# NumPy Exercises ¶

Now that we've learned about NumPy let's test your knowledge. We'll start off with a few simple tasks, and then you'll be asked some more complicated questions.

#### Import NumPy as np

In [4]:

```
import numpy as np
```

#### Create an array of 10 zeros

In [28]:

```
np.zeros(10)
```

Out[28]:

```
array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0.])
```

#### Create an array of 10 ones

In [29]:

```
np.ones(10)
```

Out[29]:

```
array([1., 1., 1., 1., 1., 1., 1., 1., 1., 1.])
```

#### Create an array of 10 fives

In [30]:

```
np.ones(10)*5
```

Out[30]:

```
array([5., 5., 5., 5., 5., 5., 5., 5., 5., 5.])
```

#### Create an array of the integers from 10 to 50

In [31]:

```
np.arange(10,51)
```

Out[31]:

```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 2
6,
       27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 4
3,
       44, 45, 46, 47, 48, 49, 50])
```

**Create an array of all the even integers from 10 to 50**

In [32]:

```
np.arange(10,51,2)
```

Out[32]:

```
array([10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 4
2,
       44, 46, 48, 50])
```

**Create a 3x3 matrix with values ranging from 0 to 8**

In [35]:

```
np.arange(0, 9).reshape(3,3)
```

Out[35]:

```
array([[0, 1, 2],
       [3, 4, 5],
       [6, 7, 8]])
```

**Create a 3x3 identity matrix**

In [36]:

```
np.identity(3)
```

Out[36]:

```
array([[1., 0., 0.],
       [0., 1., 0.],
       [0., 0., 1.]])
```

**Use NumPy to generate a random number between 0 and 1**

In [55]:

```
np.random.rand(1)
```

Out[55]:

```
array([0.04309813])
```

### Use NumPy to generate an array of 25 random numbers sampled from a standard normal distribution

In [56]:

```
np.random.randn(25)
```

Out[56]:

```
array([-0.93573542, -0.52668184,  1.20184077, -1.35430642,  0.38323445,
       -0.11155592,  0.61090249,  1.17875294,  0.61133306,  0.79222758,
       -0.33077453, -0.65231458, -0.90355706, -0.39239693,  1.70160651,
        0.52830471,  1.45331956,  0.45595711, -1.51977204,  0.71889048,
        1.31718332,  0.5706055 ,  0.36606963,  1.95801036,  0.30328775])
```

### Create the following matrix:

In [65]:

```
np.arange(1,101).reshape(10,10) / 100
```

Out[65]:

```
array([[0.01, 0.02, 0.03, 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.1 ],
       [0.11, 0.12, 0.13, 0.14, 0.15, 0.16, 0.17, 0.18, 0.19, 0.2 ],
       [0.21, 0.22, 0.23, 0.24, 0.25, 0.26, 0.27, 0.28, 0.29, 0.3 ],
       [0.31, 0.32, 0.33, 0.34, 0.35, 0.36, 0.37, 0.38, 0.39, 0.4 ],
       [0.41, 0.42, 0.43, 0.44, 0.45, 0.46, 0.47, 0.48, 0.49, 0.5 ],
       [0.51, 0.52, 0.53, 0.54, 0.55, 0.56, 0.57, 0.58, 0.59, 0.6 ],
       [0.61, 0.62, 0.63, 0.64, 0.65, 0.66, 0.67, 0.68, 0.69, 0.7 ],
       [0.71, 0.72, 0.73, 0.74, 0.75, 0.76, 0.77, 0.78, 0.79, 0.8 ],
       [0.81, 0.82, 0.83, 0.84, 0.85, 0.86, 0.87, 0.88, 0.89, 0.9 ],
       [0.91, 0.92, 0.93, 0.94, 0.95, 0.96, 0.97, 0.98, 0.99, 1.  ]])
```

### Create an array of 20 linearly spaced points between 0 and 1:

In [27]:

```
np.linspace(0, 1, 20)
```

Out[27]:

```
array([0.        , 0.05263158, 0.10526316, 0.15789474, 0.21052632,
       0.26315789, 0.31578947, 0.36842105, 0.42105263, 0.47368421,
       0.52631579, 0.57894737, 0.63157895, 0.68421053, 0.73684211,
       0.78947368, 0.84210526, 0.89473684, 0.94736842, 1.        ])
```

# Numpy Indexing and Selection

Now you will be given a few matrices, and be asked to replicate the resulting matrix outputs:

In [40]:

```
mat = np.arange(1,26).reshape(5,5)
mat
```

Out[40]:

```
array([[ 1,  2,  3,  4,  5],
       [ 6,  7,  8,  9, 10],
       [11, 12, 13, 14, 15],
       [16, 17, 18, 19, 20],
       [21, 22, 23, 24, 25]])
```

In [57]:

```
mat[2:,1:]
```

Out[57]:

```
array([[12, 13, 14, 15],
       [17, 18, 19, 20],
       [22, 23, 24, 25]])
```

In [58]:

```
mat[3,4]
```

Out[58]:

```
20
```

In [59]:

```
mat[:3,1:2]
```

Out[59]:

```
array([[ 2],
       [ 7],
       [12]])
```

In [60]:

```
mat[4,:]
```

Out[60]:

```
array([21, 22, 23, 24, 25])
```

In [61]:

```
mat[3:5,:]
```

Out[61]:

```
array([[16, 17, 18, 19, 20],
       [21, 22, 23, 24, 25]])
```

## Now do the following

#### Get the sum of all the values in mat

In [62]:

```
mat.sum()
```

Out[62]:

```
325
```

#### Get the standard deviation of the values in mat

In [64]:

```
mat.std()
```

Out[64]:

```
7.211102550927978
```

#### Get the sum of all the columns in mat

In [63]:

```
mat.sum(axis=0)
```

Out[63]:

```
array([55, 60, 65, 70, 75])
```

Type *Markdown* and LaTeX: $\alpha^2$