Excel Functions Handout
ENGR 1213 Engineering Physics Computing
Spring 2005

Built-In Functions

Excel offers many built-in functions – these may be viewed on the tool-button that has the little f_x. There are lots of mathematical functions available - many of which will never use, but many of which you can't live without when you use excel for many physics or engineering calculations. Some examples of built-in functions are:

sin(x)	returns sine of *x* (x should be in *radians*),
log(x)	returns the common (base-10) logarithm of *x*,
ln(x)	returns the natural (base-e) logarithm of *x*,
PI()	returns pi to 15 digits,
IF(X,Y,Z)	returns a value of Y, if X is true and Z if X is not true,

An example of using IF:

Assume cell A2 contains the value 2.56 and cell B9 contains 5.4.

IF(A2<B9,"A2 is smaller then B9","A2 is bigger than B9")

would return - *"A2 is smaller then B9"*

IF(A2>B9,"A2 is smaller then B9","A2 is bigger than B9")

would return - *"A2 is larger than B9"*

An example of using *ln(x):*

Assume cell A2 contains the value -2.56 and B9 contains 3.45

ln(B9) – would return *1.24*

ln(A2) – would return *#NUM* – this means there was an error

Of course the second one does not work because ln(x) is undefined for negative numbers. Recall the definition of a general logarithm below:

$\log_a x = y$ means that ***$x = a^y$***

If *a = 10* and *x = 100*, then *y = 2*. You can think of a logarithm as being a way to find out the exponent (*y*) that you would have to raise a base (*a*) to get a number (*x*).

Also you should recall rules of logarithms:

$log(xy) = log(x) + log(y)$

$log(x)^n = n\ log(x)$ – example $log_{10}(100)^2 = 2\ log_{10}(100) = 4$.

Of course you should also be familiar with exponentials. It turns out that in many science and engineering applications it is convenient to use a particular base with logarithms. This base is usually called *e* and it has the value (2.718281828459045... note it is a irrational number). You don't really need to understand why it comes up, but it does and youe should be familiar wiht dealing with *e*. You may see different notation such as

$e^x = \exp(x)$ (the right-hand-side is how you do it in Excel)

and the base-e logarithm is usually written as

$\ln x = \ln(x)$.

One last comment about built-in functions is that they are no substitution for knowing what these functions actually mean – hopefully you understand from your math courses – if not you should review trigonometric and logarithmic functions – they will show up frequently in courses you take in the future.

Add-In Functions

There are even more functions that most Excel-Users do not need to use – these are called Add-In functions. Many of these functions were written by programmers to supplement Excel's built-in functions so Excel may be used for more advanced calculations. A good example of an add-in function is the *histogram* function. The way to access this function is to go to the *Tools* menu and pick the *Data Analysis* menu item. Note if the *Data Analysis* menu item is not available then you will have to add-in the data analysis functions. Here is how to do that:

- Go to *Tools-Add-Ins*
- Check the box for *Data Analysis Toolkit* and for *VBA Data Analysis Toolkit* (while you are at it go ahead and check the *Solver* box as well).
- Click OK – and all of the add-ins will then be available on the Tools menu of Excel.

User-Defined Functions in Excel

Sometimes the built-in functions and the add-in functions do not do exactly what you need. So to help in this case you may write your own functions. This involves writing a little program that will make the calculation that you need and then return the result to a spreadsheet just like any other Excel function. Here is an example – let's say you frequently need to calculate the surface area of a cylinder. Consider a cylinder with diameter *D* and a length of *L*. The total surface area including the end-caps would be

$$A_s = \pi D L + \frac{\pi}{2} D^2$$

So we need to send the diameter and length values to our function that returns the result of the equation above. Here is how to do it:

Go to *Tools-Macro-Visual Basic Editor*

A screen for the editor will appear. On the right of the screen you should have an open module that you may add code to. Go ahead and type in the following

```
Function area_surf(d as double,l as double)
     'need pi to do calculation
     pi = Application.WorksheetFunction.PI()
     area_surf = pi * ( d * l + d^2 / 2 )
End Function
```

The first line tells Excel that you are starting a function and what kind of values are permitted to be given to the function. The second line that starts with a ' is just a comment. The third line is required to get the value of pi into the function – in fact you can use any normally available worksheet function in VBA by using this line with the name of the function you want in place of "PI." The fourth line calculates the surface area as the variable area_surf. Note this is the same name as the function. Whatever variable has the same name as the function will automatically be returned from the function.

To access this function just go back to a worksheet and type in

=area_surf(1,2)

which should return the result of *7.85*.