark next to “Tab” just in case there are any tabs in the entries.



8. Click **Next**. If you **ONLY** selected the names, enter C2 (or \$C\$2 as shown below) as the location and click **Finish**. If you selected the entire column B, including the headings, enter \$C\$1 as the location and click **Finish**. If so, you'll have to fix the headings.



9. The result is shown below

	A	B	C	D	E	F	G	H	I
1	Greeting	Name	LastName	FirstName	Company	Address	CityStateZip	SpecialText	Phone
2	Larry	Landis, Larry	Landis	Larry	Landis Mfg.	111 Landauer St.	Pittsburgh, PA 15010		412-555-1234
3	Ms. Louden	Lauden, Laurie	Lauden	Laurie	Brandis Products	21 Bandair St.	Erie, PA 16501	One thing I would like to	814-555-1235
4	Stevie	Jameson, Steve	Jameson	Steve	JK Excavating	104 Hazel St.	Pittsburgh, PA 15002		412-555-1236
5	Mr. or Ms. Nugender	Nugender, Pat	Nugender	Pat	Newage Mfg.	412 Broadway	New York, NY 10022	It has been my fantasy to	201-555-1237

10. Next save this spreadsheet somewhere where you can find it.
 11. The next step is to generate the letter or email in Word. Start a blank document and write a clever letter that will convince someone to hire you, as shown below. Actually, I hope yours is a lot more clever than this one.

10 High Fallutin' Road
Importance, PA 15000
January 1, 2010

Dear ..

I don't want to waste your time. Please read my 20-page resume, enclosed, and please offer me the highest paying position in your firm. I will do better than the incumbent, so you might as well lay him or her off right now.

Please contact me within the next 30 minutes and I'll accept the job if it pays more than my current job, \$120,000. Well, I don't really have that job right now but last year the firm said they would call me back very soon.

Sincerely,

Bob Builder

12. The next step is to start the mail-merge wizard. Click on the **Mailings** ribbon then click the small black triangle just under the **Start Mail Merge** icon. If you want to send an email, click the **Email messages** option. Otherwise, you can click **Letters** or other formats.
13. The next step is to click the icon **Select Recipients**. Choose **Use Existing List** because we will use the spreadsheet we saved up in step 10.
14. Click the **My Documents** link at the right, or whatever other folder you used, to find the existing set of recipients you saved in step 10.
15. You can click the **Edit Recipient List** icon to select certain people.
16. Move your cursor just below the date. Notice that the **Insert Merge Field** icon has become activated since you loaded the file. You can now click on the **Insert Merge Field** icon then double-click each item that needs to be merged in the inside address area. Do not worry about spacing at the moment. Your Word document will now have a new line as follows:

«FirstName»«LastName»«Company»«Address»«CityStateZip»

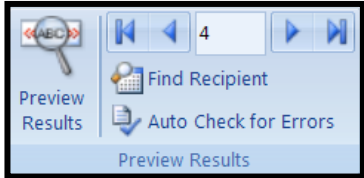
17. Then move between the «First Name» and «Last Name» merge fields and notice that the LastName field is highlighted in grey, and your insertion pointer disappears. Press the space bar to spread them apart. Move between each of the other fields and press to cause each to move to the next line.
18. Move just before the comma after "Dear" and click the triangle below the icon **Insert Merge Field** once again. Choose **Firstname** by double-clicking or clicking once then .
19. Move to the end of the first paragraph, add a space, and insert the "SpecialText" field in the same way.
20. Your letter should appear as shown below.

«FirstName» «LastName»
 «Company»
 «Address»
 «CityStateZip»

Dear «FirstName»,

I don't want to waste your time. Please read my 20-page resume,
 offer me the highest paying position in your firm. I will do better
 you might as well lay him or her off right now. «SpecialText»

21. The next step is to preview the results--click the **Preview Results** icon (see right).
22. You will see a preview of your letter and it shows which recipient this represents. You can click the right and left arrows to move backwards and forwards in the list of recipients and see what the letter looks like for each person. Recipient 2, with special text, is shown below.



Laurie Louden
 Brandis Products
 21 Bandair St.
 Erie, PA 16501

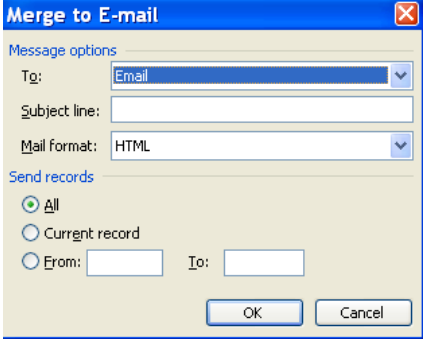
Dear Laurie,

I don't want to waste your time. Please read my 20-page resume, enclosed, and please offer me the highest paying position in your firm. I will do better than the incumbent, so you might as well lay him or her off right now. One thing I would like to point out, Ms. Louden, is that I worked for Brandis products for each of the previous three summers, and that my father is an 80% stockholder of your company. Therefore, I am confident that you will find my resume to be of interest!

Please contact me within the next 30 minutes and I'll accept the job if it pays more than my current job. \$120,000. Well, I don't really have that job right now but last year the



23. Each field has been filled in automatically. You can print each letter separately right here, or better yet, print or email all of them by clicking the icon **Finish and Merge**. Done!
24. You can click the **Start Mail Merge** icon anytime and select **Email messages** instead of **Letters**. **Finish and Merge** will “know” how to handle it at this point.
25. When you click **Finish and Merge**, you can choose **Send Email Messages** then fill in the options. The field called **Email** is automatically chosen—Word found it. Fill in the subject line, choose the format, choose the records, and click .



26. They will be sent out through the default email program defined in Windows. You might have to answer some questions from your email package if it gets suspicious.

Concatenating cells

1. If you accidentally deleted or overwrote the original **Name** column, you can recreate it by using the **Concatenate** function.
2. With **Concatenate**, simply move to the cell where you want the names to be combined once again and type =concatenate followed by the items to squeeze together as parameters in the form (text1, text2, text3,...).
3. In this case, we want to recreate it exactly. We will need to provide as parameters the Last Name then a “, “ (double quote mark, comma, space, then a second double quote mark), then the First Name. See the entry for D2 below. The function has been copied down to the other rows. Note that the comma within the double quote marks is treated as text. Anything can be placed inside the double quote marks except for a double quote mark!

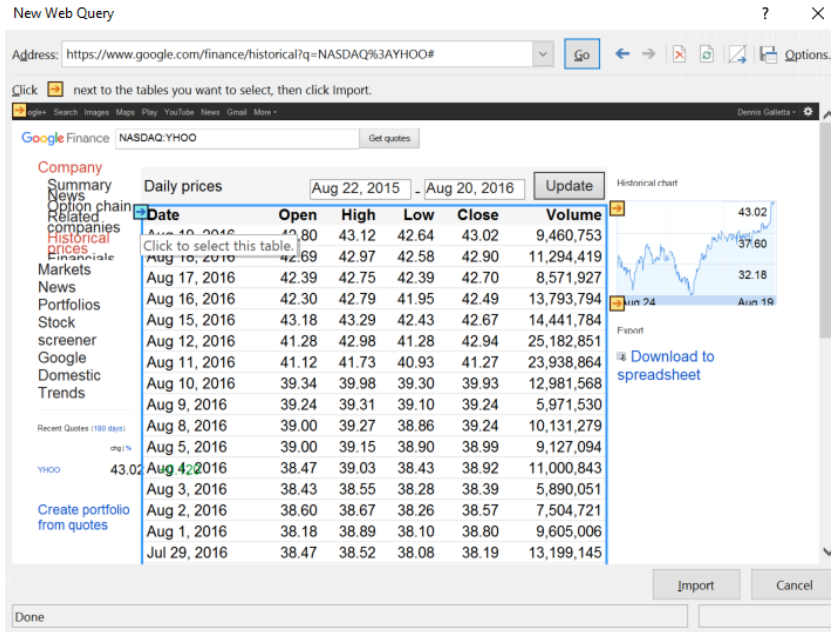
	B	C	D	
1	LastName	FirstName	Name	Com
2	Landis	Larry	Landis, Larry	Land
3	Lauden	Laurie	Lauden, Laurie	Bran
4	Jameson	Steve	Jameson, Steve	JK E
5	Nugender	Pat	Nugender, Pat	New
6				

4. If you want First Name first, separated by a space, the formula would be =concatenate(C2, “ “, B2)

Pulling In External Data

A very useful feature is to pull in data from an external spreadsheet from a Website. There are other ways to pull in data, but this one is probably the one you will find most useful. Here are the steps:

1. Open a web browser. Navigate to Google Finance (<http://finance.google.com>).
2. Go to the search field and enter YHOO
3. Click on the “Historical Prices” link in the left column.
4. You see a nice juicy table at the right, after you scroll down a little.
5. You can also get there by clicking here:
<https://www.google.com/finance/historical?q=NASDAQ%3AYHOO>
6. Copy that URL into your clipboard (**Ctrl**C)
7. Go back to your Excel window and create a new spreadsheet (**Ctrl**N)
8. On the DATA icon ribbon, click the **From Web** icon at the left.
9. A smaller window containing what looks like a web browser (because it is a web browser) will pop up. Paste the URL into the “Address” field at the top (**Ctrl**V).
10. See the example below (Excel 2016 layout and color scheme; other versions will be very similar):



11. Each of what it thinks is a table will have a yellow icon. You'll see the yellow icon at the main DAILY PRICES table.
12. Click on the yellow arrow indicating that table and a blue box will enclose the table. In Excel 2016 the numbers will all highlight in blue. Then click the IMPORT button at the bottom. Remember you're still in Excel but in a special dialog box.
13. Click A1 for the cell to put the table, and voila! A table has appeared in Excel with all the data. There's no longer a need to type all of what you see on line!

Sensitivity Analysis with Data Tables and Conditional Formatting

These next two examples make it possible to fine-tune your understanding of how secure you are in your projections. Excel has a built-in procedure for doing "what if" analysis of how far off you might be before trouble starts. Both examples can be found in the spreadsheet at <http://www.pitt.edu/~galletta/excel/datatables2007-2016.xls>. See the "One-input Table" and "Two-input Table" tabs at the bottom of the worksheet. These same instructions are placed on each worksheet. Answers can be found at <http://www.pitt.edu/~galletta/excel/datatables2007-2016answer.xls>

1. Set up the sheet with any reasonable model. (the Assumptions and Forecast Income Statement)
2. Choose an input that you wish to adjust. The interesting inputs are often in a separate "Assumptions" area. We choose Cost of Sales%
3. Insert the label for the inputs to the left of the table (in A20 in our example--For a vertical label, drag from cells A20 to A26. Click the **Format** icon on the **Home** ribbon then **Format Cells** then **Alignment**. Under Vertical choose "distributed" and check the Merge Cells option. Dial up the Orientation arrow to 90 degrees. Click
4. Enter variations of the input as row headings (in this example, in B21 through B27). Provide reasonable variation.

	A	B	C	D	E
1					
2	Assumptions				
3		Cost of Sales %	36%		
4		SG&A	200		
5		Tax Rate	35%		
6					
7	Forecast (millions)				
8		Sales	325		
9		Cost of Sales	117		
10		Gross Profit	208		
11		SG&A	200		
12		EBIT	8		
13		Interest	5		
14		EBT	3		
15		Taxes	1		
16		Net Income	2		
17					
18	Sensitivity Analysis (millions)				
19			Net income	EBIT	
20					
21	Cost of Sales %				
22			32%		
23			34%		
24			36%		
25			38%		
26			40%		
27			42%		
28		44%			

5. Provide titles in C19 and D19 for items you wish to evaluate. In this example we want to know Net Income and EBIT if the Cost of Sales % varies
 6. Under the titles, point to where each item is in your model. For example, in C20 enter =C16 and D20 enter =C12
 7. "Hide" entries in C20 and D20--click and drag from C20-D20--then **Format** from the **Home** ribbon, then **Format Cells** then **Number** then **Custom** then type " " in the type area. Then
 8. Determine the corner of the table above the new percents you are trying and left of the new table. In this case it is B20. Then click there and drag to the lower right corner (in this case, D27).
 9. Click the **Data** ribbon and select the **What-if Analysis** icon then choose **Data Table**.
 10. Enter the cell address for the main input (in this case, Cost of Sales%, or C3)
 11. Click and you have an analysis of what happens to Net Income if Cost of Sales% "wanders" a bit.
- To highlight the danger, use conditional formatting.
 - Highlight all of the cells in the table (from C21 to D27).
 - From the **Home** ribbon, chose the **Conditional Formatting** icon.
 - Choose **Highlight Cells Rules** and "less than" and insert 0 into the comparison field.
 - Define the custom format you want or accept the default, then click . The result is shown to the right.

	A	B	C	D	E
1					
2	Assumptions				
3		Cost of Sales %	36%		
4		SG&A	200		
5		Tax Rate	35%		
6					
7	Forecast (millions)				
8		Sales	325		
9		Cost of Sales	117		
10		Gross Profit	208		
11		SG&A	200		
12		EBIT	8		
13		Interest	5		
14		EBT	3		
15		Taxes	1		
16		Net Income	2		
17					
18	Sensitivity Analysis (millions)				
19			Net income	EBIT	
20					
21		32%	10	21	
22		34%	6	15	
23		36%	2	8	
24		38%	-2	2	
25		40%	-7	-5	
26		42%	-11	-12	
27		44%	-15	-18	
28					

Two-input Data Table

If this isn't enough fear about contingencies, then try it with two inputs! You probably realize that it is probably unrealistic to only expect one input to vary a little. Fortunately, a sensitivity analysis with two inputs is actually not really any more difficult than an analysis with one input. Pull up the <http://www.pitt.edu/~galletta/excel/datatables2007.xls> sheet and click on the "Two-input Table" tab at the bottom. Here are the instructions, separated into the part that has already been done and the part that is still to be done.

- Steps already done**
 1. Set up the sheet with any reasonable model.
 2. Choose two inputs that you wish to adjust. The inputs are often in a separate "Assumptions" area.
 3. Insert the labels for the inputs. (See instructions for the vertical label above).
 4. Enter variations of each input as column and row headings. Provide reasonable variation.

See the Two-Input table example below.

	A	B	C	D	E	F	G	H	I
1									
2		Assumptions							
3		Cost of Sales %	36%						
4		SG&A	200 million						
5		Tax Rate	35%						
6									
7		Forecast (millions)							
8		Sales	350						
9		Cost of Sales	126						
10		Gross Profit	224						
11		SG&A	200						
12		EBIT	24						
13		Interest	5						
14		EBT	19						
15		Taxes	7						
16		Net Income	12						
17									
18		Sensitivity Analysis							
19					Cost of Sales %				
20			30%	32%	34%	36%	38%	40%	42%
21	SG&A	160							
22		180							
23		200							
24		220							
25		240							
26		260							
27		280							

□ **New Steps**

- Click on the corner of the table--to the left of the column inputs and above the row inputs: in this case B20
 - Enter the goal (net income in this case, or =C16)
 - "Hide" entry in B20—From the **Home** ribbon click the **Format** icon then **Format Cells** then **Number** then **Custom** then type " " in the **type** area.
 - Click on that cell and drag to the lower right corner (in this case, from B20 to I27)
 - From the **Data** ribbon click the **What-if Analysis** icon then select **Data Table**.
 - Enter the formula for the horizontal label as the row item (in this case, Cost of Sales%, or C3)
 - Enter the cell address for the vertical label as the column item (in this case, SG&A, or C4)
 - Click and you have an analysis of what happens to Net Income if Cost of Sales% and SG&A "wander" a bit.
 - Use conditional formatting to pinpoint possible trouble.
- See the finished spreadsheet below. Notice the risk of loss!

	A	B	C	D	E	F	G	H	I
1									
2		Assumptions							
3		Cost of Sales %	36%						
4		SG&A	200 million						
5		Tax Rate	35%						
6									
7		Forecast (millions)							
8		Sales	350						
9		Cost of Sales	126						
10		Gross Profit	224						
11		SG&A	200						
12		EBIT	24						
13		Interest	5						
14		EBT	19						
15		Taxes	7						
16		Net Income	12						
17									
18		Sensitivity Analysis							
19					Cost of Sales %				
20			30%	32%	34%	36%	38%	40%	42%
21	SG&A	160	52	47.45	42.9	38.35	33.8	29.25	24.7
22		180	39	34.45	29.9	25.35	20.8	16.25	11.7
23		200	26	21.45	16.9	12.35	7.8	3.25	-1.3
24		220	13	8.45	3.9	-0.65	-5.2	-9.75	-14.3
25		240	0	-4.55	-9.1	-13.65	-18.2	-22.75	-27.3
26		260	-13	-17.55	-22.1	-26.65	-31.2	-35.75	-40.3
27		280	-26	-30.55	-35.1	-39.65	-44.2	-48.75	-53.3

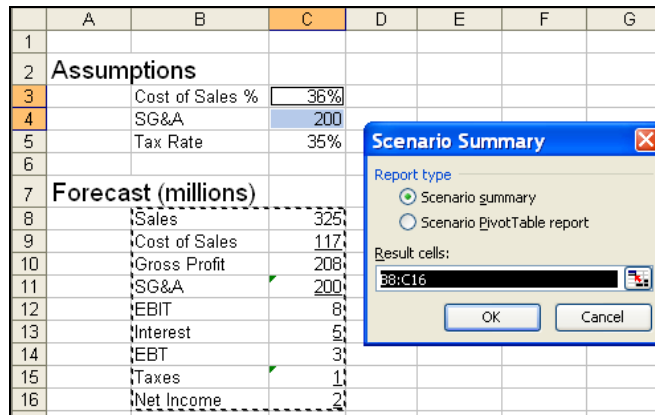
Scenarios

A similar goal can be reached with scenarios. We will begin with a very simple income statement, available at <http://www.pitt.edu/~galletta/excel/scenarios.xls> (see the spreadsheet at right). Scenarios can be labeled and will provide information that is defined in each scenario. We will create an optimistic scenario and a pessimistic scenario and manipulate the Cost of Sales%.

	A	B	C
1			
2	Assumptions		
3		Cost of Sales %	36%
4		SG&A	200
5		Tax Rate	35%
6			
7	Forecast (millions)		
8		Sales	325
9		Cost of Sales	117
10		Gross Profit	208
11		SG&A	200
12		EBIT	8
13		Interest	5
14		EBT	3
15		Taxes	1
16		Net Income	2
17			

- First, click the **Data** ribbon, then the **What-if Analysis** icon, then **Scenario Manager**.
- Click the Add button to create a scenario.
- Type “Pessimistic” as the scenario name.
- Tab to the “changing cells” field, then click directly on C3 and drag to C4. Move the dialog box if necessary.
- Click
- It is asking you to enter values for the changing cells.
- Enter .4 for the value of C3 and 230 as the value for C4.

- Click **Add** to enter the next scenario.
- Use .3 for C3 and 180 for C4.
- Click **Add** for one more scenario.
- Call this one “No Sales”
- Tab to the “changing cells” field, then type (or click on cell) C8
- Use 0 for C8 then click
- You will now have the following set of scenarios. Beware clicking the button marked Show! It will permanently change your spreadsheet! Don’t worry—it’s not really permanent. You always have the UNDO function.
- Click the button marked **Summary**. A new dialog box will pop up. Leave the selection as “Scenario Summary” and choose the entire income statement (including labels and numbers) for “Result cells.” See below.



- Results are placed into a new spreadsheet and are provided complete with outline bars. See below for the report that describes pretty completely what will occur under each scenario. You can make many different types of assumptions, such as uncollectible percentages, suppliers who fail to deliver, dates of completion, etc. Just make sure you name each one clearly enough so that you know what each means. In the example, “No sales” is an excellent title.

The screenshot shows an Excel spreadsheet with the following data:

Scenario Summary				
	Current Values	Pessimistic	Optimistic	No sales
Changing Cells:				
\$C\$3	36%	40%	30%	36%
\$C\$4	200	230	180	200
\$C\$8	325	325	325	0
Result Cells:				
\$B\$8	Sales	Sales	Sales	Sales
\$C\$8	325	325	325	0
\$B\$9	Cost of Sales	Cost of Sales	Cost of Sales	Cost of Sales
\$C\$9	117	130	98	0
\$B\$10	Gross Profit	Gross Profit	Gross Profit	Gross Profit
\$C\$10	208	195	228	0
\$B\$11	SG&A	SG&A	SG&A	SG&A
\$C\$11	200	230	180	200
\$B\$12	EBIT	EBIT	EBIT	EBIT
\$C\$12	8	-35	48	-200
\$B\$13	Interest	Interest	Interest	Interest
\$C\$13	5	5	5	5
\$B\$14	EBT	EBT	EBT	EBT
\$C\$14	3	-40	43	-205
\$B\$15	Taxes	Taxes	Taxes	Taxes
\$C\$15	1	-14	15	-72
\$B\$16	Net Income	Net Income	Net Income	Net Income
\$C\$16	2	-26	28	-133

Notes: Current Values column represents values of changing cells at time Scenario Summary Report was created. Changing cells for each scenario are highlighted in gray.

Lookup Tables

A very useful function is available in Lookup Tables. We will do a 1-dimensional and a 2-dimensional lookup. They can be done horizontally (HLOOKUP) and vertically (VLOOKUP).

HLOOKUP

- Load the following spreadsheet: <http://www.pitt.edu/~galletta/excel/lookup.xls>
- The following instructions are also shown right on the spreadsheet

One-Dimensional Lookup Table

Name Box	B	C	D	E	F	G	H	I
1	Shipping Cost Calculator							
2								
3		Distance	<input type="text"/>		Order Subtotal		<input type="text"/>	
4								
5		Weight	<input type="text"/>		Shipping Cost		<input type="text"/>	
6								
7					Order Total		<input type="text"/>	
8								
9								
10								
11	Shipping Table - Cost per lb.							
12		Distance in miles						
13		0	25	50	100	200	500	1.00E+99
14		\$ 4.00	\$ 3.00	\$ 2.50	\$ 2.00	\$ 1.50	\$ 1.00	

Easy Steps

1. Create a table with the item to be looked up as the top of two rows. Please note that the scan starts in the first column of the first row (0) and if the amount does not exceed the next column, the first column's result (\$4.00) will be used. No number will exceed 1 followed by 99 zeros, which is one place below the original google. If the distance is higher than that, someone is following a grossly inefficient path!
2. In your spreadsheet, the formula will scan this horizontal table and pull out the proper shipping charge (the one that does not exceed the next column).

New steps

3. In H5, use the HLOOKUP formula and multiply by the weight:
 $=\text{HLOOKUP}(D3, c13.i14, 2) * D5$. Note that hlookup needs to know what to look up (the distance, D3), where is the table (c13.i14), and which row of the table to use (2).
4. In cell H7, enter $=H3+H5$
5. Enter amounts for the other cells and see the result of changing the distance.

The result is shown below. The answer can be found at

<http://www.pitt.edu/~galletta/excel/lookupANSWER.xls>

	A	B	C	D	E	F	G	H	I
1	Shipping Cost Calculator								
2									
3			Distance	<input type="text" value="30"/>		Order Subtotal		<input type="text" value="\$2,250.00"/>	
4									
5			Weight	<input type="text" value="25"/>		Shipping Cost		<input type="text" value="\$ 75.00"/>	
6									
7						Order Total		<input type="text" value="\$2,325.00"/>	
8									
9									
10									
11	Shipping Table - Cost per lb.								
12		Distance in miles							
13		0	25	50	100	200	500	1.00E+99	
14		\$ 4.00	\$ 3.00	\$ 2.50	\$ 2.00	\$ 1.50	\$ 1.00		

Two-Dimensional Lookup Table

- A two-dimensional lookup table is more realistic, but not really much different. It is accomplished by creative use of the row number parameter. We will give a discount for
- Here is the start of the spreadsheet.

	A	B	C	D	E	F	G	H	I
17	Shipping Cost Calculator								
18									
19			Distance	51		Order Subtotal		\$5,000.00	
20									
21			Weight	25		Shipping Cost			
22									
23			Order size			Order Total			
24									
25									
26									
27	Shipping Table - Cost per lb.								
28			Distance in miles						
29		Order Size	0	25	50	100	200	500	1.00E+99
30		1	\$ 4.00	\$ 3.00	\$ 2.50	\$ 2.00	\$ 1.50	\$ 1.00	
31		2	\$ 3.00	\$ 2.50	\$ 2.00	\$ 1.50	\$ 1.25	\$ 0.75	
32		3	\$ 2.00	\$ 1.50	\$ 1.25	\$ 1.20	\$ 1.00	\$ 0.50	
33		4	\$ 1.00	\$ 0.75	\$ 0.50	\$ 0.45	\$ 0.40	\$ 0.25	

Here are the steps (also shown on the spreadsheet):

1. Create a table with the item to be looked up as the top of several rows.
2. The second dimension of the lookup is expressed as extra rows in the table.
3. In your spreadsheet, the formula will scan this horizontal table and pull out the proper shipping charge
4. In cell D23, create an index of the order size that will call out the proper row of the table. I used a compound IF statement: `=IF(H19>=10000,4,IF(H19>=5000,3,IF(H19>=2500,2,1)))`
This creates a 4-tier system that will be used to choose the table row.
5. In H21, use the HLOOKUP formula and multiply by the weight:
`=HLOOKUP(D19,c29:i33,D23+1)*D19` Note that we use D23+1 as the table row.
Unfortunately, the count we obtained in step 4 above is off by one given that the first answer row of the table is on row 2!
6. In cell H23, enter `=H19+H21`
7. Enter amounts for the other cells and see the result of changing the distance and order total. See the sample below.

	A	B	C	D	E	F	G	H	I
17	Shipping Cost Calculator								
18									
19			Distance	51		Order Subtotal		\$5,000.00	
20									
21			Weight	25		Shipping Cost		\$ 31.25	
22									
23			Order size	3		Order Total		\$5,031.25	
24									
25									
26									
27	Shipping Table - Cost per lb.								
28			Distance in miles						
29		Order Size	0	25	50	100	200	500	1.00E+99
30		1	\$ 4.00	\$ 3.00	\$ 2.50	\$ 2.00	\$ 1.50	\$ 1.00	
31		2	\$ 3.00	\$ 2.50	\$ 2.00	\$ 1.50	\$ 1.25	\$ 0.75	
32		3	\$ 2.00	\$ 1.50	\$ 1.25	\$ 1.20	\$ 1.00	\$ 0.50	
33		4	\$ 1.00	\$ 0.75	\$ 0.50	\$ 0.45	\$ 0.40	\$ 0.25	

8. Save this, as you will need it for the bottom of the next page. Save it as LookupAnswer.

VLOOKUP

- There is also a VLOOKUP function that works exactly like HLOOKUP. It is valuable if you want to look up information next to data items in a list, or a database you might obtain from one of your corporate databases.
- For a moment we will go back to the store inventory example.
- You might want to display the inventory quantity, cost per item, and total cost of a particular item. Load the sheet <http://www.pitt.edu/~galletta/excel/StoreInventory1b.xls> for simplicity's sake.
- In the following cells, enter the following text:

B25	Enter the item number in cell C26:
B26	Item number
B27	Item name
B28	Number on hand
B29	Cost, each

- In the following cells, enter the following formulas carefully

C26	102
C27	=VLOOKUP(C\$26,\$A\$2:\$I\$19,2)
C28	=VLOOKUP(C\$26,\$A\$2:\$I\$19,6)
C29	=VLOOKUP(C\$26,\$A\$2:\$I\$19,7)

- In cell C26, enter 103 and see how it changes. Try other inventory item numbers and see what happens. Try something that doesn't exist and you'll see one limitation in this way of doing things.
- If you have trouble, you can see the answer at <http://www.pitt.edu/~galletta/excel/StoreInventoryLookup.xls> and enter different amounts in C26

Auditing Spreadsheet Cells

- Given that there are so many spreadsheet errors, it is important to audit your models or "trade papers" and audit someone else's.
- There are three main tools. The first is a set of arrows that are drawn between cells that have dependencies. The second allows you to see the results of each step in a calculation. The third allows you to see all formulas at the same time.
- Arrows
 - In the Shipping Calculator spreadsheet (we called "LookupAnswer" or obtain it from <http://www.pitt.edu/~galletta/excel/LookupAnswer.xls>), you can move to any cell you would like to audit (try H5) and click on the **Formulas** ribbon then find the **Trace Precedents** icon in the **Formula Auditing** section. Arrows will point to the cells that are used in the formula for H5 as shown below.

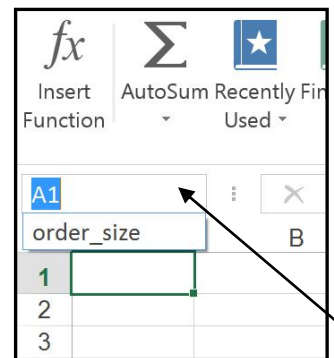
	A	B	C	D	E	F	G	H	I	
1	Shipping Cost Calculator									
2										
3			Distance	30		Order Subtotal		\$2,250.00		
4										
5			Weight	25		Shipping Cost		\$75.00		
6										
7						Order Total		\$2,325.00		
8										
9										
10										
11			Shipping Table - Cost per lb.							
12			Distance in miles							
13				0	25	50	100	200	500	1.00E+99
14				\$ 4.00	\$ 3.00	\$ 2.50	\$ 2.00	\$ 1.50	\$ 1.00	

- You can also trace arrows to cells dependent on that result.
- Clear the arrows by clicking **Remove Arrows** in the **Formula Auditing** section of the **Formulas** ribbon.
- Calculation Steps
 - Move to a cell with a complex formula, especially one with parameters such as H5.
 - Click on the **Formulas** ribbon and find the icon for **Evaluate Formula**.
 - The calculation will take place step by step and you can see each intermediate calculation that leads to the final result.
 - Click **Evaluate** to get to the next step.
 - Click **Step In** and **Step Out** to get deeper into the calculation and back up.
- Seeing all formulas
 - Any time while working on your spreadsheet, from the **Formulas** ribbon, click on the **Show Formulas** icon.
- Controlling errors
 - Often an error will show up as an odd-looking message such as #VALUE!, #REF!, or #DIV/0! You might not wish to see those messages. Thus using conditional statements can be useful for avoiding them yet promoting accuracy in the spreadsheet.
 - Pull up the <http://www.pitt.edu/~galletta/excel/LookupAnswer.xls> spreadsheet and try the following:
 - Using an IF formula, you can control the inputs to a small extent as well to make sure some subtle yet common errors in the lookup table do not occur.
 - In cell H21, change the formula from =HLOOKUP(D19,C29:I33,D23+1 to =IF(D23>0,HLOOKUP(D19,C29:I33,D23+1)*D21,"Error in order size")
 - In D23, enter an order size of 0 and see what happens.
 - Then in D23, enter an order size of ZBT and see what happens.
 - If you have trouble, the spreadsheet is stored at <http://www.pitt.edu/~galletta/excel/LookupAnswerBetter.xls>
 - You can check to see if there's an error before doing other computations, using the ISERROR formula, to serve as a test that you can use in an IF formula. You can also use it independently of an IF formula, and it will simply display a less helpful TRUE or FALSE. Here's how to use it in an IF formula:
 - In cell K11 enter "Error Tests"
 - In cell K12 enter the following formula:
=IF(ISERROR(H5),"Error finding shipping cost in example 1","Shipping cost ok in example 1")
 - In cell K13 enter the following formula

- **=IF(ISERROR(H21),"Error finding shipping cost in example 2","Shipping cost ok in example 2")**
- Then insert problematic entries, such as
 - -1 in D3 (distance)
 - ABC in D23 (order size)
- Beware, because if you tested for negative or zero order size in the IF statement above, there will no longer be an error condition in H21.
- If you have trouble, the spreadsheet is stored at <http://www.pitt.edu/~galletta/excel/LookupAnswerBetterYet.xls>
- **IFERROR:** You can use IFERROR for a short-hand version that combines IF and ISERROR formulas. Note that this is was only offered starting with Excel 2007.
 - Pull up <http://www.pitt.edu/~galletta/excel/LookupAnswerBetterYet.xls> and try the following:
 - Move to H19 and enter “225O” in that spot (using the letter O instead of the zero that is supposed to be there).
 - Notice that #VALUE! appears in the result for H23.
 - The ugly error message pops up in H23
 - Move back to H19 and correct it to be 2250 (all numbers).
 - Due to the limited space, we will provide a short, albeit customized error message for cell H23
 - Just create your formula for H23 inside of the IFERROR function as follows:
 - Move to H23 and enter the following: **=IFERROR(H19+H21,"Oops!")**
 - Enter 225O (again with the letter O rather than the zero) in cell H19 and you will see “Oops!” as the result of the Order Total.
 - If you have trouble, the answer is stored at <http://www.pitt.edu/~galletta/excel/LookupAnswerNearBest.xlsx> (note that it cannot be stored as an “old” Excel file (2003 and earlier) and must be stored as an “.xlsx” file.

Using Named Ranges – Reprise – Preparing for next step

- Earlier you named a range. You can also name any single cell and then use the cell’s name in a formula instead of the address. In the Shipping Cost Calculator, for instance, you can name cell D23 as “Order Size” as follows:
 - Pull up the spreadsheet named <http://www.pitt.edu/~galletta/excel/LookupAnswerNearBest.xlsx>
 - Move to D23.
 - From the **Formulas** ribbon, click the **Define Name** icon. Excel will actually suggest the name because of the text in C23. However, it will have an underscore, so you might want to change it to OrderSize. Either way, click when you’re happy with the name.
 - Now the lookup table can be expressed as follows (if you kept the underscore):
=HLOOKUP(D19,C29:I33,Order_size+1)*D5
 - **Cool shortcut:** You can also jump to any named cell by clicking the down arrow near the right edge of the name input area, at the left side, near the top of the spreadsheet.



- The range names will pop down in a list and you can choose the one you want to jump right there. You can also type a cell name, such as H23 right there.

Constraining inputs

- Some of the best control will be afforded if you constrain inputs to fit a particular type of data or even a particular set of possible responses.
- Assume the permitted order sizes for automatic shipping calculation is 1, 2, 3, or 4. Anything else has to be done manually, depending on special arrangements that are outside of our scope here.
- You will need a second sheet in your Excel file. Pull up <http://www.pitt.edu/~galletta/excel/LookupAnswerNearBest.xlsx>
- Click on the Sheet 2 tab, way down at the bottom left of the Excel window. You will see a blank new sheet.
- Type **PermittedOrderSizes** in cell A1
- Enter 1 in cell A2, 2 in cell A3, 3 in cell A4, and 4 in cell A5
- Click in A2 and drag to A5
- Click the Formulas tab and click Define Name in the middle of the top row of the icon bar.
- The range should show up as A2 to A5. Type the name you typed in A1 (or any shorthand if you'd like such as **Quant**) and then click
- Click on the Sheet 1 tab at the bottom left of the Excel window.
- Click on cell D23.
- Click the DATA tab and select Data validation in the icon bar near the middle, top. The window that pops up will appear as shown below.

The screenshot shows the 'Data Validation' dialog box in Microsoft Excel. The 'Settings' tab is active. The 'Validation criteria' section is configured as follows:

- Allow:** List
- Ignore blank:**
- In-cell dropdown:**
- Source:** =PermittedOrderSizes

The background spreadsheet shows a shipping cost table with columns for Order Size (1-4) and Distance in miles (0, 25, 50, 100, 200, 500, 1.00E+99). The table is highlighted in yellow.

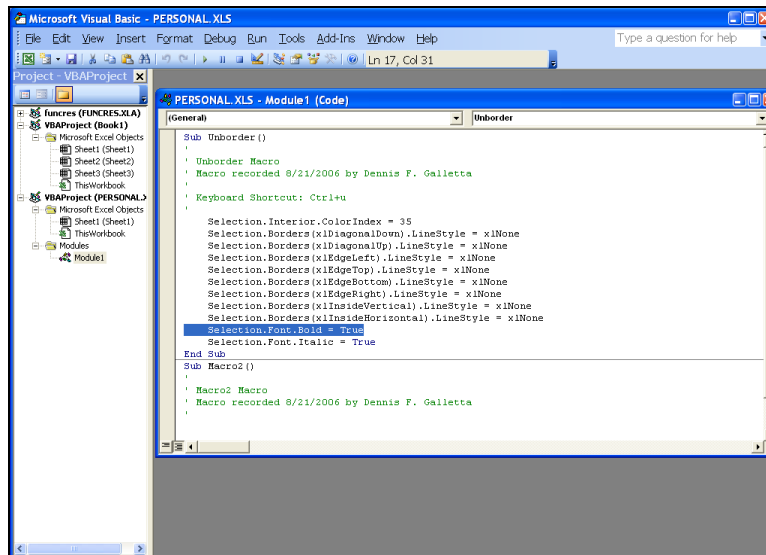
Order Size	0	25	50	100	200	500	1.00E+99
1	\$ 4.00	\$ 3.00	\$ 2.50	\$ 2.00	\$ 1.50	\$ 1.00	
2	\$ 3.00	\$ 2.50	\$ 2.00	\$ 1.50	\$ 1.25	\$ 0.75	
3	\$ 2.00	\$ 1.50	\$ 1.25	\$ 1.20	\$ 1.00	\$ 0.50	
4	\$ 1.00	\$ 0.75	\$ 0.50	\$ 0.45	\$ 0.40	\$ 0.25	

- Click on the drop-down arrow next to “Any Value” under “Allow.”

- Select List
- Type **=PermittedOrderSizes** (or **=Quant** if you used my shorthand version) in the Source text box. Note: don't forget the "="
- Click
- Now on Sheet 1, if you move the cursor to D23, you will now see a dropdown arrow appear next to the input area for the Order Size. You can click it and choose 1, 2, 3, or 4. This will prevent any strange input that will go beyond the list you have in the second sheet.
- If you have any trouble, the answer is stored in <http://www.pitt.edu/~galletta/excel/LookupAnswerBest.xlsx>

Basic Macros

- Macros can be studied in an entire 3-credit course. This is meant to whet your appetite for macros. To get the most out of macros, it is useful to learn Visual Studio.
- Macros are useful any time there are repetitive operations. In some cases, you might want to use **(Ctrl)-Y** (repeat). However, if you need to do the same repetitive thing again intermittently, you should use a macro.
- In the Shipping Cost Calculator, you might not want to see the yellow background and border around the shipping table. In fact, you might have dozens of spreadsheets with cells that are formatted in that way.
- The goal is to change the yellow background to pale green, to remove the border, then to change the fonts to bold + italics.
- Here are the steps for creating the macro
 - Highlight the cells for which you want this macro to work. You will then see it work in a meaningful way as you create it.
 - From the **View** ribbon, click the triangle under the **Macros** icon, then **Record New Macro**.
 - Give your macro a name. I called this one "unborder"
 - I assigned a shortcut key **(Ctrl)-x** to the macro by entering an **x** into the box.
 - Choose the current workbook unless you will want it to be used again. If so, select your personal macro workbook to store this rather than just the current workbook.
 - Click only when you are ready. From this moment on, everything you click will be played back, even errors. You can do all the formatting that you desire here. Make sure you choose boldfacing (for undoing this in a later step).
 - When you are finished, from **View** ribbon, click the small triangle under the **Macros** icon then choose **stop recording**.
- Here are the steps for running the macro:
 - Select the cells you want to format
 - Click **(Ctrl)-x**
- Here are the steps for modifying the macro:
 - Let's assume you do not want to select boldfacing. Most people will be happier to restart the macro all over again in such a simple situation.
 - But if you are brave, you can move on.
 - If you saved the macro in the personal workbook you must unhide it by clicking the **View** ribbon and clicking on the **Unhide** icon. Then select **Personal.xls**.
 - You can then go to the **View** ribbon and click the **Macros** pull-down menu and choose **View Macros**.
 - Select the macro you wish to edit and click the **Edit** button.
 - In this example, you see the following perhaps confusing screen.



- I have selected the line with boldfacing. Change the word True to False.
- You can click the red X in the windows to exit the editing function. If you save the spreadsheet, your change is recorded forever for this spreadsheet file.
- The **Ctrl-x** macro will now make sure there is no bold text in the selected range.
- There is not time enough today or even this week to cover macros completely. But you can see if you have interest in working further with them.

Linking Cells from other Worksheets and Files

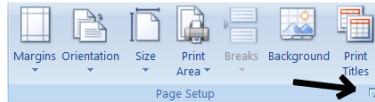
- Linking from one spreadsheet page to another in the same workbook (Excel file) is quite easy. You only have to begin a formula (for example, with an equal sign) then begin typing your formula. While typing the formula, when you want to use a value from another sheet, just click on the tab for the sheet that has the number you want, then click the cell that you want. The formula will appear as follows:
Sheetname!celladdress. If the sheet is named, then the name will be used. If the cell is named, then no indication of sheet is necessary. Here are some examples:
 =Sheet2!C4 =WesternDivision!C4 =Profit_Western_Division
- Linking to another spreadsheet file is a matter of copying and pasting. Here are the steps:
 - Open the spreadsheet that has the source (I'll call it "source") and the spreadsheet that needs to link to that information (I'll call it "destination").
 - Navigate to the cell in "Source" that has the source information and copy the cell or cells to the clipboard.
 - Navigate to "Destination" and go to the location you want the linked information to appear. The next instruction assumes you want it to look exactly the same (with the same formatting) as the original.
 - Do not press Control-V! You need to prepare the area first to accept the same formatting. Click on the triangle just under the **Paste** icon from the **Home** ribbon. Choose **Paste Special**. And rather than clicking ok, find the **Formats** option under the **Paste** group and then click . The format will transfer.
 - Then click the triangle under the **Paste** icon again and then click **Paste Link**.
 - Save and close "Destination."
 - Make some changes to the data in "Source" that will affect the cell you pasted in "Destination." Save and close "Source."
 - Once again open "Destination." You will be asked if you want to update the

information that is linked.

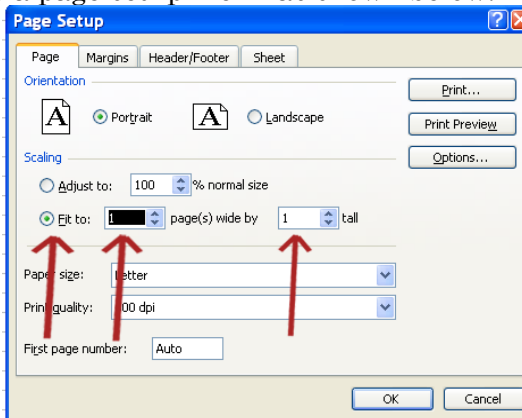
- Now, open the newer, linked workbook. In the box asking if you want to update the information. You can click Yes if you're sure or No if you want to review it first.
- If you clicked No and now want to update it, all you need to do is get to the **Data** ribbon, in the **Connections** group, click the **Edit Links** icon, and click **Update Values**. You're done!

Taming Printing

- Sometimes printing just does not seem to work as you predict. Here are some handy hints to make sure that you can recover from any problems that might creep up.
- **Page breaks**
 - Page breaks are one of the biggest nuisances. Even if you choose a print area carefully, you might be surprised that your one-page report takes 4 pages to print. The first page has most of what you want, but the other pages have a few stray characters, numbers, or lines that could not fit on one page.
 - One powerful tool is to use the **Fit to** feature to keep the sheet to 1 page by 1 page (and forces the printer to shrink the text). From the **Page Layout** ribbon, in the **Page Setup** group, click the small symbol just after the group name **Page Setup**. See below.

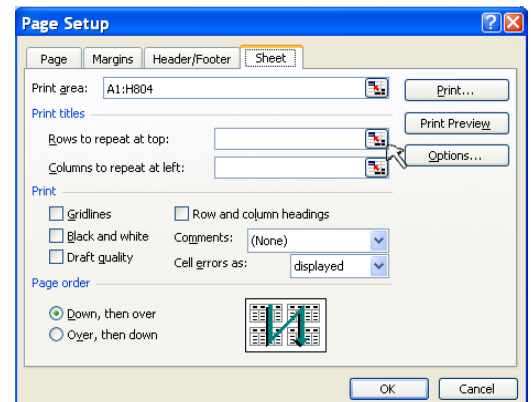


- You will then see a page setup menu as shown below.



- This will solve many of your problems quickly. Naturally, some wide spreadsheets will benefit from Landscape mode. If the spreadsheet is too wide or too long, the tiny text will be unreadable.

- **Repeat column titles on each page**
 - Often, in a long report with several pages, you want headings to indicate the column titles.
 - To fix this, get back to the **Page Setup** menu (from the **Page Layout** ribbon, click the small symbol next to the **Page Setup** group). Note that this does not work in print preview mode, so this is the place to start.
 - Choose the **Sheet** tab and click the colorful spreadsheet-looking icon at the right of **Rows to repeat at top**. See the screenshot to the right.

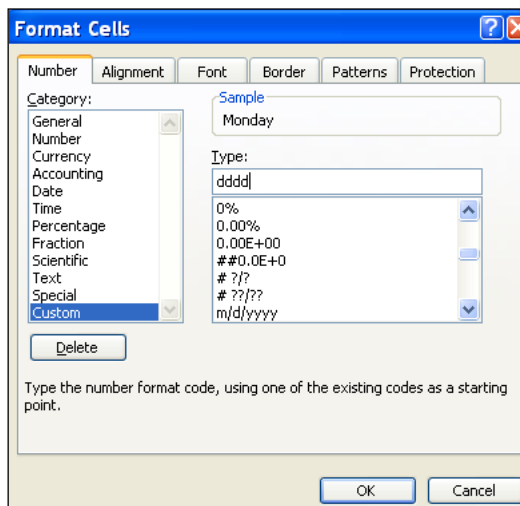


- Go right to the spreadsheet and drag any rows you want that will provide useful column headings.
- Click on the X to close the window.
- Click to finish setting up the titles.

Custom Date Formatting

- This is handy, quick and almost surprising.
- Create a new spreadsheet and enter any date from the past, present, or future in B2.
- Drag the date down with the + to B13 and allow it to increment. Copy the column to column C
- See the graphic to the right to check what you are seeing.
- Drag the items in column C.
- From the **Home** ribbon, click the **Format** icon and select **Format Cells**.
- In the Number tab, click Custom.
- Click in the Type field and enter the lower-case “d” four times as shown below. See the result to the right.
- If you use three “d” characters, it will abbreviate the day of the week.
- Enjoy Excel! There is more to learn and discover, but I guarantee you have a great head start to share and trade tips with nearly any Excel expert!

	A	B	C
1		Date	Day
2		8/21/2006	8/21/2006
3		8/22/2006	8/22/2006
4		8/23/2006	8/23/2006
5		8/24/2006	8/24/2006
6		8/25/2006	8/25/2006
7		8/26/2006	8/26/2006
8		8/27/2006	8/27/2006
9		8/28/2006	8/28/2006
10		8/29/2006	8/29/2006
11		8/30/2006	8/30/2006
12		8/31/2006	8/31/2006
13		9/1/2006	9/1/2006



	A	B	C
1		Date	Day
2		8/21/2006	Monday
3		8/22/2006	Tuesday
4		8/23/2006	Wednesday
5		8/24/2006	Thursday
6		8/25/2006	Friday
7		8/26/2006	Saturday
8		8/27/2006	Sunday
9		8/28/2006	Monday
10		8/29/2006	Tuesday
11		8/30/2006	Wednesday
12		8/31/2006	Thursday
13		9/1/2006	Friday