Che2410 - Our First Jupyter Notebook

September 28, 2016

```
In [39]: # Solving our first differential equation numerically
         # Let's use a for loop to evaluate the function at later points in space

         y0 = 1 # y(x=0) = 1
         dx = 0.02 # our "grid spacing"

         y_next = 1 # initial value (will be ignored)
         y_prev = 1 # initial vlaue (will be ignored)

         numSteps = int(2 / dx)
         y_array = [y0]

         for i in range(0, numSteps):
             y_next = dx*y_prev + y_prev
             y_prev = y_next
             y_array.extend([y_next])
```

```
In [3]: # To plot in Jupyter notebooks you need to use
        # "matplotlib" which has to be imported
        import matplotlib
        %pylab inline

        # There are some handy array/matrix functions in library called "numpy"
        # (they mimic how Matlab works)
        import numpy as np
```

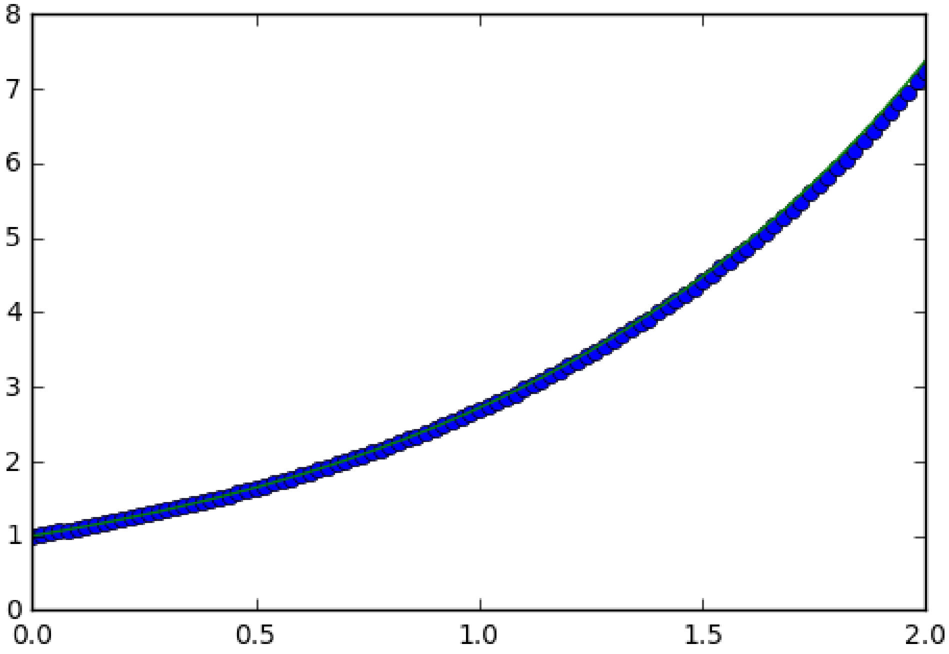
```
Populating the interactive namespace from numpy and matplotlib
```

```
In [40]: # Plot numerical solution
         plt.plot(np.arange(0, 2+dx, dx), y_array, '-o')
         plt.axis([0, 2, 0, 8])

         # Plot exact solution and compare

         # generates 100 linearly (evenly) spaced numbers between 0 and 1
         x = numpy.linspace(0, 2.0, 100)
         # generate 100 e^x values between x = 0 and x = 2
         y = numpy.exp(x)
         plt.plot(x,y)

Out[40]: [<matplotlib.lines.Line2D at 0x8197a20>]
```



```
In [41]: y[-1] # exact solution for e^x at x=2

Out[41]: 7.3890560989306504

In [42]: y_array[-1] # numnerical approximation

Out[42]: 7.244646118252337

In [46]: error = y[-1] - y_array[-1] # difference between them
         error

Out[46]: 0.14440998067831323
```