Benedict College
ENGR 130: Introduction to Engineering
Excel Unit: Handout 1

Excel: Key Terms and Operations

Key Terms

Cell: each box in the spreadsheet. Cells can have numerical, text, or other values.

Row: horizontal collection of cells, infinitely long

Column: vertical collection of cells, infinitely long

Format: the way the data in a cell is displayed (including font, text size, justification, borders…)

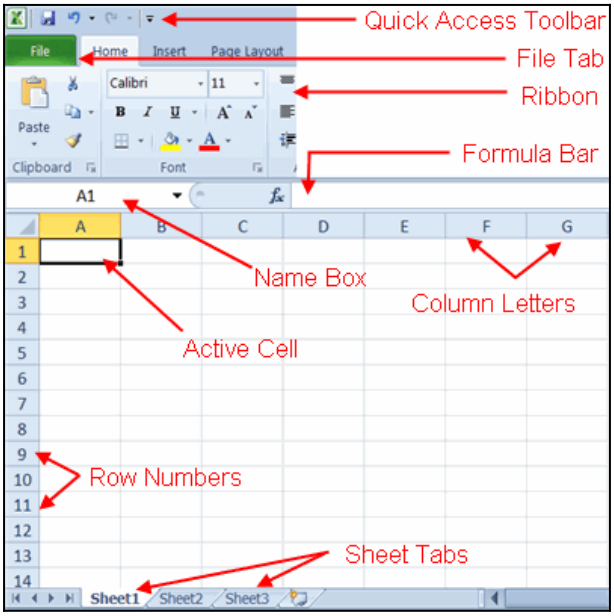
Formula: an expression telling Excel how to calculate the desired value of a cell based on the values of other cells

Formula bar: at the top of the page, allows user to see what is being typed into a cell

Tabs: options at the top of the page (Home, Insert, Page Layout,…) that enable user to access different functions in the software.

Ribbon: Set of buttons at the top of screen (arranged into Tabs) that allows the user to select options without accessing a drop-down menu.

Sheet: A new .xls file opens with 3 sheets by default. You can add, delete, copy or rename sheets by right-clicking on the sheet tab at the bottom of the screen.



http://spreadsheets.about.com/od/excel101/ss/2010-06-26-Parts-Of-The-Excel-2010-Screen.htm

Key Operations for Formatting Spreadsheets

Adjust format of cells: Highlight the desired cells and use the appropriate options in the Home tab under *Font* and *Alignment*. Or select and right-click to access the Format menu. Choose whether data in cell is numeric, general, text, etc. Then select the desired properties.

Adjust row height/column width: highlight row/column heading(s) and use cursor to move bottom/right boundary to desired height/width

Merge cells: Highlight cells to be combined and click *Merge & Center* in the *Home* tab.

Insert rows/columns/cells: Select and right-click on the row/column/cell before which the insertion should appear. Choose Insert and select the appropriate options.

Delete rows/columns/cells: Select and right-click on the row/column/cell and select Delete.

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Excel Formulas

Key Operations and Terminology

Entering formulas: All formulas start with **=**. Then, using order of operations and parentheses, tell Excel which cell values to use in the calculation by clicking on them or typing in the cell references.

Formula example: **=(A1+A2)/(B6-B7)** This takes the values in cells A1, A2, B6, and B7 and performs the specified operations.

References: Cells whose values are used in a formula. In the example above, **A1, A2, B6, and B7** are the references.

Copying cell values or formulas: Select cell to be copied. Place cursor over the box in the lower right corner of the cell. Click and pull down and/or across to copy the value or formula to the desired cells.

Relative and Absolute References

Relative references: Shown as "B5". Relative references change as the formula is copied from one cell to another.

Absolute references: Shown as "$B$5". Absolute references remain the same no matter where the formula is copied.

Useful Functions

Square Root: Calculates the square root of the input value.
Syntax: **=sqrt(A1)** Takes the square root of the value in A1, and displays the result in the cell where you type the formula.

Exponential Function: Calculates e^x, where x is the input value
Syntax: **=exp(A1)** Calculates e^(value in cell A1)

Trigonometric Functions: Calculate sin, cos, tan of an input angle in radians. Inverse functions are asin, acos, and atan (arc-tangent or inverse tangent).
Syntax: **=sin(C6)** or **=acos(sqrt(2)/2)**

π: Inserts the value of π into the cell
Syntax: **=pi()** - you must include the empty parentheses

Logarithms: You specify the number to be calculated and the base of the log.
Syntax: **=log(C6,2)** takes $\log_2$ of the value in cell C6
=log(C6,10) takes $\log_{10}$ of the value in cell C6
=ln(C6) takes the natural log or $\log_e$ of the value in cell C6

Sum: Adds a list of numbers.
Syntax: **=sum(A1:A4)** Adds the values in cells A1, A2, A3, and A4.

Count: Calculates the number of values or entries in a block of cells.
Syntax: **=count(A1:A4)** Calculate the number of numerical entries in the cells A1, A2, A3, A4.
Variation: **=counta(A1:A4)** counts the number of non-empty cells (including text entries).

Average: Calculates the average of a list of numbers.
Syntax: **=average(A1:A4)**
This will add A1, A2, A3, and A4 and divide the sum by the number of values.
Equivalent formula:

Standard deviation: Calculates the standard deviation of a list of numbers.
Syntax: **=stdev(A1:A4)**

Max/Min: Find the largest/smallest value in a list of numbers.
Syntax: **=max(A1:A4)** or **=min(A1:A4)**

Round: Rounds a value from a cell to a specific number of digits.
Syntax: **=round(A1,2)**
This function will take the value of A1, round it to 2 decimal places, and display the modified value in the cell where the formula is placed.

If statement: Checks for a specified condition, then displays one value if the condition is true, and another if false.
Syntax: =if(logical_test, value_if_true, value_if_false)
Example: **=if(A1>5, "yes", "no")** Displays ***yes*** if the value in A1 is greater than 5, and ***no*** otherwise.
=if(A1=3,1,0) Displays ***1*** if the value in A1 is equal to 3, and ***0*** otherwise.
Note that the value displayed may be text or numerical. Text must be in quotations, numbers should not. The allowable conditional statements include: >, <, =, >=, <=, <> (not equal to)

You can combine conditions using **"and"** as follows: **=if(and(B6>=$B$2,B6<$B$3),"Bonus","No bonus"). You could use "or" the same way.**

Exercise: Label the following in the Excel formula below: equal sign, function, mathematical operation, relative reference, absolute reference.

=(4*B5^2-3*B4+$B$3)*EXP($A$17-A15)+SUM(D3:D7)

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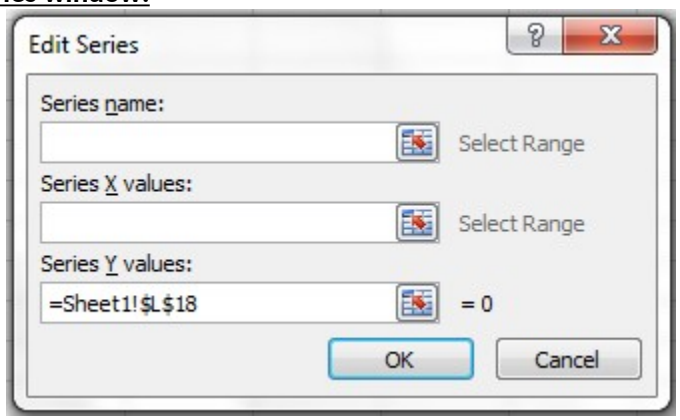
Creating Scatterplots

In this lesson we will learn to create scatterplots from data series. Excel allows users to define the range of cells for plotting, then customize every facet of the chart's appearance.

1. **Insert a new chart:** Choose the Insert tab, and insert a blank scatterplot.
2. **Choose data:** Right-click on the chart and choose Select Data.
    a. You can edit an existing series by selecting it then clicking Edit.
    b. You can add a new series by clicking Add.

3. **Edit Series window:**



    a. Type the name of the series, or hit Select Range to click on a cell containing the title.
    b. Hit the Select Range button for the X values. This allows you to highlight a range of cells in your spreadsheet.
    c. Repeat for the y values.

4. **Chart appearance options:** Click on the chart, and a Chart Tools section will appear in the ribbon with 3 tabs (Design, Layout, Format).
    a. Design tab: Layouts will give you preset options for the appearance of your chart. This is like a setup shortcut.
    b. Layout tab: will allow you to specifically set all options, such as Titles, Legend, Axis Labels, etc.
    c. Format tab: lets you choose the background colors and font.
    d. You can also right-click any aspect of the chart and select Format.

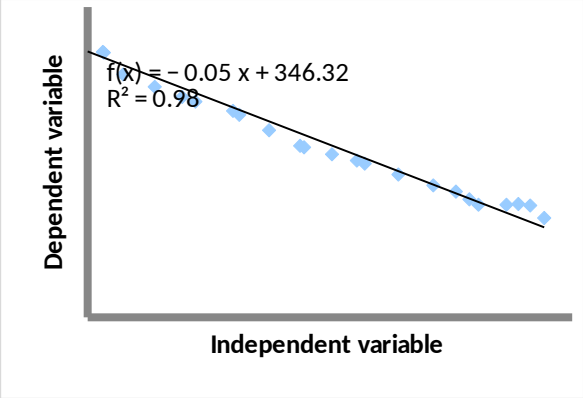
5. **Style guidelines:**
    a. For each axis, include a descriptive label (unit in parentheses).
    b. Title should be included only if necessary. In a report, you would eliminate the title and use a caption to describe the plot instead.
    c. Gridlines can often be removed to make the chart appear cleaner.
    d. Legend should be included for plots with two or more series. One series does not need a legend.

Some Basic Statistical Concepts

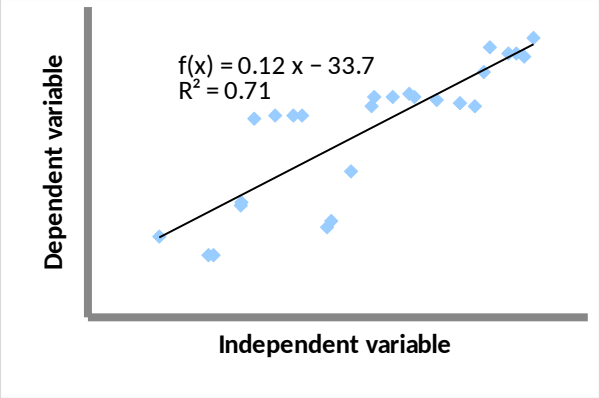
Key terms:

1. **Scatterplot:** Plot in which data points are displayed according to the paired values of an independent and dependent variable.
2. **Correlation:** Relationship between two random variables. See plots below.
    a. Variables are positively correlated if the dependent variable increases as the independent variable increases.
    b. Variables are negatively correlated if the dependent variable decreases as the independent variable increases.
3. **Best-fit line:** Linear function of the form **y=mx+b** which minimizes the squared differences between the line and all points on the scatterplot.
4. **Correlation coefficient (R):** A measure of how well data points fit a line.
    a. $-1 \leq R \leq 1$
    b. R=1 for perfectly linear positively correlated variables
    c. R=-1 for perfectly linear negatively correlated variables
    d. $R \approx 0$ for uncorrelated variables
    e. We often use the square of the correlation coefficient $\mathbf{R^2}$. $0 \leq R^2 \leq 1$

Strong negative correlation



Weaker positive correlation



The MathWorld entry for Correlation Coefficient shows R^2 for a range of scatterplots with varying levels of linearity.

http://mathworld.wolfram.com/CorrelationCoefficient.html

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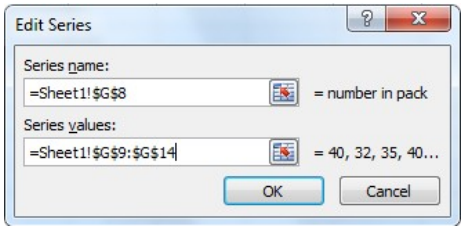
Pie Charts and Bar Graphs in Excel

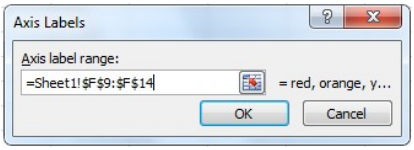
In this lesson we will learn to create pie charts and bar graphs from data series. The format for selecting data is the same for both types of plots.

1. **Insert a new chart:** Choose the Insert tab, and insert a blank pie chart or bar/column graph.
2. **Choose data:** Right-click on the chart and choose Select Data.
    a. You can edit an existing series by selecting it then clicking Edit.
    b. You can add a new series by clicking Add.

3. **Edit Series window:**
    a. Type the name of the series, or hit Select Range to click on a cell containing the title.
    b. Hit the Select Range button for the series values. This allows you to highlight a range of cells in your spreadsheet.



4. **Axis Labels window:**
    a. Hit Select Range to highlight the list of category labels. They must be in the same order as your data.



5. **Chart appearance options:**
    a. Click on the chart, and a Chart Tools section will appear in the ribbon with 3 tabs (Design, Layout, Format).
    b. Add data labels by right-clicking on the chart and selecting Data Labels. Format data labels (number, percentage, both) by right-clicking on the labels and selecting Format.
    c. Add axis labels as necessary (same method as for scatterplots).

6. **Style guidelines:**
    a. For each axis, include a descriptive label (unit in parentheses).
    b. Title should be included only if necessary. In a report, you would eliminate the title and use a caption to describe the plot instead.
    c. Gridlines can often be removed to make the chart appear cleaner.
    d. Legend is needed for plots with two or more series. One series does not need a legend.