Useful Microsoft Excel Functions & Formulas

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This document contains a series of examples that illustrate some useful functions and formulas you can use in Microsoft Excel. It is meant to be an extension of my "Formulas & Functions in Microsoft Excel" lecture that is available on my website (http://boistat.mc.vanderbilt.edu/TheresaScott) under *Current Teaching Material*.

General Instructions:
- All of the demonstrated functions and formulas are calculated in a separate column from the column(s) containing the cells they reference – most often the directly adjacent column. Depending on the layout of your spreadsheet, this may require you to *insert* a new column between existing columns.
- The functions and formulas are demonstrated in only a few rows. You will have to copy and paste the function/formula down the appropriate column in your spreadsheet in order for it to calculate the result for every desired row.
- A help file, which includes examples, can be accessed for any function by clicking the "Help on this function" link in the Function Wizard after you've highlighted the function of interest.

Functions to be illustrated (listed by category):
- Date and Time:
  - TODAY; NOW: returns the current date, the current date and time, respectively.
  - DATE: returns the number that represents the date given in Excel date-time code.
  - TIME: converts the hours, minutes, and seconds given as numbers to an Excel serial number (formatted with a time format).
  - DAY; MONTH; and YEAR: returns the day of the month (1 to 31), the month (1 to 12), and year from a date, respectively.
  - HOUR; MINUTE; and SECOND: returns the hour (0 to 23), minute (0 to 59), and second (0 to 59) from a time, respectively.
- Engineering:
  - CONVERT: converts a number (or a time) from one measurement system to another.
- Information:
  - COUNTBLANK: counts the number of blank cells in a specified range of cells.
- Logical:
  - AND: checks whether *all* of the arguments are TRUE and returns TRUE only if *all* arguments are TRUE (returns FALSE otherwise).
  - OR: checks whether any of the arguments are TRUE and returns FALSE only if *all* arguments are FALSE (returns TRUE otherwise).
  - IF: checks whether a condition is met, and returns one value if TRUE, another if FALSE.
- Math:
  - COUNTIF: counts the number of cells within a range that meet the given condition.
  - ROUND, ROUNDDOWN, and ROUNDUP: rounds a number to a specified number of digits, down (toward zero), and up (away from zero), respectively.
  - SUMIF: adds all the cells specified by a given condition, respectively.
- Statistical:
  - COUNTA: counts the number of cells that are not empty.

- Text and Data:
  - CONCATENATE: joins several text strings into one text string.
  - LEFT; RIGHT: returns the first, last (respectively) character or characters in a text string, based on the number of characters you specify.
  - LEN: returns the number of characters in a text string.
  - LOWER; UPPER: converts a text string to lowercase, uppercase, respectively.
  - PROPER: capitalizes the first letter in a text string and any other letters in the text that follow any character other than a letter. Converts all other letters to lowercase letters.
  - SEARCH: returns the number of the character at which a specific character or text string is first found, beginning with a specific starting number. Often used to determine the location of a character or text string within another text string.
  - TEXT: converts a value to text in a specific number format.
  - TRIM: removes all the spaces from a text string except for single spaces between words. Often used on text you have received from another application that may have irregular spacing (ie, leading or trailing spaces).

Additional functions not illustrated but often useful (listed by category):[1]
- Date and Time:
  - NETWORKDAYS: returns the number of whole *workdays* between two dates.
  - WEEKDAY: returns a number (1 to 7) identifying the day of the week of a date.
  - WEEKNUM: returns the week number in the year.
  - WORKDAY: returns the date so many workdays before/after a given start date.
- Information:
  - ISBLANK: checks whether the reference is a blank cell; returns TRUE if it is, FALSE otherwise.
- Logical:
  - TRUE; FALSE: returns the logical value TRUE; FALSE, respectively.
  - NOT: reverses the logic of its argument (ie, changes TRUE to FALSE or FALSE to TRUE).
- Lookup and Reference:
  - CHOOSE: chooses a value or action to perform from a list of values, depending on an index number. Alternative to nested IF functions. Another formula is often used to return the index number.
- Math:
  - CEILING; FLOOR; EVEN; ODD; INT: rounds a number to the nearest integer or to the nearest multiple of significance, down towards zero, up to the nearest even integer, up to the nearest odd integer, and down to the nearest integer, respectively.
  - LN; LOG; LOG10: returns the natural logarithm of a number, the logarithm of a number to the specified base, and the base-10 logarithm of a number, respectively.
  - RAND; RANDBETWEEN: returns a random number greater than or equal to 0 and less than 1 (changes on recalculation), between the numbers you specify, respectively.
  - SQRT: returns the square root of a number.
- Statistical:
  - AVERAGE; MEDIAN: returns the average (arithmetic mean), median (respectively) of the given numeric arguments.
  - MIN; MAX: returns the smallest, largest number (respectively) in a set of values.
  - STDEV; VAR: estimates the standard deviation, variance (respectively) of the given numeric arguments.

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1 There is additionally an extensive amount of Financial functions available – full list given in the Function Wizard.

Examples of useful functions and formulas:

➢ Common Text:

→ *Change the case of a text string using the UPPER, LOWER, and PROPER functions.*
Example spreadsheet:

	A
1	Name
2	nancy Davolio

Formula	Result
=UPPER(A2)	NANCY DAVOLIO
=LOWER(A2)	nancy davolio
=PROPER(A2)	Nancy Davolio

→ *Remove spaces from the beginning and end of a cell with the TRIM function.*
Example spreadsheet:

	A
1	Data
2	BD122
3	Vitamin A

Formula	Result*
=TRIM(A2)	BD122
=TRIM(A3)	Vitamin A

* original text strings were " BD122   " and "   Vitamin A".

→ *Remove characters from text using the LEFT, RIGHT, and LEN functions.**
Example spreadsheet:

	A
1	Data
2	Vitamin Ester-C
3	Vitamin B1

Formula	Result
=LEFT(A2, LEN(A2)-8)	Vitamin
=RIGHT(A3, LEN(A3)-8)	B1

* Depending on the situation, can also use the *Replace* from the *Edit* drop-menu.

→ *Combine first and last names with the CONCATENATE function.*
Example spreadsheet:

	A	B
1	First Name	Last Name
2	Nancy	Davolio
3	Andrew	Fuller

Formula	Result
=A2&" "B2	Nancy Davolio
=B3&", "A3	Fuller, Andrew
=CONCATENATE(A2, " ", B2)	Nancy Davolio

NOTE: First formula is equivalent to third.

→ *Extract the first or last name from a cell containing both first and last name using the LEFT, RIGHT, and SEARCH functions.*
Example spreadsheet:

	A
1	Name
2	Nancy Davolio
3	Fuller, Andrew

Formula	Result
=LEFT(A2, SEARCH(" ", A2)-1)	Nancy
=RIGHT(A2, LEN(2)-SEARCH(" ", A2))	Davolio
=LEFT(A2, SEARCH(",", A2)-1)	Fuller
=RIGHT(A2, LEN(A2)-SEARCH(" ", A2))	Andrew

➢ <u>Common Math:</u>
→ *Convert measurements using the CONVERT function (see help file for complete list).*
Example spreadsheet:

	A
1	Data
2	6

Formula	Result
=CONVERT(A2, "C", "F")	42.8
=CONVERT(A2, "lbm", "kg")	2.721554
=CONVERT(A2, "cm", "in")	2.362204724

→ *Round a number with the ROUND, ROUNDUP, and ROUNDDOWN functions.*
    Example spreadsheet:

	A
1	Data
2	20.3
3	-5.9
4	12.5493
5	22230

Formula	Result
=ROUND(A2, 0)	20
=ROUNDUP(A2, 0)	21
=ROUNDUP(A4, 2)	12.55
=ROUNDDOWN(A3, 0)	-5
=ROUNDDOWN(A4, 2)	12.54
=ROUND(A5, -2)	22200
=ROUNDUP(A5, -3)	23000

NOTE: Use the *Number* tab from the *Format Cells* dialog box (reached via *Cells* from the *Format* drop-menu) to only change the number of decimal places *displayed* (ie, this does not change the actual number).

→ *Count cells with the COUNTA and COUNTBLANK functions.*
    Example spreadsheet:

	A
1	Data
2	20.3
3	
4	12.5
5	15.0

Formula	Result
=COUNTA(A2:A5)	4
=COUNTBLANK(A2:A5)	1

NOTE: PivotTables are an alternative to manually calculating counts using function and formulas – see my "PivotTable & PivotChart Reports, and Macros in Microsoft Excel" lecture (also available on my website).

→ *Conditionally count the values in cells using the COUNTIF function.*
Example spreadsheet:

	A	B
1	Salesperson	Invoice
2	Buchanan	15000
3	Buchanan	9000
4	Suyama	8000
5	Suyama	20000
6	Buchanan	5000
7	Dodsworth	22500

Formula	Result
=COUNTIF(B2:B7, ">9000")	3
=COUNTIF(B2:B7, "<=9000")	3
=COUNTIF(A2:A7, "Buchanan")	3
=COUNTIF(A2:A7, A4)	2

→ *Conditionally add numbers using the SUMIF function.*
Example spreadsheet:

	A	B
1	Salesperson	Invoice
2	Buchanan	15000
3	Buchanan	9000
4	Suyama	8000
5	Suyama	20000
6	Buchanan	5000
7	Dodsworth	22500

Formula	Result
=SUMIF(A2:A7, "Buchanan", B2:B7)	29000
=SUMIF(B2:B7, ">=9000", B2:B7)	66500
=SUMIF(B2:B7, "<9000", B2:B7)	13000

NOTE: The three arguments to the SUMIF function are (1) the range to evaluate (these cells are checked to determine whether a row meets the criteria); (2) the criteria (the condition that the cells evaluated must meet for the row to be included in the sum); and (3) the range to sum (the numbers in these cells are added, provided the row satisfies the condition).

➤ Common Conditional:
    → *Conditionally evaluate the contents of a cell using the IF, AND, and OR functions:*
        Example spreadsheet:

	A	B
1	Gender	Test Value
2	Female	15
3	Male	9
4	Female	8
5	Female	20
6	Male	4
7	Male	22

Formula	Result
=IF(B2 > 10, "High Risk", "Low Risk")	High Risk
=IF(AND(B2 > 10, A2 = "Female"), "High Risk Female", "Low Risk Male/Female")	High Risk Female
=IF(AND(B7 > 10, A2 = "Female"), "High Risk Female", "Low Risk Male/Female")	Low Risk Male/Female
=IF(B3 < 5, "<5", IF(AND(B3 >= 5, B3 <= 10), "5-10", ">10"))	5-10
=IF(B6 < 5, "<5", IF(AND(B6 >= 5, B6 <= 10), "5-10", ">10"))	<5

        NOTE: Last two formulas are examples of *nested* IF functions.

➤ Common Date and Time:
    → *Insert an automatically updated date or time using the TODAY and NOW functions.*

Formula	Result
=TODAY()	(current date; varies)
=NOW()	(current date & time; varies)

    → *Convert times using the CONVERT and other functions.*
        Example spreadsheet:

	A
1	Time
2	6
3	10:35 AM
4	12.25

Formula	Result
=CONVERT(A2, "day", "hr')	144
=CONVERT(A2, "hr", "mn")	360
=CONVERT(A2, "yr", "day')	2191.5
=(A3-INT(A3))*24	10.583333
=TEXT(A4/24, "h:mm")	12:15

NOTE: The fourth and fifth formulas convert hours from a standard format (hours : minutes : seconds) to a decimal number and vice versa (reference time = 12:00 AM).

→ *Add dates.*

Example spreadsheet:

	A	B	C	D
1	Date	Days to add	Months to add	Years to add
2	6/9/2007	3	3	3
3	9/2/2007	5	5	5
4	12/10/2008	25	1	2

Formula	Result
=A2+B2	6/12/2007
=A4+B4	2/2/2009
=DATE(YEAR(A2), MONTH(A2)+B2, DAY(A2))	9/9/2007
=DATE(YEAR(A3), MONTH(A3)+B3, DAY(A3))	2/2/2008
=DATE(YEAR(A4)+C4, MONTH(A4), DAY(A4))	12/10/2010
=DATE(YEAR(A2)+D2, MONTH(A2)+C2, DAY(A2)+B2)	9/12/2010

→ *Add times.*

Example spreadsheet:

	A	B
1	Time	Time to be added
2	10:35:00 AM	10

Formula	Result
=A2 + TIME(B2, 0, 0)	08:35:00 PM
=A2 + TIME(0, B2, 0)	10:45:00 AM
=A2 + TIME(0, 0, B2)	10:35:10 AM

→ *Calculate the difference between two dates.*
Example spreadsheet:

	A	B
1	Date1	Date2
2	6/9/2007	6/15/2007
3	9/2/2007	10/8/2007
4	12/10/2008	9/19/2009

Formula	Result
=A3 – A2	6
=MONTH(B3) – MONTH(B2)	1
=(YEAR(B4)-YEAR(A4))*12 + MONTH(B4) – MONTH(A4)	9
=YEAR(B4) – YEAR(A4)	1

→ *Calculate the difference between two times.*
Example spreadsheet:

	A	B	C
1	Start time	End time 1	End time 2
2	6/9/2007 10:35 AM	6/9/2007 3:30 PM	6/10/2007 4:30 PM

Formula	Result
=TEXT(B2-A2, "h")	4
=TEXT(B2-A2, "h:mm")	4:55
=TEXT(B2-A2, "h:mm:ss")	4:55:00
=INT((C2-A2)*24)	29

Removing functions and formulas using "Paste Special":
It is useful to know how to save only the calculated value of a function or formula – that is, the function or formula that produced the value is removed. For instance, when you save an Excel file as a delimited text file (eg, .txt or .csv) all values calculated by a function or formula are replaced with 0s. This obviously can cause major problems. To get around this, we can copy the functions and formulas in specific cells and then paste only their values using the "Paste Special" option from the "Edit" drop-menu. For example,
1. Select the cell(s) you want to copy and select "Edit" > "Copy" (or press Ctrl+C).
2. Click the cell or range you want to paste the information into.
3. Right-click and choose "Paste Special" (or select "Edit" > "Paste Special").
4. Choose "Values" and click OK.

The "Paste Special" feature also allows you to paste just the *format* of the cell(s) (ie, font, alignment, etc) and to quickly switch data from columns to rows (ie, *transpose* the cells).