EXCEL 2016 – FORMULA BASICS

Participant Guide

EXCEL 2016 – FORMULA BASICS

Target Audience: This class is designed for Excel users with a solid understanding of the basics of spreadsheets who wish to perform more complex operations.

Time Allotted: 3 hours

Objectives:

Overall: Understand how to effectively use the advanced formatting features available in Excel to quickly and efficiently format large amounts of data. This class will also teach skills related to understanding and using basic formulas and functions.

Specific: Participant will…
- Filter and sort data in a worksheet
- Define mathematical operators and demonstrate proper use
- Construct basic formulas to perform calculations
- Practice common functions such as: CONCATENATE, UPPER, IF, TRIM, and TODAY
- Practice the Subtotal, Text to Columns, Conditional Formatting, and Remove Duplicate features

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Agenda	Notes
- Housekeeping - Introductions - Filter and Sort - Conditional Formatting - Calculation Order - Building Formulas - Mathematical Operators - Functions - Data Tab Features - Subtotals - Remove Duplicates - What-if Analysis	

Introduction Activity	Notes
Please tell us: • *Your Name* • *Your Department* • *What you hope to get out of today's session*	

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Filter Data	**Notes**

1. Click on any cell in your data.
2. Click **Filter** (Data tab, Sort and Filter group)
   - The filter will be applied to the column header row
3. To use the filter:
   - Click the arrow ▾
     - Select one or more values to filter data by

NOTE: When a column is filtered the 🔽 icon will show. Click on **Select All** to un-filter data.
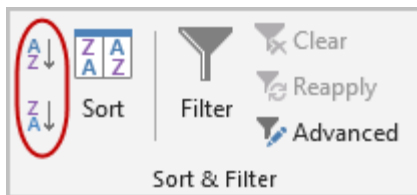
Sort Data - Simple Sort	**Notes**

When you sort data, you can select data in a range that goes across columns and rows, or a range that is a single column. The range can include titles (headers) that you create to identify columns or rows.

1. Click on a cell in the data range you wish to sort.

   NOTE: If the data you are sorting has headers, you will need to indicate this so that Excel does not include the headers in the sort. To indicate that your data has headers, click on the **Sort** button and ensure that the check-box for **My data has headers** is checked.

2. Select the preferred sort order, either **A to Z** (or lowest number to highest) or **Z to A** (or highest number to lowest).

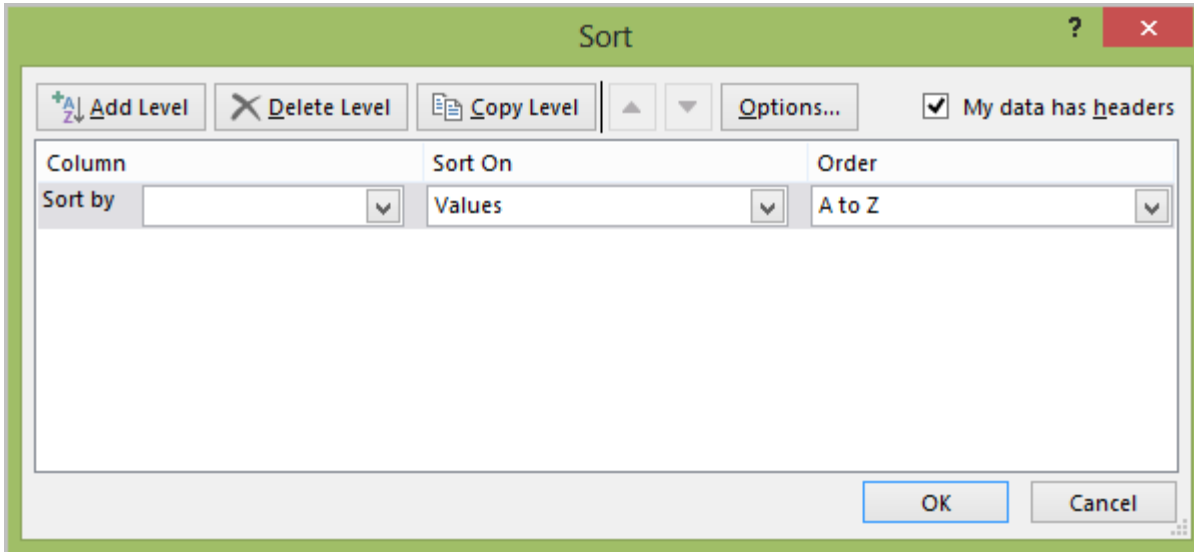3. The spreadsheet will automatically sort.

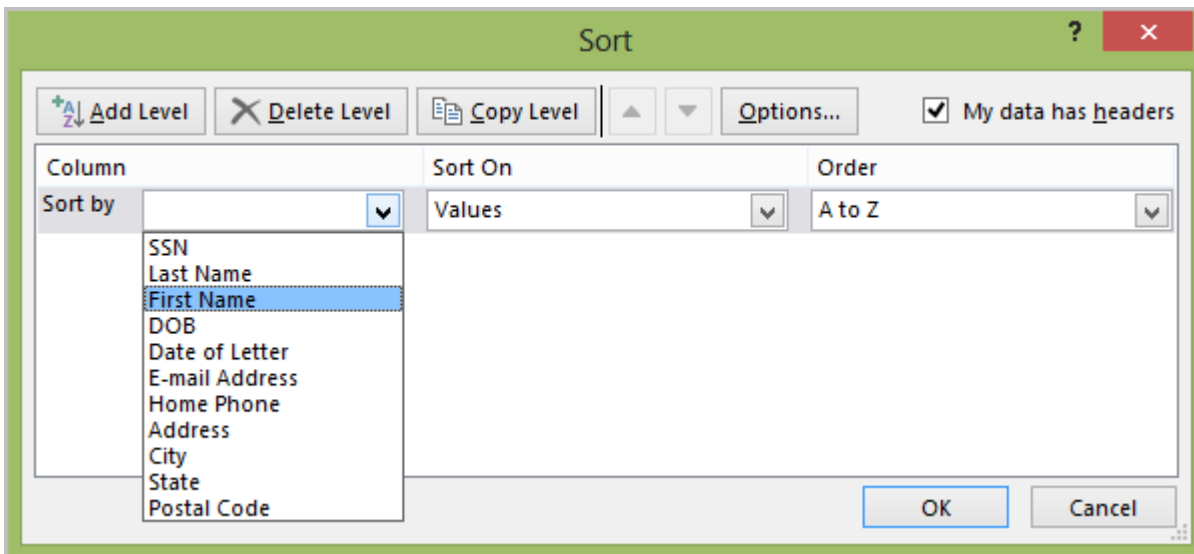| **Sort Data - Multi Level Sort**	**Notes**

1. Select the data to sort.
2. Click the **Sort** button.

3. The custom sort box will open.

4. Use the drop down menus to select criteria for the first level of sorting.

5. Click **Add Level** and then repeat **step 4** if you wish to sort by additional columns.
6. Click **OK** when you have finished selecting your sort criteria and are ready to sort.

Sort By Date   Notes

Dates can also be sorted, with either the oldest date on top or the newest date on top.

To Sort By Date
1. Select all of the dates in the column to sort.
2. On the **Home** tab, in the **Editing** group, click the arrow under **Sort & Filter**.
3. Select either **Sort Oldest to Newest** or **Sort Newest to Oldest**.

   NOTE: If the results are not what you expected, the column might contain dates stored as text.

| *Exercise #1* | *Notes* |

1. Open the **Formulas and Functions Exercises** file.
2. Using the data in the **Exercise 1** tab, add filters and utilize sort tools as appropriate to get answers to the following:

State with highest number of murders	
State with lowest number of murders	
State with lowest number of robberies	
State with highest number of robberies	
Midwest state with the largest # police	
Northern state with lowest number of robberies	
Northern state with lowest percentage urban population	
Number of states in the West beginning with A or W	
West A and W states that has the highest number of robberies	

| *Conditional Formatting* | *Notes* |

Conditional formatting helps you highlight specific data and emphasize values in a worksheet by formatting cells based on a criteria or condition that you specify in a rule. If the condition is fulfilled, the formatting is applied to the cells.

Format cells based on their values
Using this rule, you can format a range of cells by using 2-color scales, 3-color scales, data bars, and icon sets.

Format only cells that contain
Using this rule, you can format cells that contain values in a certain range. You can format cells that contain text beginning with, ending with, or containing specific characters. You can use this rule to highlight dates occurring in the last week, month, or across other time intervals. You can highlight blanks, no blanks, errors, and no errors in a worksheet.

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Format only top or bottom ranked values

Using this rule, you can format the top or bottom 10 values in the selected cell range. In addition, you can also format the values that rank in a specified top or bottom percent of the selected range. For example, you can choose to format the values that rank in the top 10 percent of the selected range. Then, you can click the Format button to specify the formatting to be applied to the cells that contain those values.

Format only values that are above or below average

Using this rule, you can format the cells that contain values that are above or below average for the selected cell range. You can also format the cells that contain values 1, 2, or 3 standards above or below the average. Specify the formatting to be applied to these cells by using the Format button.

Format only unique or duplicate values

Using this rule, you can format the duplicate or unique values in the selected range of cells. You can then specify the formatting to be applied to the values containing duplicate or unique values by using the Format button.

To Apply Conditional Formatting

1. Select the column to format.
2. In the **Home** tab click **Conditional Formatting**.
3. Select **New Rule**.
4. Select the appropriate criteria.
5. Click **OK**.

The column will automatically format based on the criteria chosen.

Exercise #2   Notes

Using the data in the **Exercise 2** tab, add conditional formatting to:
1. Highlight all negative values in column H.
   a. Filter by color to see the values, write them here:

2. Highlight dates between 7/1/2015 and 9/30/2015 in column B.
    a. Sort by color
    b. Count the total number of dates _____

Formula Calculation Order   Notes

A formula in Excel always begins with an equal sign (=). The equal sign tells Excel that the characters that follow constitute a formula. Formulas are always calculated from left to right according to a specific mathematical order. The following sentence will help you remember the correct order.

Please **E**xcuse **M**y **D**ear **A**unt **S**ally
P   Parenthesis
E   Exponents (Powers or Square Roots)
M   Multiplication <u>or</u> Division (left to right)
D   Multiplication <u>or</u> Division (left to right)
A   Addition <u>or</u> Subtraction (left to right)
S   Addition <u>or</u> Subtraction (left to right)
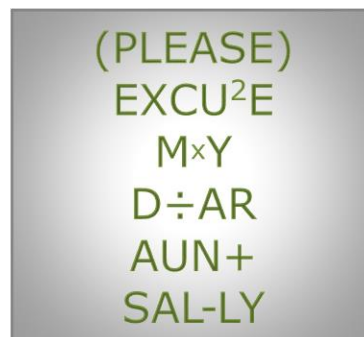
Exercise #3   Notes

Complete the math sheet that will be passed around the room.

Building Formulas   *Notes*

Use of Parentheses
To change the order of evaluation, enclose in parentheses the part of the formula to be calculated first. For example, the following formula produces 11 because Excel calculates multiplication before addition. The formula multiplies 2 by 3 and then adds 5 to the result.

=5+2*3

 In contrast, if you use parentheses to change the syntax, Excel adds 5 and 2 together and then multiplies the result by 3 to produce 21.

=(5+2)*3

In the following example, the parentheses around the first part of the formula force Excel to calculate B4+25 first and then divide the result by the sum of the values in cells D5, E5, and F5.

=(B4+25)/SUM(D5:F5)

Formulas
A formula performs calculations or other actions in your worksheet. A formula always starts with an equal sign (**=**), which can be followed by functions, references, operators, and constants.

Functions – A prewritten formula that takes a value or values, performs an operation, and returns a value or values. Use functions to simplify and shorten formulas on a worksheet, especially those that perform lengthy or complex calculations.

References – The set of coordinates that a cell occupies on a worksheet. For example, the reference of the cell that appears at the intersection of column B and row 3 is B3.

Operators – A sign or symbol that specifies the type of calculation to perform within an expression. There are mathematical, comparison, logical, and reference operators.

Constants – A value that is not calculated and, therefore, does not change.

The 4 Types of Calculation Operators
- Mathematical (or Arithmetic)
- Comparison
- Text Concatenation
- Reference

Mathematical Operators

To…	Use this symbol	Example
Multiply	*	9*9
Divide	/	81/9
Add	+	8+1
Subtract	-	10-1
Denote negative numbers		-9
Percent	%	90%
Exponentiation	^	3^2

Comparison Operators – compare two values

Comparison Operator	Means	Example
=	Equal to	A7=B7
>	Greater Than	A7>B7
<	Less Than	A7<B7
>=	Greater than or equal to	A7>=B7
<=	Less than or equal to	A7<=B7
<>	Not equal to	A7<>B7

Concatenation Operator – join values/text
The operator & is used to join one or more strings of text to produce a single piece of text.

Reference Operators- combine ranges of cells for calculations

Reference Operator	Means	Example
: (colon)	Range operator which produces one reference to all cells between two references. It includes the two references.	SUM (C1:E17)
, (comma)	Union operator which combines multiple references into one.	SUM(C1:C4, A3:D5)
(space)	Intersection operator, which returns a reference to the cells common to the ranges in the formula. In this example, cell C7 is common, so it is the intersection.	B7:D7 C6:C8

To Create a Formula
1. Click in the cell where you would like the result of your formula to appear.
2. Type the equal sign (**=**).
3. Enter your formula by typing in the cell reference or clicking on the desired cells. Use the desired mathematical symbols and operators to complete your formula.
4. Hit the **Enter** key.

Exercise #4	*Notes*

1. Utilize the **Exercise 4** tab and your **Exercise 3** math worksheet to enter the formulas into Excel and check your answers.

The Syntax of Functions	*Notes*

Functions are predefined formulas that perform calculations by using specific values, called arguments, in a particular order, or structure. Functions can be used to perform simple or complex calculations.

Structure of a Function
*   Structure – The structure of a function begins with an equal sign (=) followed by the function name, an operating parenthesis, the arguments for the function separated by commas, and a closing parenthesis. The structure in the screenshot below is =SUM(B2:B5).
*   Function Name – A complete list can be found by clicking in a cell and pressing **Shift+F3**. The function name in the screenshot below is **SUM**.
*   Arguments – Arguments can be numbers, text, logical values such as TRUE or FALSE, arrays, error values such as #N/A, cell references, constants, formulas, or other functions. The argument in the screenshot below is **(B2:B5)**.
*   Argument Tooltip – A tooltip with the syntax and arguments appears as you type the function, displaying only built-in functions. The argument tooltip in the screenshot below is **SUM(number1, [number2], …)**.

Quarter	Digital camera	Webcam	Camcorder	Television	Refrigerator
2009 (Quarter 1)	9300	31500	3500	21300	12000
2009 (Quarter 2)	12200	6500	9000	23400	17500
2009 (Quarter 3)	8500	12000	5500	28500	13000
2009 (Quarter 4)	4000	17000	12000	14800	13500
	=SUM(B2:B5)				
	SUM(**number1**, [number2], …)				

Exercise #5	*Notes*

1. Navigate to the **Exercise 5** tab.
2. Enter formulas as necessary to perform the calculations.

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Other Functions | Notes

=A1+A2+A3	Adds the values in cells A1, A2 and A3
=SQRT(A1)	Uses the SQRT function to return the square root of the value in A1
=TODAY()	Returns the current date
=UPPER("hello")	Converts the text "hello" to "HELLO" by using the UPPER function
=IF(A1>0)	Tests the cell A1 to determine if it contains a value greater than 0
=TRIM	Removes extra spaces from the specified cells

Concatenate | Notes

The concatenate function plus **&** is used to join one or more cells into one single cell. An example would be joining Last Name from one cell and First Name from another cell.

=CONCATENATE(C2&"."&B2&"@fakemail.com")

TIPS:
- Click on cells, don't type cell addresses. It is faster and easier.
- An ampersand (&) must be present between items you wish to join.
- Add spaces, characters or text between **" "**.
- The formula =C2&"."&B2&"@fakemail.com" would accomplish the same result as =CONCATENTATE(C2&"."&B2&"@fakemail.com")
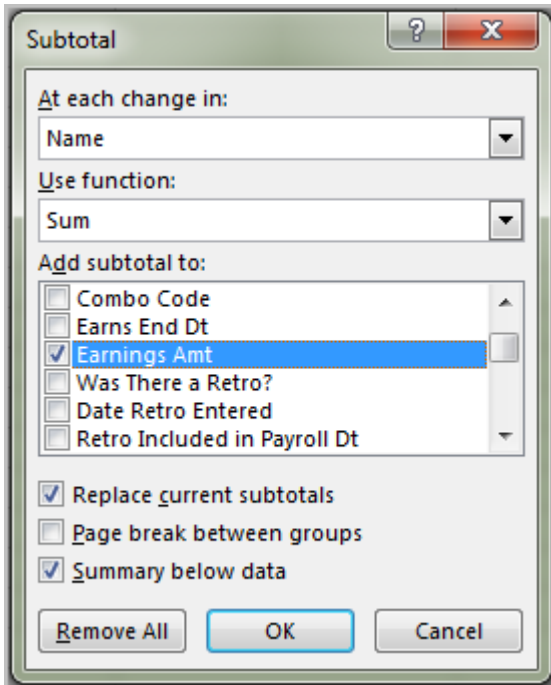
Exercise #6 | Notes

Utilizing the **Exercise 6** tab and the functions listed above, perform the following:
1. Trim the extra spaces from the data in the **Address** column.
2. Capitalize the information in the **State** column.
3. Use a formula to enter e-mail addresses in column F using the format:
   First Name.Last Name@fakemail.com

Subtotals | Notes

You can automatically create subtotals and grand totals by using the Subtotal command.

1. Click the **Data** tab.
2. Sort the data.
3. In the **Outline** group select **Subtotal**.
4. Select the criteria for subtotaling.
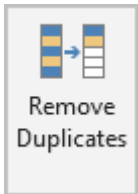

5. Click **OK**.

Exercise # 7 | Notes

Using the data in the **Exercise 7** tab of the **Formulas and Functions Exercises** workbook, add automatic subtotals to the earnings amount.
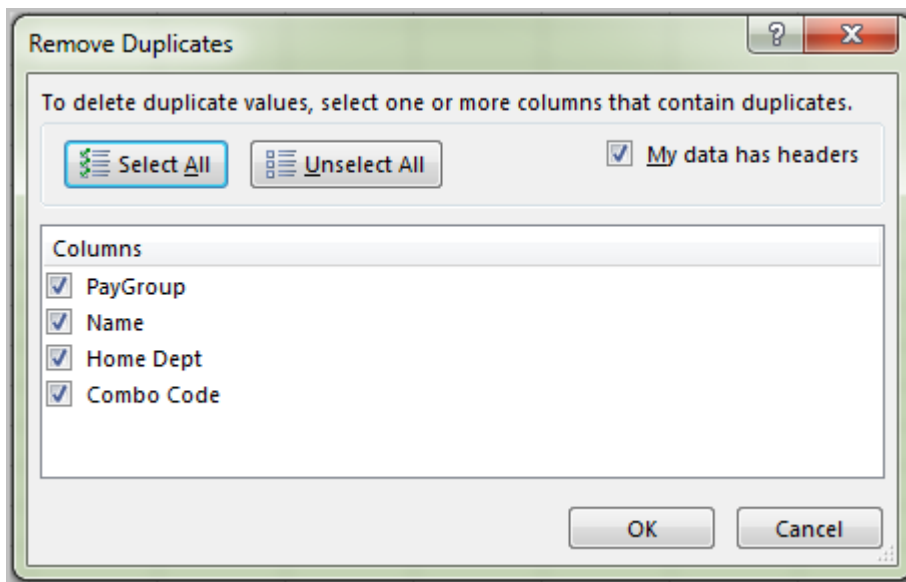
Remove Duplicates	Notes

When you use the **Remove Duplicates** feature, the duplicate data will be permanently deleted. Before you delete the duplicates, it's a good idea to copy the original data to another worksheet so you don't accidentally lose any information. 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.

1. Click the **Data** tab.
2. In the **Data Tools** group click on **Remove Duplicates**.

3. The dialogue box will open and automatically populate the columns in the current spreadsheet.

4. Check the box next to the columns from which you would like to remove duplicates.
5. Click **OK**.
6. The rows containing any duplicate data will be removed and Excel will display the number of duplicate values removed and the number of unique values that remain.

Exercise #9	*Notes*

1. Using the data in the **Exercise 9** tab of the **Formulas and Functions Exercises** workbook, create a list of employees (removing duplicates) with their Paygroup, Name, Home Department and Combo Code.
2. What is the total number of employees _____

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Exercise #10

Notes

Using the data in the **Exercise 10** tab of your **Formulas and Functions Exercises** workbook and the skills practiced in this session, format the worksheet as follows:

1. Remove any duplicates.
2. Split column A into first and last name.
3. Create an e-mail address column using the following email convention:
    FirstName.LastName@fakemail.com
4. Remove the extra spaces in the address column.
5. Change the state column to upper case.
6. Subtotal the spreadsheet to produce sales totals by city (you will need to sort first).
7. Enter the sales totals below:

Bellevue	
Kirkland	
Redmond	
Seattle	
Grand Total	

| **Audit a Formula** | *Notes* |

Using the auditing commands in the **Formula Auditing** group on the **Formulas** tab, you can audit formulas in a worksheet by tracing precedents and dependents, checking errors, and stepping through a formula.
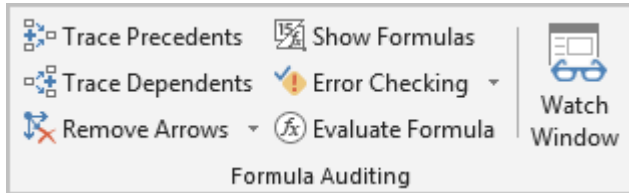
Tracing Precedents and Dependents
A formula that you add in a cell is always dependent on other cells referenced in the formula. The **Trace Precedents** option in Excel helps you find all the cells that a formula depends on. To trace precedents of a formula:
1. Click the cell that contains the formula.
2. On the **Formulas** tab, in the **Formula Auditing** group, click **Trace Precedents**.
3. Excel marks all the dependent cells with blue tracer arrows.

Similarly, a worksheet can contain several formulas that are dependent on the value of one cell. To view cells that contain formulas that depend on the value of a cell:
1. Select the cell that contains the value.
2. On the **Formulas** tab, in the **Formula Auditing** group, click **Trace Dependents**.
You can use the **Remove Arrows** command in the **Formula Auditing** group on the **Formulas** tab to clear the arrows displayed when tracing precedents and dependents in the worksheet.

> **TIP**: To view all the formulas in a worksheet, click **Show Formulas** in the **Formula Auditing** group on the **Formulas** tab.

Error Checking
Using the **Error Checking** option in the **Formula Auditing** group, you can find errors in a formula. The **Error Checking** dialog box displays the errors in the formulas. You can find help about the error, edit the formula in the formula bar, and ignore the error if required. Use the **Previous** and **Next** commands to view the other errors in the worksheet.

Stepping Through a Formula
To step through complex formulas, use the **Evaluate Formula** command in the **Formula Auditing** group on the **Formulas** tab. In the **Evaluate Formula** dialog box, Excel displays the formula. You can evaluate the value of each expression in the formula and then calculate the final result. Excel helps you step through the formula, one expression at a time, and evaluate the final result for the formula.

Error Messages   *Notes*

When a formula is created in Excel that contains an error or circular reference, Excel will display one of a handful of error messages. Knowing the meaning of these error messages helps in identifying the underlying problems, and in correcting the error.

| Error	Meaning
#DIV/0!	Appears when the formula calls for division by a cell that either contains the value 0 or, as is more often the case, is empty. Division by zero is a not allowed in mathematics.
#N/A!	A formula or a function inside a formula cannot find the referenced data.
#NAME?	Appears when the formula refers to a range name that doesn't exist in the worksheet. This error value appears when the wrong range name is typed or quotation marks are not used to enclose some text used in the formula, causing Excel to think that the text refers to a range name.
#NULL!	Appears most often when you insert a space (where a comma should have been used) to separate cell references used as arguments for functions.
#NUM!	Appears when Excel encounters a problem with a number in the formula, such as the wrong type of argument in a function or a calculation that produces a number too large or too small to be represented in the worksheet.
#REF!	Appears when Excel encounters an invalid cell reference, such as when you delete a cell referred to in a formula or paste cells over the cells referred to in a formula.
#VALUE!	Appears when the wrong type of argument or operator is used in a function, or when a mathematical operation refers to cells that contain text entries.

Using What-if Analysis   *Notes*

In Excel, you can save different sets of values as scenarios that you can substitute as required in a worksheet. You can switch between the different scenarios to compare the different results.

Create Scenarios
1. Select the cells that will contain the set of values of the scenarios.
2. On the **Data** tab, in the **Data Tools** group, click **What-If Analysis**.
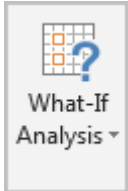
3. Click **Scenario Manager**.
4. In the **Scenario Manager** dialog box, click **Add**.
5. In the **Add Scenario** dialog box, in the **Scenario name** box, type a name for the first scenario.
6. Click **OK**.
7. In the **Scenario Values** dialog box, type the values for the first scenario.
8. Click **OK**.
9. Similarly, create other scenarios.

The **Scenario Manager** dialog box displays the scenarios that you created. You can simply select a scenario and click **Show** to view the results. You can delete a scenario by using the **Delete** button in the **Scenario Manager** dialog box.

To use values or data from other worksheets in the scenarios you created, merge the scenarios. After collating all scenarios, create a scenario summary report that includes information from all the scenarios. Excel displays the scenario summary report in a new worksheet.

Merging Scenarios
1. On the **Data** tab, in the **Data Tools** group, click **What-If Analysis**.
2. Click **Scenario Manager**.
3. In the **Scenario Manager** dialog box, click **Merge**.
4. To merge the required scenario, in the **Book** list section of the **Merge Scenarios** dialog box, select the required workbook.
5. In the **Sheet** box select the required worksheet, then click **OK**.
6. In the **Scenario Manager** dialog box, click **Close**.
7. The **Scenario Manager** dialog box displays the merged scenario.

Summarizing Scenarios
1. On the **Data** tab, in the **Data Tools** group, click **What-If Analysis**.
2. Click **Scenario Manager.**
3. In the **Scenario Manager** dialog box, click **Summary**.
4. In the **Scenario Summary** dialog box, select the required result cells, and then click **OK**.
5. Excel displays the summary report in a new worksheet named **Scenario Summary**.

Additional Resources	*Notes*

To contact me directly:

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NOTE: If you are having problems with a spreadsheet, sending me a copy will make it easier for me to help you!

Additional Resources:
To view all classes offered by Professional Development & Training, go to our website http://www.uvm.edu/develop. Here you can view the class schedule by date, read class descriptions, learn about the certificate programs we offer, and find PeopleSoft Mini Manuals.

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