***Mathematica*® Tutorial**

A. **Basic mechanics:** Opening, saving and closing *Mathematica*® notebooks will be demonstrated, as well as the notion of a 'cell' and the different types of writing formats that are available. Note that if you ever have questions about *Mathematica*®, it is typically very efficient to google your question.

B. ***Mathematica*® as a calculator:** Type the following and ***Mathematica*®** will evaluate the cell when you press 'shift' and 'enter' simultaneously:

```
5+10
Sin[0]
FactorInteger[260]
Max[5,7,2]
```

Note that ***Mathematica*®** functions are capitalized and arguments are always enclosed within square brackets.

C. Understanding *Mathematica*®'s memory for variables.

Type in the following line and evaluate it:

```
k
```

In a new cell, type in the following line and evaluate it:

```
k=4
```

Now go back to the first cell and evaluate that.

There are two ways to clear variables. In a new cell, type:

```
Clear[k]
```

(Now re-evaluate the first cell.)

Often, *Mathematica*® just starts acting strange, and you want to clear all the variables! Then, navigate to kernel and click 'quit'. It is like starting over with a new worksheet, without having to type anything again.

D. Recursive functions

(1) To build a recursive function in *Mathematica*®, first define the initial conditions:
f[1] = 1

Then define the recursive function using the following syntax:
f[n_] := n * f[n - 1]

Your recursive function has now been defined, and you can calculate any term in the sequence:
f[5]

What are the 1st 5 terms of this sequence? _____

(2) This is the Fibonnaci sequence: {1, 1, 2, 3, 5, 8, …}. It is built by specifying the initial conditions F(1)=1 and F(2)=1, and then subsequent terms are the sum of the two previous terms. Build this function in *Mathematica*®. What is the 100th term of the Fibonacci sequence?_____

E. One of the more recent features…

Consider a simple function with a parameters, such as $f(x) = b^x$.
(1) You can plot the function for a particular value of *b*:
Plot[0.5^x,{x,-5,5}]

(2) You can plot the function for multiple values of *b*:
Plot[{0.5^x,1^x,1.5^x},{x,-5,5}]

(3) Or you can build a graphic that manipulates the value of *b*:
Manipulate[Plot[b^x,{ x,-5,5}],{b,0.1,2}]

F. Tables and Arrays:

(1) Note that the plot function won't work for negative values of *b*:
Plot[{(-0.5)^x,1^x,1.5^x},{x,-5,5}]

(2) We want to instruct ***Mathematica®*** to only consider integer values of *x,* which can be done within an array or table:
Table[5^x, {x, -5, 5}]

(3) Tables can be plotted with the ListPlot function:
ListPlot[Table[5^x, {x, -5, 5}], PlotJoined -> True]

(4) And manipulate can be combined with most any graphic function:
ListPlot[Table[b^x, {x, -5, 5}], PlotJoined -> True], {b, -5, 5}]