Advanced Excel

Microsoft Excel 2013

Instructor: Don Bremer

Presented and co-sponsored by:

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UNIVERSITY OF MINNESOTA DULUTH
Driven to Discover

11 East Superior Street, Suite 210
Duluth, MN 55802
218-726-7298
www.umdced.com
umdced@d.umn.edu

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Contents

Powerful tools in Excel

Not only will Excel add and subtract, but it can make words or sentences and make workbooks with calculations easier to read.

Count vs. Counta vs. Countif

Count - Counts the number of cells that contain numbers and numbers within the list of arguments. Use COUNT to get the number of entries in a number field in a range or array of numbers.

Counta - Counts the number of cells that are not empty and the values within the list of arguments. Use COUNTA to count the number of cells that contain data in a range or array.

Countif - Counts the number of cells within a range that meet the given criteria.

Examples

Suppose A3:A6 contain "apples", "oranges", "peaches", "apples", respectively:

COUNTIF(A3:A6,"apples") equals 2

Suppose B3:B6 contain 32, 54, 75, 86, respectively:

COUNTIF(B3:B6,">55") equals 2

Trim

Removes all spaces from text except for single spaces between words. Use TRIM on text that you have received from another application that may have irregular spacing. This is especially useful when doing text matching.

Example
TRIM(" First   Quarter   Earnings   ") = "First Quarter Earnings"

Concatenation

Sometimes, a number is best placed within a sentence on a spreadsheet. To do this, use the "&" symbol to add strings and numbers together.

Example:

- In A1 Type 2
- In A2 Type 2

- In A3 Type =A1+A2
- In A4 Type ="The quantity" & A1 & "+" & A2 & "=" & A3

Ceiling, Floor

These functions make round up (ceiling) or down (floor) depending how they are called.

Example

How many cars are needed if each car can fit 4 people and we have 23 people?

Example

How many dollars do we have if we have 235 pennies?

Today

Gives the current date. This field is updated every time the spreadsheet is updated (like on load).

Lookup

A vector is a range of only one row or one column. The vector form of LOOKUP looks in a one-row or one-column range (known as a vector) for a value and returns a value from the same position in a second one-row or one-column range. Use this form of the LOOKUP function when you want to specify the range that contains the values you want to match.

Example

	A	B	C
1	Frequency	Color	
2	4.14234	red	
3	4.19342	orange	
4	5.17234	yellow	
5	5.77343	green	
6	6.38987	blue	
7	7.31342	violet	
8			

LOOKUP(4.91,A2:A7,B2:B7) equals "orange"
LOOKUP(5.00,A2:A7,B2:B7) equals "orange"
LOOKUP(7.66,A2:A7,B2:B7) equals "violet"
LOOKUP(7.66E-14,A2:A7,B2:B7) equals #N/A, because 7.66E-14 is less than the smallest value in the lookup_vector A2:A7

Vlookup

Searches for a value in the leftmost column of a table, and then returns a value in the same row from a column you specify in the table. Use VLOOKUP instead of

HLOOKUP when your comparison values are located in a column to the left of the data you want to find.

Example

	A	B	C	D
1	**Air at 1 atm pressure**			
2	**Density**	**Viscosity**	**Temp**	
3	**(kg/cubic m)**	**(kg/m*s)*1E+05**	**(degrees C)**	
4	0.457	3.55	500	
5	0.525	3.25	400	
6	0.616	2.93	300	
7	0.675	2.75	250	
8	0.746	2.57	200	
9	0.835	2.38	150	
10	0.946	2.17	100	
11	1.09	1.95	50	
12	1.29	1.71	0	

VLOOKUP (1, A4:C12, 1) equals 0.946
VLOOKUP (1, A4:C12, 2) equals 2.17
VLOOKUP (1, A4:C12, 3) equals 100
VLOOKUP (.746, A4:C12, 3) equals 200
VLOOKUP (0.1, A4:C12, 2) equals #N/A, because 0.1 is less than the smallest value in column A
VLOOKUP (2, A4:C12, 2) equals 1.71

Left, Right, Mid

Left
LEFT returns the first character or characters in a text string, based on the number of characters you specify.

Right
RIGHT returns the last character or characters in a text string, based on the number of characters you specify.

	A	B	C	D
1	The quick brown fox	The qui	=LEFT(A1,7)	
2	The quick brown fox	own fox	=RIGHT(A2,7)	
3	The quick brown fox	quick b	=MID(A3,5,7)	
4				
5				

Mid
MID returns the characters from the middle of a text string, given a starting position and length.

Referencing Cells in Excel

We are quite familiar with referencing particular cells in Excel. When we copy formulas, the cell references change with the new cell location. What if we didn't want to change the location of the cell? We can tell Excel to use an absolute reference. This is denoted by putting a $ in front of both the column and the row.

Example

Compound Interest	5%
$1,000.00	$ 50.00
$1,050.00	$ 52.50
$1,102.50	$ 55.13
$1,157.63	$ 57.88
$1,215.51	$ 60.78
$1,276.28	$ 63.81
$1,340.10	$ 67.00
$1,407.10	$ 70.36
$1,477.46	$ 73.87
$1,551.33	$ 77.57
$1,628.89	$ 81.44
$1,710.34	$ 85.52
$1,795.86	$ 89.79

Now what happens if we want 5% and 6%?

Copying the formula over creates a mess because it is looking at the 5% interest column! To make sure that it is only looking at the Money column, put a $ in front of the column. Now the formula will always look in the right place as the formula is being copied to the right.

Subtotals

Returns a subtotal in a list or database. It is generally easier to create a list with subtotals using the Subtotals command (Data menu). Once the subtotal list is created, you can modify it by editing the SUBTOTAL function.

Example

Open ListSort.xls in Beyond the Basics of Excel

- Add a subtotal to the list on bundles and trees
- Use the filter function

Note:

SUBTOTAL will ignore any hidden rows that result from a list being filtered. This is important when you want to subtotal only the visible data that results from a list that you have filtered.

Macros

Macros are simply small programs written in Visual Basic that do specific tasks. These macros can be created or downloaded and incorporated into a spreadsheet.

In the View Tab of the Ribbon, Click on the Macros dropdown and Record New Macro

Gets to the macro menu

- Macros…   Alt+F8
  Shows the macros in the workbook.
- Record New Macro…
  Allows a person to create macros even if you don't know the language
- Visual Basic Editor   Alt+F11
  This shows the language and commands used to create the macro

READY ■

To Stop a Macro

Macro Window

Hello World

The first program customarily written by a new programmer is "Hello World!". This program simply prints out Hello World. To do this using Excel macros,

- In the View Tab of the Ribbon, Click on the Macros dropdown and Record New MacroNew Macro

- o Name
- o Shortcut (ctrl and/or shift)
- o Store macro in…
- o Description (help others)
- Enter in these commands
  - o Name – HelloWorld
  - o Shortcut – ctrl+w
  - o Store macro in… (This workbook)
  - o Description (Print out Hello World – First program)
- Click OK
- New Form comes up with a stop button
- Type in Hello World! and click on the stop button.
- Test it – in various places

Hello World (part 2)

It goes back to the same spot, regardless of where you start. To make it relative, click on the red arrow right next to the stop button. Follow the steps above and try again. Did it work?

Looking at the code

The commands that are used to create the Hello World should look like the following:

```
Sub HelloWorld2()
'
' HelloWorld2 Macro
' Macro recorded 11/1/2003 by Don Bremer
'
' Keyboard Shortcut: Ctrl+w
'
    ActiveCell.FormulaR1C1 = "Hello World"
    ActiveCell.Offset(1, 0).Range("A1").Select
End Sub
```

The ' marks represent comments and are not read by the computer.

Structures of programming

There are actually 3 structures to any programming language. They are:
- Statement
- Loop
- Logical

To make a loop in a macro with a known number of times through, we can use the for command. We can change the comands of the macro to read:

```
For i = 1 To 5
 ActiveCell.FormulaR1C1 = "Hello World"
 ActiveCell.Offset(1, 0).Range("A1").Select
Next
```

This will write "Hello World" on the cell, move down one cell, and write "Hello World" again. Try this….

Logicals will ask a question. Depending on the answer, it will do a set of commands. Take for example the last "Hello World" example. Instead of having it say "Hello World" all 5 times, what if we have it say "Goodbye Cruel World!" on the last loop. We can do that using the conditional (or if) statement:

```
For i = 1 To 5
    If i = 5 Then
        ActiveCell.FormulaR1C1 = "Goodbye Cruel World!"
    Else
        ActiveCell.FormulaR1C1 = "Hello World"
    End If

  ActiveCell.Offset(1, 0).Range("A1").Select
Next
```

Sort Worksheets using Macros

In this exercise, we will create a macro from scratch. This macro can then be called from another.

- Start a new workbook
- In the View Tab of the Ribbon, Click on the Macros dropdown and Record New Macro
- Type in the code below:

```
Sub SortSheets()

Dim SheetCount As Integer
Dim i As Integer
Dim j As Integer

    SheetCount = Worksheets.Count

    If SheetCount = 1 Then
      Exit Sub
```

```
    End if

    For i = 1 To SheetCount - 1
        For j = i + 1 To SheetCount
            If Worksheets(j).Name < Worksheets(i).Name Then
                Worksheets(j).Move Before:=Worksheets(i)
            End If
        Next j
    Next i


End Sub
```

- Create another macro that calls this macro by writing:

```
Sub Caller()

    ' MsgBox shows something on the screen in a window
    MsgBox ("Preparing to Sort Sheets")
    ' Our macro
    SortSheets

    MsgBox ("Sheets Sorted")

End Sub
```

Pivot Tables

A PivotTable report is an interactive table that you can use to quickly summarize large amounts of data. You can rotate its rows and columns to see different summaries of the source data, filter the data by displaying different pages, or display the details for areas of interest You can start a Pivot table by opening the Pivot Table toolbar and clicking on the wizard.

Example

- Sorting Lists from class 2 of Excel
- Northwind database in access

Breaking the screen into frames

Selecting the tabs on the top slider and the bottom slider will allow the user to open up 4 different panes that can be in 4 separate sections of the worksheet.

Common Error Types

Error	Description
#NULL!	The formula contains a null (probably as a reference). Is your formula complete?
#DIV/0	The formula contains a division by 0. Are two pieces the same value? Is your formula correct?
#VALUE!	A textual value of a cell or an incorrect argument has been used in the calculation. While there are other possibilities for receiving this error, these two are the most common.
#REF!	The value in the referenced cell is no longer available in the formula. The cells, rows, or columns may have been deleted that were used in the formula.
#NAME?	A formula is not entered correctly. The defined name used may not exist, has been deleted or misspelled, or the quotes around text may have been omitted.
#NUM!	There is a problem with a number. Excel cannot interpret it because it is too small or too big or may not exist. Check for incorrect argument types in a function.
#N/A	This can signify several problems, depending on the formula. • No value was available (as in a lookup function). • It is being used as a placeholder when data is not yet available. • Charting features ignore this, so it is often used when you are charting data. To leave the cells empty would distort the chart, so use #N/A to prevent a 0 value.

Transpose (Matrices)

Say you have a column of numbers/letter and want them to become columns themselves. You can do this by transposing the matrix.

- Select the column
- Copy to the clipboard
- Go to the new location
- Go to Paste Special…
- Paste while checking the Transpose checkbox

Example

Abe
Ben
Carl
Dave
Edward

Can become….

Abe   Ben   Carl   Dave   Edward

Breaking apart formulas

Remember the Quadratic Formula in Algebra?

$$ax^2 + bx + c = 0$$

has the solutions

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Program this? Yick! It might be easier to break it apart to get the answer:

A1: a
A2: b
A3: c

Now break apart the formula:

A5: -A2
A6: ((A2^2)-(4*A1*A3))^0.5
A7: 2*A1

Answers:

A8: (A5-A6)/A7
A9: (A5+A6)/A7

Text to Columns
Use this method if your names have a delimited format, such as "First_name Last_name" (where the space between First_name and Last_name is the delimiter) or "Last_name, First_name" (where the comma is the delimiter).

1. Select the range of data that you want to convert.

2. On the **Data** tab, in the **Data Tools** group, click **Text to Columns**.

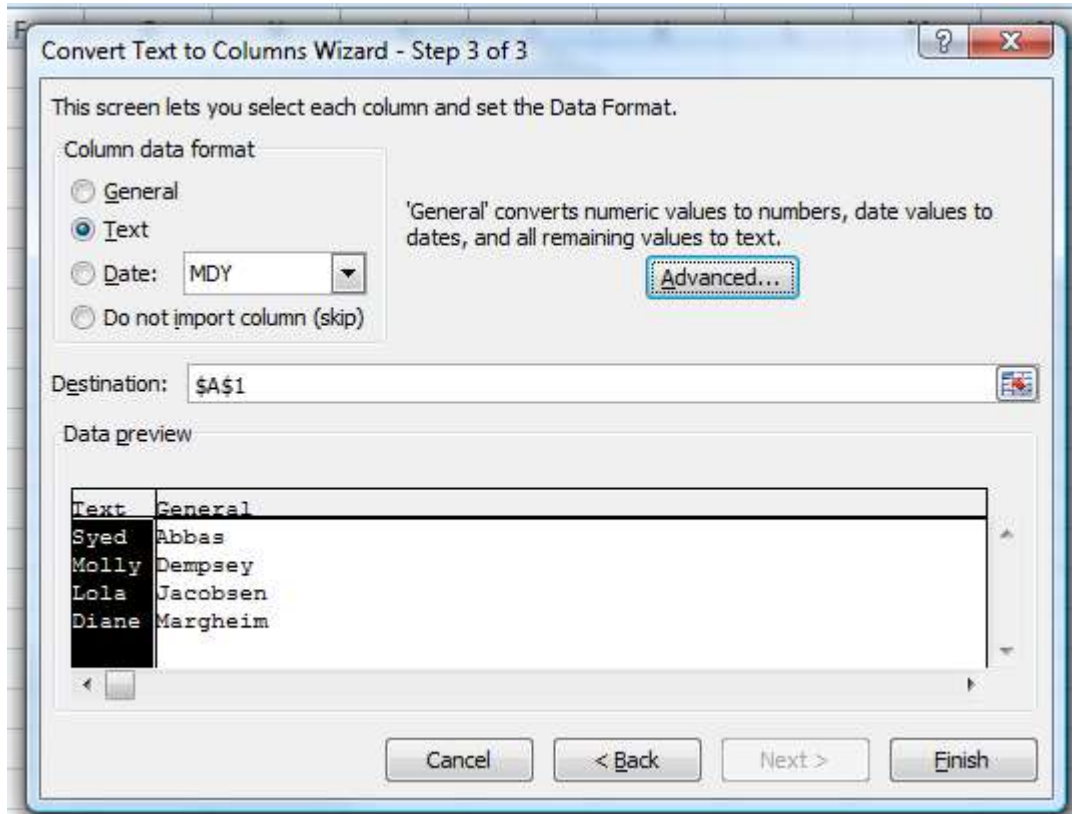3. In Step 1 of the Convert Text to Columns Wizard, click **Delimited**, and then click **Next**.

4. In Step 2, select the **Space** check box, and then clear the other check boxes under **Delimiters**.
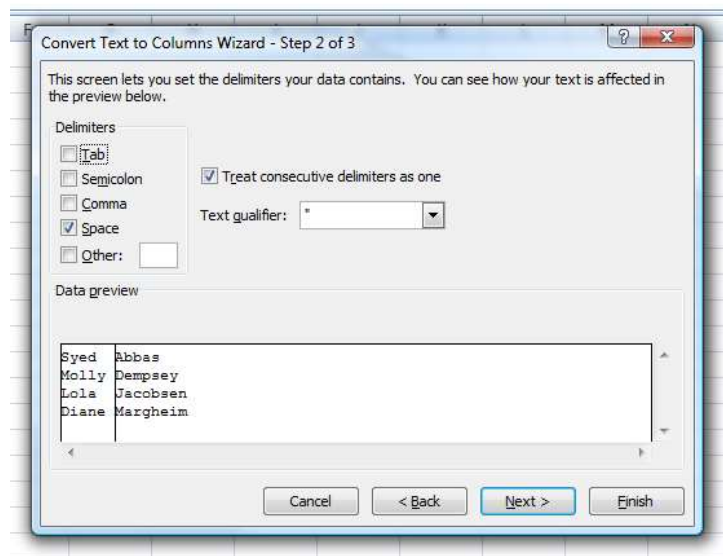
5. Click Next.

6. In Step 3, click a column in the Data preview box, and then click Text under Column data format.

    Repeat this step for each column in the Data preview box.

7. If you want to insert the separated content into the columns next to the full name, click the icon to the right of the Destination box, and then select the cell next to the first name in the list (B2, in this example).

8. Click the icon to the right of the Convert Text to Columns Wizard.

Remove Duplicates

When you remove duplicate values, only the values in the range of cells or table are affected. Any other values outside the range of cells or table are not altered or moved.
Caution   Because you are permanently deleting data, it's a good idea to copy the original range of cells or table to another worksheet or workbook before removing duplicate values.

1. Select the range of cells, or make sure that the active cell is in a table.
2. On the **Data** tab, in the **Data Tools** group, click **Remove Duplicates**.

3. Do one or more of the following:
    - Under **Columns**, select one or more columns.
    - To quickly select all columns, click **Select All**.
    - To quickly clear all columns, click **Unselect All**.
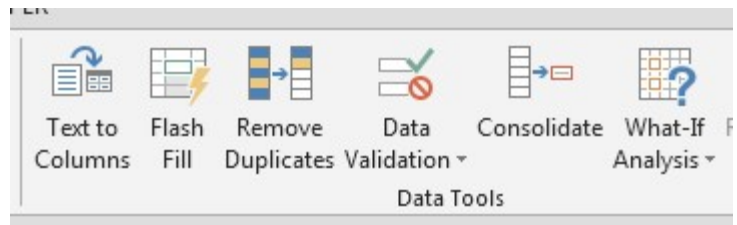
If the range of cells or table contains many columns and you want to only select a few columns, you may find it easier to click **Unselect All**, and then under **Columns**, select those columns.

4. Click **OK**.

A message is displayed indicating how many duplicate values were removed and how many unique values remain, or if no duplicate values were removed.

5. Click **OK**.

Naming Ranges

A Named Range is way to describe your formulas. So you don't have to have this in a cell:

$$= SUM(B2:B4)$$

You can replace the cell references between the round brackets. You replace them with a descriptive name, all of your own. So you could have this, instead:

$$= SUM(Monthly\_Totals)$$

Behind the Monthly_Totals, though, Excel is hiding the cell references. We'll see how it works, now.

Open up Excel 2013, and create the spreadsheet below:

	A	B	C
1		Monthly Totals	
2		124	
3		234	
4		344	
5	Results	702	
6			
7			

Select the Monthly Totals from B2:B4 and where it says B2 on the formula bar, type "Monthly_Totals"

	A	B	C
1		Monthly Totals	
2		124	
3		234	
4		344	
5	Results	702	
6			

	A	B	C	D
1		Monthly Totals		
2		124		
3		234		
4		344		
5	Results	702		
6				

Now you can refer to that range as Monthly_Totals, no matter how big it is.

$$= SUM(Monthly\_Totals)$$

Getting Information from the Web

The premise behind how you query stock information in your web browser ultimately boils down to the URL address. Here is the standard URL address formula with two inputs (the Ticker Symbol and the Data Type).
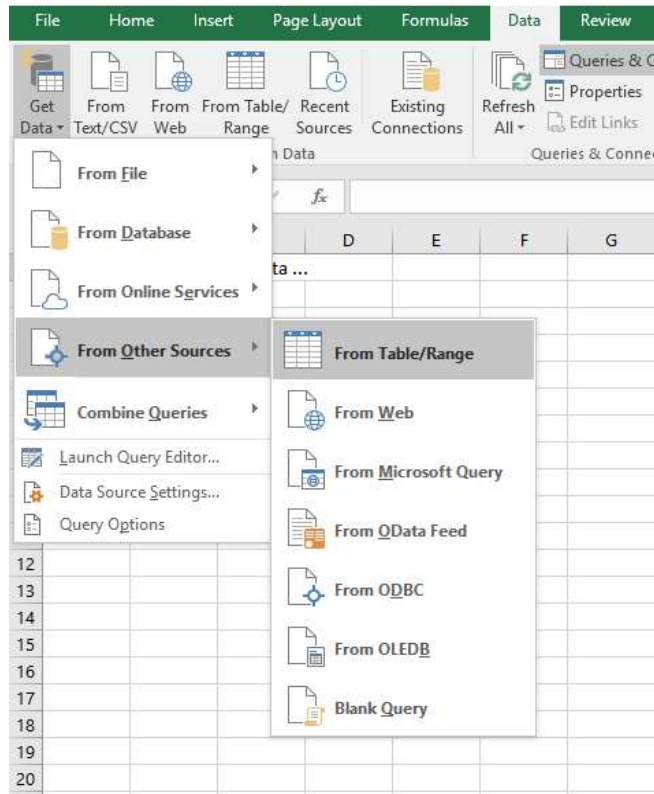
Breakdown Of The Yahoo! Finance Query URL

https://download.finance.yahoo.com/d/quotes.csv?s=[Ticker Symbol]&f=[Data Type]

So, let's get the historical data on Microsoft

Go to finance.yahoo.com and apply the current time period:
https://finance.yahoo.com/quote/MSFT/history?period1=1475081729&period2=1
506617729&interval=1d&filter=history&frequency=1d

Then, go to Data->Get Data-> From Web

Then, grab the right table!

The period is the number of seconds since 1970 (If you would like to build this by yourself).

Example 1: Pull The "Current Stock Price" for Microsoft's Stock

=NUMBERVALUE(WEBSERVICE("https://download.finance.yahoo.com/d/quotes.csv?s=**MSFT**&f=**l1**"))

Example 2: Pull The "Current Dividend" for Microsoft's Stock

=NUMBERVALUE(WEBSERVICE("https://download.finance.yahoo.com/d/quotes.csv?s=**MSFT**&f=**d**"))

Stock Pricing

Variable	Description
a	Ask
b	Bid
b2	Ask (Real-time)
b3	Bid (Real-time)
p	Previous Close
o	Open
c1	Change
c	Change & Percent Change
c6	Change (Real-time)
k2	Change Percent (Real-time)
p2	Change in Percent
d1	Last Trade Date
d2	Trade Date
t1	Last Trade Time

Averages

Variable	Description
c8	After Hours Change (Real-time)
c3	Commission
g	Day's Low
h	Day's High
k1	Last Trade (Real-time) With Time
l	Last Trade (With Time)
l1	Last Trade (Price Only)
t8	1-Year Target Price
m5	Change From 200 Day Moving Average
m6	% Change From 200 Day Moving Average
m7	Change From 50 Day Moving Average
m8	% Change From 50 Day Moving Average
m3	50-Day Moving Average
m4	200-Day Moving Average

Dividends

Variable	Description
y	Dividend Yield
d	Dividend per Share
r1	Dividend Pay Date
q	Ex-Dividend Date

Volume

Variable	Description
v	Volume
a5	Ask Size
b6	Bid Size
k3	Last Trade Size
a2	Average Daily Volume

52-Week Pricing

Variable	Description
k	52-Week High
j	52-Week Low
j5	Change From 52-Week Low
k4	Change From 52-Week High
j6	Percent Change From 52-Week Low
k5	Percent Change From 52-Week High
w	52-Week Range
g1	Holdings Gain Percent

Ticker Related Information

Variable	Description
i	More Info
j1	Market Capitalization
j3	Market Cap (Real-time)
f6	Float Shares
n	Name
n4	Notes
s	Symbol
s1	Shares Owned

Variable	Description
g3	Annualized Gain
g4	Holdings Gain
g5	Holdings Gain Percent (Real-time)
g6	Holdings Gain (Real-time)

Variable	Description
x	Stock Exchange
j2	Shares Outstanding

Financial Ratios

Variable	Description
e	Earnings per Share
e7	EPS Estimate Current Year
e8	EPS Estimate Next Year
e9	EPS Estimate Next Quarter
b4	Book Value
j4	EBITDA
p5	Price / Sales
p6	Price / Book
r	P/E Ratio
r2	P/E Ratio (Real-time)
r5	PEG Ratio
r6	Price / EPS Estimate Current Year
r7	Price / EPS Estimate Next Year
s7	Short Ratio

Miscellaneous

| Variable	Description
t7	Ticker Trend
t6	Trade Links
i5	Order Book (Realtime)
l2	High Limit
l3	Low Limit
v1	Holdings Value
v7	Holdings Value (Realtime)
s6	Revenue
w1	Day's Value Change
w4	Day's Value Change (Realtime)
p1	Price Paid
m	Day's Range
m2	Day's Range (Realtime)
c4	Currency

Statistics

Even though it seems that the makers of Excel put the kitchen sink in and reasdy to go – not everything is visible. There is another statistical package that is an Add-In if you want to go even further.

File->Options->Add-Ins->Manage Excel Add-ins (Go…)

Select on Analysis ToolPak and click OK
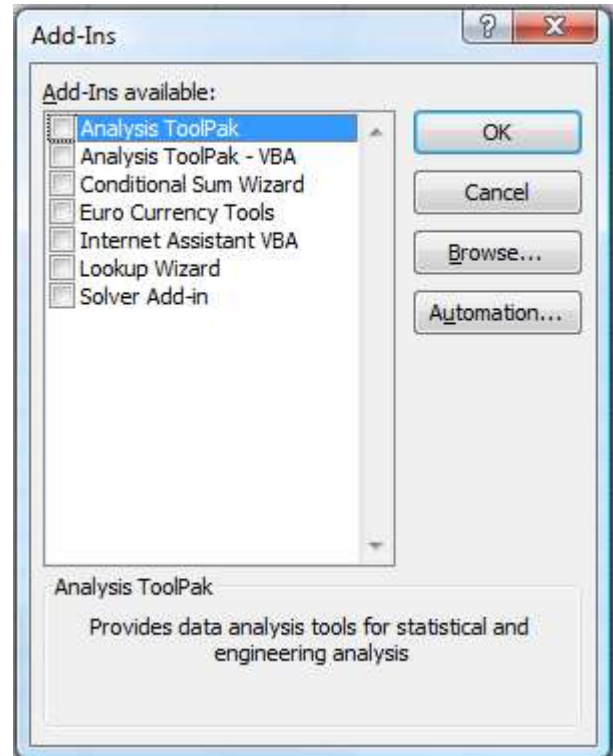
A new item appears under data called "Data Analysis". When the item is selected, it shows the different things you can do:
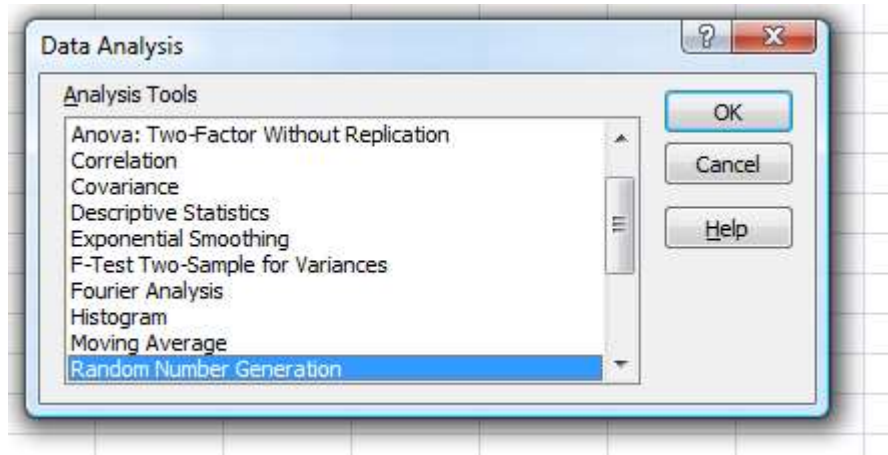
Moving Average example:

The following illustration shows a summary of Contoso Pharmaceutical's inventory for their 10 best-selling products from last year. This report shows a large variance in the ending inventory quantities from month to month, indicating both shortages and stagnant product — neither of which is good for business. With a few simple steps, you can use this information to manage your inventory levels more precisely this year.

Prod_ID	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
1176	96	10	10	72	72	60	60	14	2	93	94	26
401	19	11	4	47	47	69	52	13	13	56	64	75
1482	78	11	7	46	5	30	30	19	9	100	90	74
1548	96	11	0	99	99	74	74	18	1	73	18	74
1406	48	13	65	99	99	46	46	16	16	94	33	58
1517	3	13	13	26	26	92	92	10	1	44	18	47
301	15	15	32	55	55	17	8	46	8	59	69	84
303	32	18	41	65	65	11	11	50	1	72	43	51
688	46	18	0	-20	26	75	75	15	1	23	99	49
786	43	18	65	94	92	85	85	35	3	82	91	23

The Moving Average analysis tool projects values in the forecast period, based on the average value of the variable over a specific number of preceding periods. A moving average provides trend information that a simple average of all historical data would mask. This example uses the data for Contoso product 1176 to predict a target inventory level for the new fiscal year.

1. On the Tools menu, click Data Analysis.
2. In the Data Analysis dialog box, click Moving Average, and then click OK.
3. The Moving Average dialog box opens.

4. In the Input Range box, enter a single row or column of data. This example uses the row of data from product 1176 on the Contoso top-10 products report.
5. In the Interval box, enter the number of values that you want to include in the moving average. In this example, enter 3, the default interval.

    NOTE   The interval is the number of data points used to calculate the moving average. The larger the interval, the smoother the moving average line; the smaller the interval, the more the moving average is affected by individual data point fluctuations.

6. In the Output Range box, enter the cell address where you want the results to start.
7. Select the Chart Output check box to see a graph comparing the actual and forecasted inventory levels.
8. Click OK.
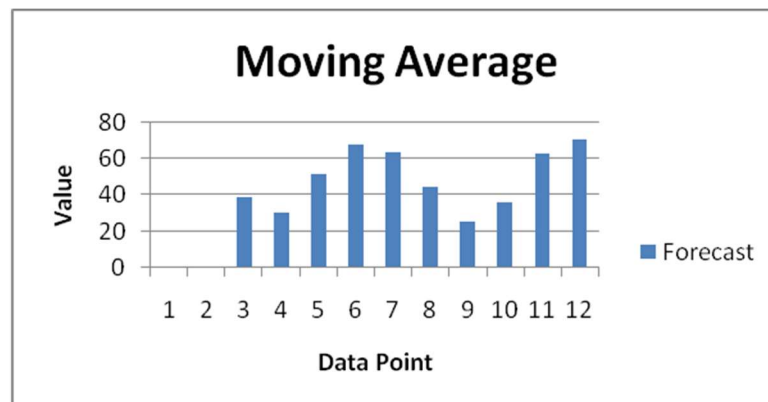
Linest
Returns statistics that describe a linear trend matching known data points, by fitting a straight line using the least squares method.
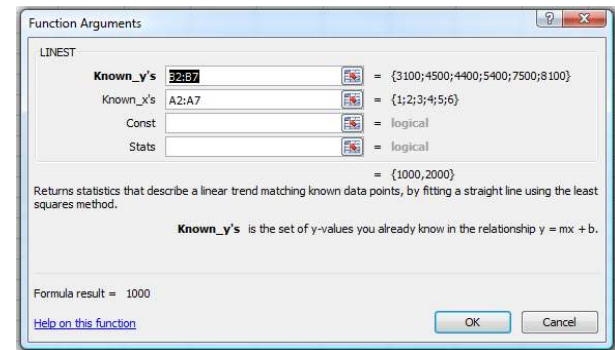
The equation for the line is:
$y = mx + b$

Example 1
Take for example the linear regression of sales per month

Month	Sales
1	3100
2	4500
3	4400
4	5400
5	7500
6	8100

Answer: 1000

What is the sales on the 9th month?
Sales = 1000* 9 = 9000

Example 2 – Multiple Linear Regression (the world is not linear)
Suppose a commercial developer is considering purchasing a group of small office buildings in an established business district.

The developer can use multiple linear regression analysis to estimate the value of an office building in a given area based on the following variables.

VARIABLE	REFERS TO THE
y	Assessed value of the office building
x1	Floor space in square feet
x2	Number of offices
x3	Number of entrances
x4	Age of the office building in years

This example assumes that a straight-line relationship exists between each independent variable (x1, x2, x3, and x4) and the dependent variable (y), the value of office buildings in the area.

The developer randomly chooses a sample of 11 office buildings from a possible 1,500 office buildings and obtains the following data. "Half an entrance" means an entrance for deliveries only.

Floor space (x1)	Offices (x2)	Entrances (x3)	Age (x4)	Assessed value (y)
2310	2	2	20	142,000
2333	2	2	12	144,000
2356	3	1.5	33	151,000
2379	3	2	43	150,000
2402	2	3	53	139,000
2425	4	2	23	169,000
2448	2	1.5	99	126,000
2471	2	2	34	142,900
2494	3	3	23	163,000
2517	4	4	55	169,000
2540	2	3	22	149,000

Formula

=LINEST(E2:E12,A2:D12,TRUE,TRUE)

NOTE: The formula in the example must be entered as an array formula. After copying the example to a blank worksheet, select the range A14:E18 starting with the formula cell. Press F2, and then press CTRL+SHIFT+ENTER. If the formula is not entered as an array formula, the single result is -234.2371645.

When entered as an array, the following regression statistics are returned. Use this key to identify the statistic you want.

	A	B	C	D	E	F
1	m_n	m_{n-1}	...	m_2	m_1	b
2	se_n	se_{n-1}	...	se_2	se_1	se_b
3	r^2	se_y				
4	F	d_f				
5	ss_{reg}	ss_{resid}				

The multiple regression equation, y = m1*x1 + m2*x2 + m3*x3 + m4*x4 + b, can now be obtained using the values from row 14:

y = 27.64*x1 + 12,530*x2 + 2,553*x3 - 234.24*x4 + 52,318

The developer can now estimate the assessed value of an office building in the same area that has 2,500 square feet, three offices, and two entrances and is 25 years old, by using the following equation:

y = 27.64*2500 + 12530*3 + 2553*2 - 234.24*25 + 52318 = $158,261

Or you can copy the following table to cell A21 of the example workbook.

FLOOR SPACE (X1)	OFFICES (X2)	ENTRANCES (X3)	AGE (X4)	ASSESSED VALUE (Y)
2500	3	2	25	52317.83051

Assessed Value Y
=D14*A22 + C14*B22 + B14*C22 + A14*D22 + E14

Solver

The idea behind the solver is to optimize a process or question. To do this, we usually have multiple equations and multiple unknowns. It is the solver's duty to take these equations and optimize the results to get the best overall answer that you define. That's right – you have to tell it what it is looking for before it can find it!

An optimization model has three parts: the target cell, the changing cells, and the constraints.

Target cell
The target cell represents the objective or goal. We want to either minimize or maximize the target cell.

Changing cells
Changing cells are the spreadsheet cells that we can change or adjust to optimize the target cell.

Constraints
Constraints are restrictions you place on the changing cells

Installing and Running the Solver
To install the Solver, go to the **Options Panel->Add-Ins->Go…**

This is the same as getting the analysis Toolpak – but in this case, we want the Solver Add-in. When it is installed, we will see a new "Solver" button in the Analysis section of the Data tab.

I've set up a spreadsheet that we will use to find the maximum profit while creating a certain amount of pallets using the solver. You can download this file from donneray.info/excel. It is named pallet-solver.xlsx

	A	B	C	D	E	F	G	H	I
1									
2				Panel Type					
3		Tahoe	Pacific	Savannah	Aspen				
4	Pallets	0	0	0	0	Total Profit			
5	Profit	$ 450.00	$1,150.00	$ 800.00	$400.00	$ -			
6									
7			Resources Required per Pallet Type			Used	Available		
8	Glue	50	50	100	50	0	5800	quarts	
9	Pressing	5	15	10	5	0	730	hours	
10	Pine Chips	500	400	300	200	0	29200	pounds	
11	Oak Chips	500	750	250	500	0	60500	pounds	
12									
13									

Creating your own worksheet should be done in a similar fashion – where the target cells and the changing cells are arranged in some logical fashion and are marked – making it easier to see what you are doing.

In this worksheet, B4:E4 are the changing cells which represent our decision variables representing the number of pallets of each type of panel to produce. The solver will determine the optimal values for these cells.

Notice that the profit for each pallet of panels ($450, $1,150, $800 and $400) was entered in cells B5, C5, D5 and E5, respectively. This allows us to compute the target cell in F5 as:

=B5*B4+C5*C4+D5*D4+E5*E4
Or equivalently,
=SUMPRODUCT(B5:E5,B4:E4)

In cells B8:E11, we've entered the amount of resources needed to produce a pallet of each type of panel. For example, the value 15 in cell C9 means that 15 hours of pressing is required to produce a pallet of Pacific style panels.

With these values in place, we can enter a formula in cell F8 to compute the total amount of glue used for any number of pallets produced:

Formula for cell F8:   =SUMPRODUCT(B8:E8,$B$4:$E$4)

With these values in place, we can enter a formula in cell F8 to compute the total amount of glue used for any number of pallets produced:

Formula for cell F8:   =SUMPRODUCT(B8:E8,$B$4:$E$4)

We can copy this formula to cells F9:F11 to compute the total amount of pressing, pine chips, and oaks chips used. (The dollar signs in $B$4:$E$4 specify that this cell range stays constant, while the cell range B8:E8 becomes B9:E9, B10:E10, and B11:E11 in the copied formulas.) The formulas in cells F8:F11 correspond to the left hand side values of the constraints.

In cells G8:G11, we've entered the available amount of each type of resource (corresponding to the right hand side values of the constraints). This allows us to express the constraints as:

$F$8:$F$11<=$G$8:$G$11

This is equivalent to the four constraints: F8<=G8, F9<=G9, F10<=G10, and F11<=G11. We can enter this set of constraints directly in the Solver dialogs along with the non-negativity conditions:
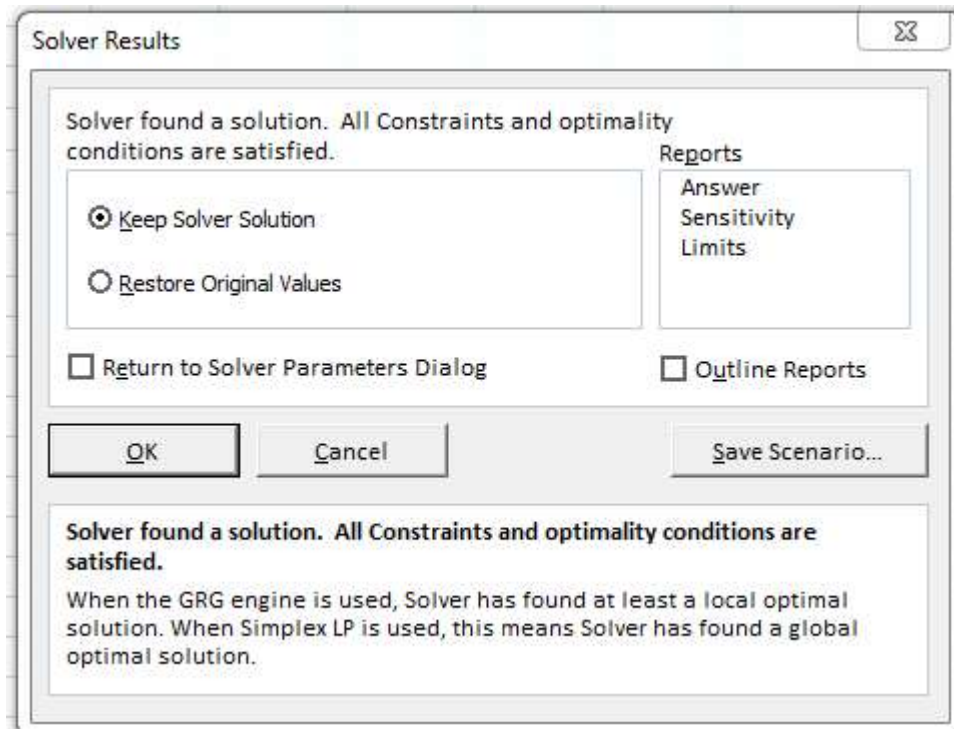
$B$4:$E$4>= 0

To let the Solver know which cells on the worksheet represent the decision variables, constraints and objective function, we click Solver button on the Data tab, which displays the Solver Parameters dialog. In the Set Objective (or Set Target Cell) edit box, we type or click on cell F5, the objective function. In the By Changing Variable Cells edit box, we type B4:E4 or select these cells with the mouse.

To find the optimal solution, we simply click on the Solve button!
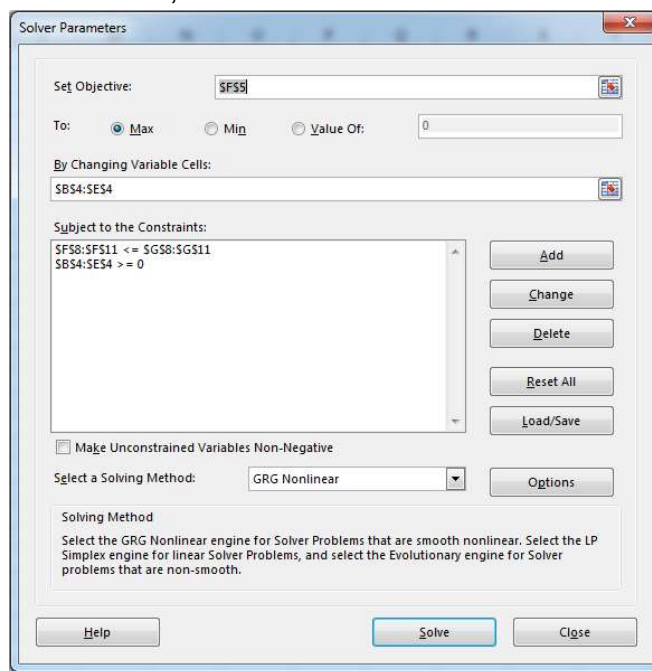
At this point, it asks to keep the solution or restore the values. You can also get a report which describes the solution.

Select the Outline Reports and click OK. In Excel 2013, you get new tabs with all the information

	A	B	C	D	E	F	G	H
1		Microsoft Excel 12.0 Answer Report						
2		Worksheet: [Book1]Sheet1						
3		Report Created: 10/12/2012 8:43:29 PM						
4								
5								
6		Target Cell (Max)						
7		Cell	Name	Original Value	Final Value			
8		$F$5	Profit Total Profit	0	58800			
9								
10								
11		Adjustable Cells						
12		Cell	Name	Original Value	Final Value			
13		$B$4	Pallets Tahoe	0	23			
14		$C$4	Pallets Pacific	0	15			
15		$D$4	Pallets Savannah	0	39			
16		$E$4	Pallets Aspen	0	0			
17								
18								
19		Constraints						
20		Cell	Name	Cell Value	Formula	Status	Slack	
21		$F$8	Glue Used	5800	$F$8<=$G$8	Binding	0	
22		$F$9	Pressing Used	730	$F$9<=$G$9	Binding	0	
23		$F$10	Pine Chips Used	29200	$F$10<=$G$10	Binding	0	
24		$F$11	Oak Chips Used	32500	$F$11<=$G$11	Not Binding	28000	
25		$B$4	Pallets Tahoe	23	$B$4>=0	Not Binding	23	
26		$C$4	Pallets Pacific	15	$C$4>=0	Not Binding	15	
27		$D$4	Pallets Savannah	39	$D$4>=0	Not Binding	39	
28		$E$4	Pallets Aspen	0	$E$4>=0	Binding	0	

Answer Report 1 | Sensitivity Report 1 | Limits Report 1 | Sheet1

Histogram Example

Sometime the easiest way to see how the data falls is to use a histogram. This takes a lot of data and puts it into bins. Then, you count how many items have been put into those bins.

Take for example, how many students in grade 9 are a certain height? How is this data distributed? I've put this data into a file and you can download this file from donneray.info/excel. It is named pallet-solver.xlsx

So, click on Data Analysis, then Histogram:
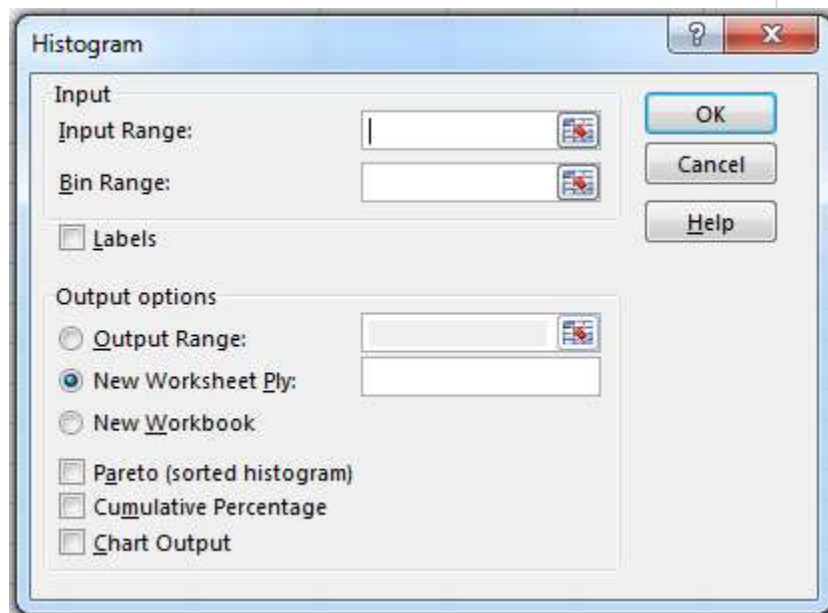
	A	B	C	D	E	F
		Student Number	Height to the nearest inch		Bin	
		1	65		56	
		2	70		58	
		3	65		60	
		4	73		62	
		5	68		64	
		6	59		66	
		7	63		68	
		8	67		70	
		9	65		72	
		10	63		74	
		11	64			
		12	71			
		13	59			
		14	61			
		15	70			
		16	68			
		17	66			
		18	65			
		19	69			
		20	71			
		21	67			
		22	64			
		23	63			
		24	70			
		25	61			

Histogram dialog box:

Input
Input Range: |
Bin Range:
☐ Labels

Output options
○ Output Range:
◉ New Worksheet Ply:
○ New Workbook

☐ Pareto (sorted histogram)
☐ Cumulative Percentage
☐ Chart Output

[OK] [Cancel] [Help]
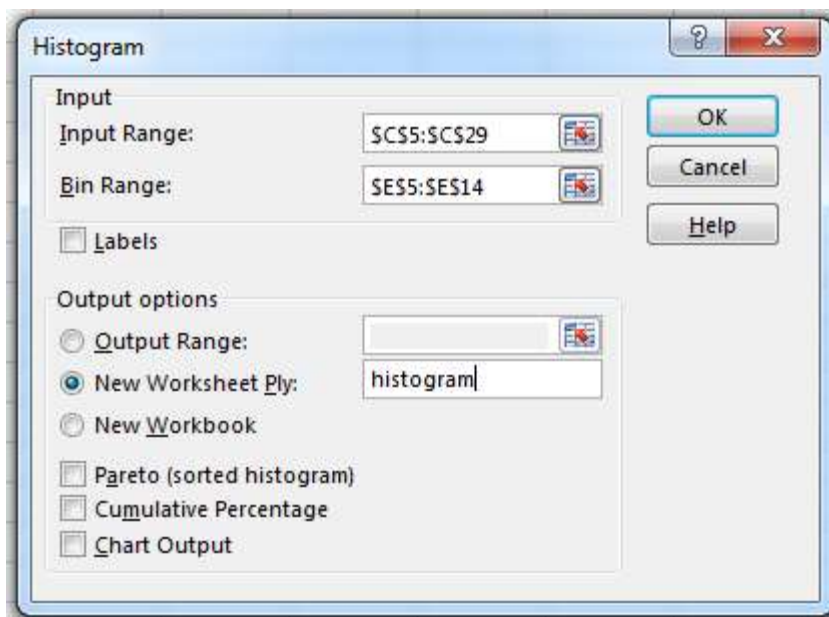
The input range is the all of the student's heights. The bin range contains range of items want to throw them in. I made a container every 2 inches from below the minimum height.

The Output gives the possibility of putting it on the sheet, in a new worksheet, or a new workbook. I usually pick the new worksheet.

It also gives the ability to add:
- Pareto charts
- Cumulative Percentages
- Chart Output

Bin	Frequency
56	0
58	0
60	2
62	2
64	5
66	5
68	4
70	4
72	2
74	1
More	0

Which, when graphed, makes it much easier to understand what is going on:
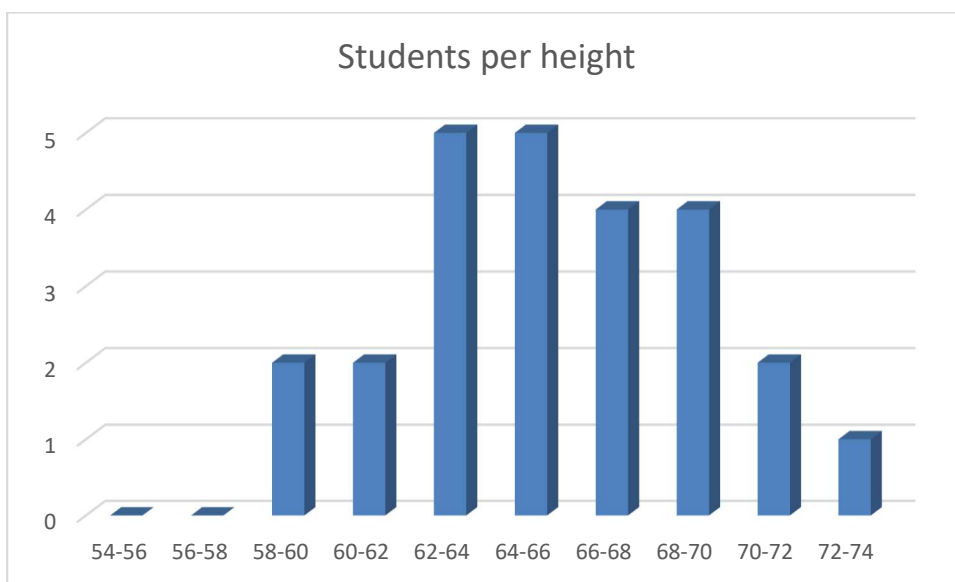
Sampling

Since I was just listening to the Car Talk guys talk about this, I thought this would be a good example to do! Sampling creates a sample from a population. This is good, because we don't have to test every single item, we can pick a representative sample from the data given.

This example uses the Audit file which can be downloaded from donneray.info/excel.

In this file, a company named Outlander Spices needs to audit 15 quarterly sales values for several stores. The first step is to randomly select the 15 store and quarter combinations by using the Sampling analysis tool.

The Sampling sheet contains a list of stores and quarters, with a combination of both combined in a column (because the Sampling tool requires that the information be numeric). For example, 203 represents store 002's third-quarter sales.

Select Sampling from the Analysis Tools.

In the Input Range box, enter C7:C66.

Under Sampling Method, select Random.
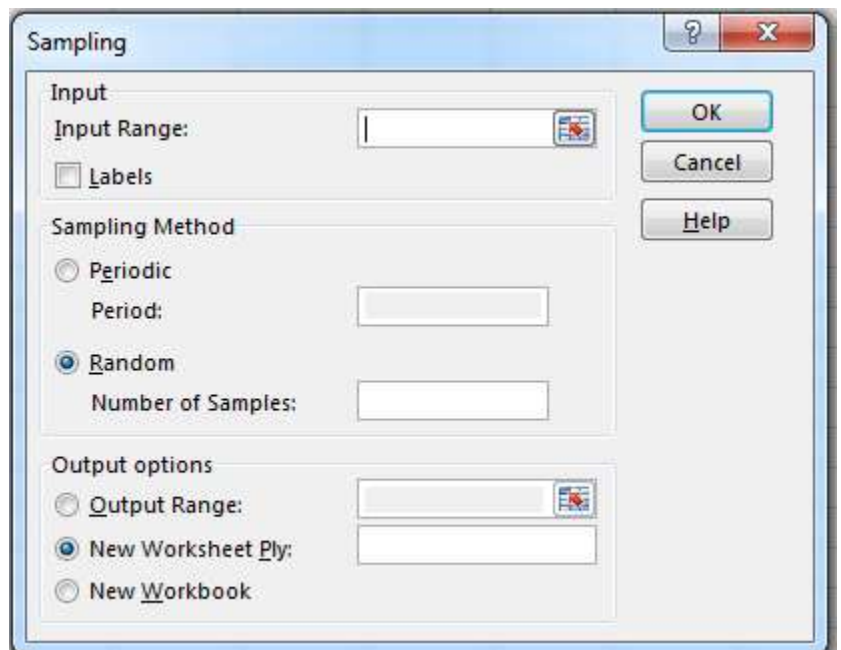
In the Number of Samples Box, Enter 20. With 20 samples, 15 or more are likely to be unique.

Under the Output options, select Output Range and enter E7.

Click OK!

You now have 20 values to pick from, but some are duplicates.
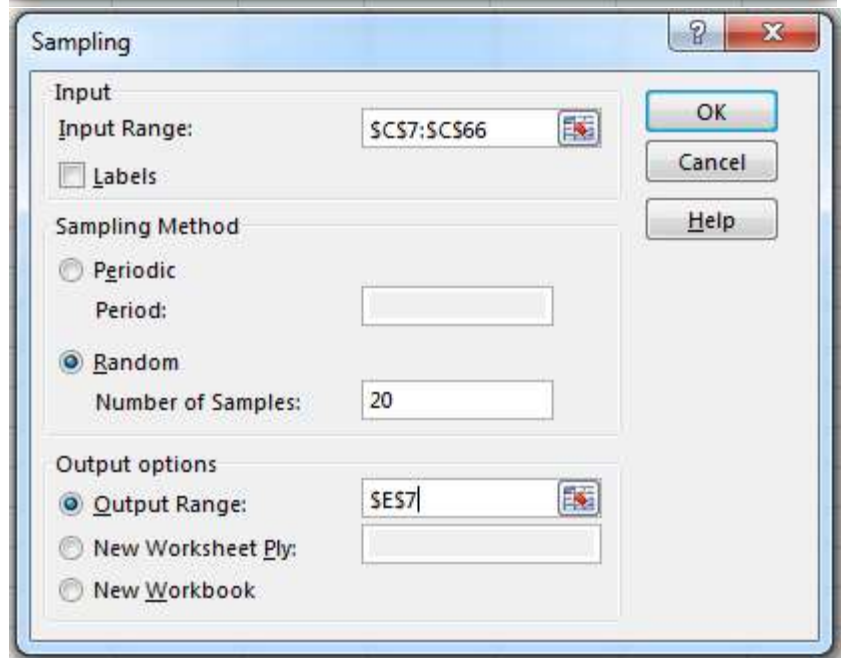
How do you remove the duplicates?

Scenarios

Scenarios are sets of input values that produce different results. For example, in a budget projection worksheet, you can have one scenario that includes conservative sales figures, and another scenario that includes more aggressive sales figures. Instead of creating a new scenarios every time, you can modify existing scenarios. In a worksheet containing multiple scenarios, you can switch among them to view the results for different input values. In addition, you can merge scenarios from other worksheets.

This example uses the Projections file which can be downloaded from donneray.info/excel.

In the Scenarios sheet, select B8:E8 and then **Data->What If Analysis->Scenario Manager.**
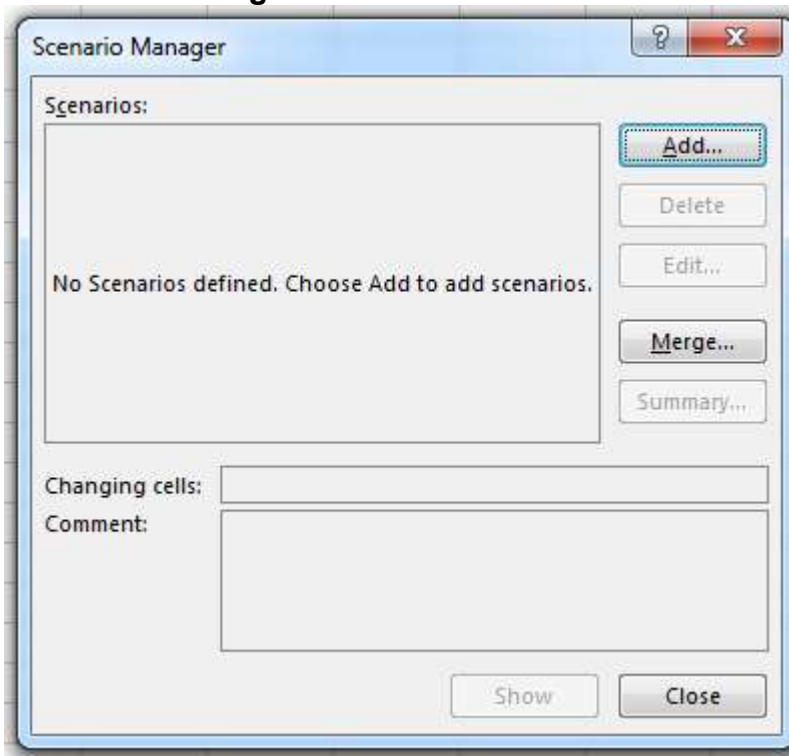
Click Add.

In the Scenario name box, enter Original profit. In the Comment box, edit the box to say: Original projected profit.

Click OK.

A box now comes up with all the original values. Click on Add.
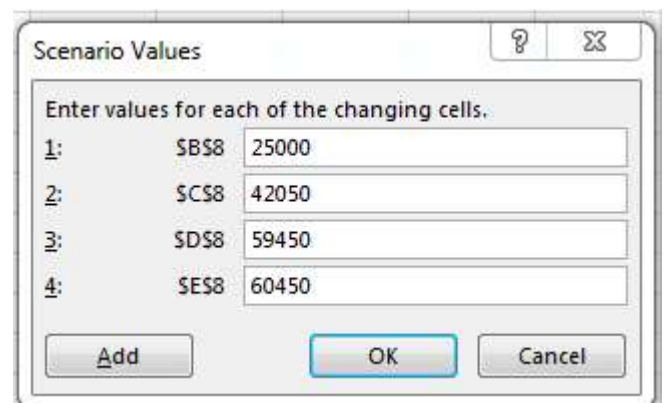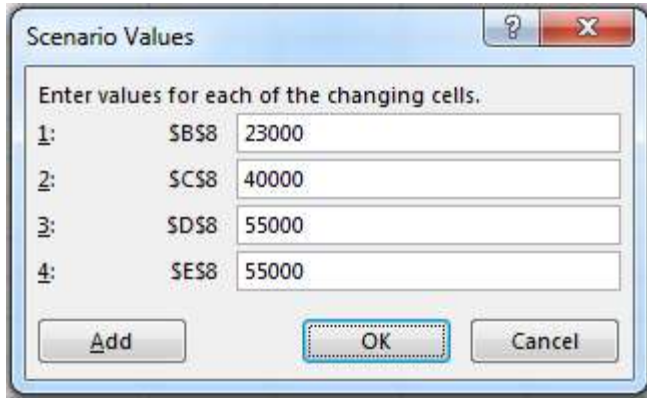
A new scenario box appears. In this box, put in:
Decreased cost of sales

Edit this comment box to say:
Projected profit with decreased cost of sales.

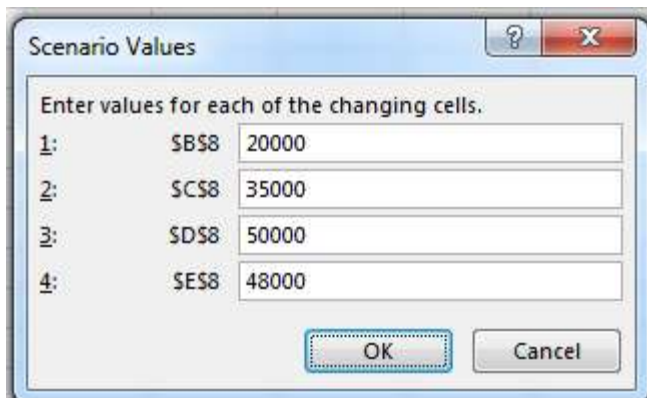Click OK.

Enter the values as shown

Click OK

Now, you can select on any of the scenarios and it will automatically update the table to show the changes based on the scenario.

If the scenario ended up being even better, one you can change the scenario by clicking it and selection Edit…. Edit the "Decreased cost of sales" scenario to the values below:

Click OK. Click Show. Click Close.

Goal Seek

Even though you know the formula to something, sometimes you would like to adjust the numbers until you reach a desired outcome. Take for example the payment of a home mortgage. You may know what type of loan you want and the payment – yet, you would need to figure the percentage necessary to get that type of loan.

Create a new worksheet and type:
1. In cell A1, type Loan **Amount**.
2. In cell A2, type Term in **# of Payments**.
3. In cell A3, type **Interest Rate**.
4. In cell A4, type **Payment**.

Next, add the values you know
1. In B1, type 100000 – this is the amount you want to borrow
2. In B2, type 180 – the number of months to pay off the loan

We know the equation for finding a mortgage payment is PMT. In this case, we want to type this into B4:

=PMT(B3/12,B2,B1)

In this example, we want to pay $900/month. We won't enter that amount here, because you want to use Goal Seek to determine the interest rate, and Goal Seek requires that you start with a formula.

1. On the Data tab, in the Data Tools group, click What-If Analysis, and then click Goal Seek.
2. In the **Set cell** box, enter the reference for the cell that contains the formula that you want to resolve. In the example, this reference is cell B4.
3. In the **To value** box, type the formula result that you want. In the example, this is -900. Note that this number is negative because it represents a payment.
4. In the **By changing cell** box, enter the reference for the cell that contains the value that you want to adjust. In the example, this reference is cell B3.
5. Click **OK**

Remember to change the Number look into a percentage so that it makes sense.

	A	B
1	Amount	100000
2	# of Payments	180
3	Interest Rate	7.02%
4	Payment	($900.00)
5		