# 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.

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**Import NumPy as np**

In [1]:
```
import numpy as np
```

**Create an array of 10 zeros**

In [3]:
```
arr=np.zeros(10)
```

In [4]:
```
arr
```

Out[4]:
```
array([0., 0., 0., 0., 0., 0., 0., 0., 0., 0.])
```

In [16]:
```
arr=np.full(10,0)
```

In [17]:
```
arr
```

Out[17]:
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
```

**Create an array of 10 ones**

In [6]:
```
arr1=np.ones(10)
```

In [7]:
```
arr1
```

Out[7]:
```
array([1., 1., 1., 1., 1., 1., 1., 1., 1., 1.])
```

In [19]:
```
arr1=np.full(10,1)
```

In [20]:
```
arr1
```

Out[20]:
```
array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1])
```

**Create an array of 10 fives**

In [9]:
```
arr2=np.full(10,5)
```

In [10]:
```
arr2
```

Out[10]:
```
array([5, 5, 5, 5, 5, 5, 5, 5, 5, 5])
```

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

In [11]:
```
arr3=np.arange(10,50)
```

In [12]:
```
arr3
```

Out[12]:
```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26,
       27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43,
       44, 45, 46, 47, 48, 49])
```

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

In [14]:
```
for i in range(50):
    arr4=arr3[arr3%2==0]
```

In [15]:
```
arr4
```

Out[15]:
```
array([10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42,
       44, 46, 48])
```

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

In [21]:
```
ar=np.arange(0,9)
```

In [22]:
```
ar
```

Out[22]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8])
```

In [23]:
```
ar.reshape(3,3)
```

Out[23]:
```
array([[0, 1, 2],
       [3, 4, 5],
       [6, 7, 8]])
```

**Create a 3x3 identity matrix**

In [24]:
```
ar1=np.eye(3)
```

In [25]:
```
ar1
```

Out[25]:
```
array([[1., 0., 0.],
       [0., 1., 0.],
       [0., 0., 1.]])
```

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

In [27]:
```
ar2=np.random.rand(1)
```

In [28]:
```
ar2
```

Out[28]:
```
array([0.68576312])
```

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

In [29]:
```
ar3=np.random.rand(25)
```

In [30]:
```
ar3
```

Out[30]:
```
array([0.42253929, 0.59922811, 0.13367137, 0.08588275, 0.77835322,
       0.61379805, 0.49763348, 0.63246695, 0.26866605, 0.2846623 ,
       0.91730218, 0.45741811, 0.15525493, 0.23654642, 0.86800851,
       0.47738619, 0.8851191 , 0.6736989 , 0.36929546, 0.1073235 ,
       0.98902746, 0.83384097, 0.83429759, 0.42792883, 0.29344299])
```

**Create the following matrix:**

In [33]:
```
ar4=np.linspace(0.01,1,100)
```

In [35]:
```
ar4.reshape(10,10)
```

Out[35]:
```
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 [37]:
```
ar5=np.linspace(0,1,20)
ar5
```

Out[37]:
```
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 [0]:
```
# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW
# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T
# BE ABLE TO SEE THE OUTPUT ANY MORE
```

In [42]:
```
mat[2:5,1:5]
```

Out[42]:
```
array([[12, 13, 14, 15],
       [17, 18, 19, 20],
       [22, 23, 24, 25]])
```

In [0]:
```
# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW
# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T
# BE ABLE TO SEE THE OUTPUT ANY MORE
```

In [43]:
```
mat[3,4]
```

Out[43]:
```
20
```

In [0]:
```
# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW
# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T
# BE ABLE TO SEE THE OUTPUT ANY MORE
```

In [45]:
```
mat[0:3,1:2]
```

Out[45]:
```
array([[ 2],
       [ 7],
       [12]])
```

In [0]:
```
# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW
# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T
# BE ABLE TO SEE THE OUTPUT ANY MORE
```

In [46]:
```
mat[4]
```

Out[46]:
```
array([21, 22, 23, 24, 25])
```

In [0]:
```
# WRITE CODE HERE THAT REPRODUCES THE OUTPUT OF THE CELL BELOW
# BE CAREFUL NOT TO RUN THE CELL BELOW, OTHERWISE YOU WON'T
# BE ABLE TO SEE THE OUTPUT ANY MORE
```

In [47]:
```
mat[3:]
```

Out[47]:
```
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 [48]:
```
mat.sum()
```

Out[48]:
```
325
```

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

In [49]:
```
np.std(mat)
```

Out[49]:
```
7.211102550927978
```

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

In [50]:
```
mat.sum(axis=0)
```

Out[50]:
```
array([55, 60, 65, 70, 75])
```

In [51]:
```
mat.sum(axis=1)
```

Out[51]:
```
array([ 15,  40,  65,  90, 115])
```

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