Coding Skills Workshop

1. The following python script creates a two dimensional array $f(x, y)$.

```python
import numpy as np
import matplotlib.pyplot as plt
x,y = np.meshgrid(np.arange(0,10,.1),np.arange(-5,5,.2))
f = np.exp(-(x-y)**2-y**2)
```

   a. Cut and paste the script in your jupyter notebook.
   b. Spend 5 minutes freely exploring the code.
   c. add to the script some lines of code to plot the values of $f(0, y)$ vs. y and $f(x, y)$ vs. y.

2. Without using any `for` or `while` loop, write a python script that:
   a. plots the mathematical function $f(x) = 3x^3 e^{-\sqrt{x}}$ in the domain $x \in [0,10]$
   b. plots in a different color, on the same graph, the same function in the domain $x \in [3,5]$
   c. plots with a symbol the specific point $x = [4, f(4)]$

3. The following snippet of code contains an array with names of some acquaintances of mine (invented) and their ages (also invented).

```python
friends=np.array(['Frank','Jen','Carl','Hassan','Mei','Xa
vier'])
ages=np.array([43,21,64,37,32,53])
```

   a. Write some additional code that sorts the names in increasing order of age.

4. Run by hand the following code and predict what it will print, when executed:

```python
ages=range(4)
print(ages)
for i in ages: print(i)
npages=np.arange(4)
print(npages)
for i in npages: print(i)
strages='range(4)'
print(strages)
for i in strages: print(i)
```

5. Debug either of the following two pieces of code:

   a. This is a piece of code that sets the initial condition of a traveling wave.

```
v=10
dx=.3
CFL=.1
dt=CFL*dx/v
nx=100 ; nt=1000.
L=(nx-1)*dx
x=np.arange(0,L+dx/2,dx)
y=np.zeros(nx,nt)
y[:,0]=np.exp(-(i-L/2)**2/10)
y[:,1]= np.exp(-(x-L/2-v*dt)**2/10)
```

   b. This is. apiece of code that carries out an Euler integration of $\frac{dy}{dx} = x \sin x$

```
dx=.1
nx=1000
x=np.arange([0,nx*dx,dx])
y=np.zeros(dx.size)
for i in range(0,nx):
     y[i]=y[i-1]+x[i-1]*np.sin(x[i-1])*dx
plt.clf()
plt.plot(x,y[0,:])
```