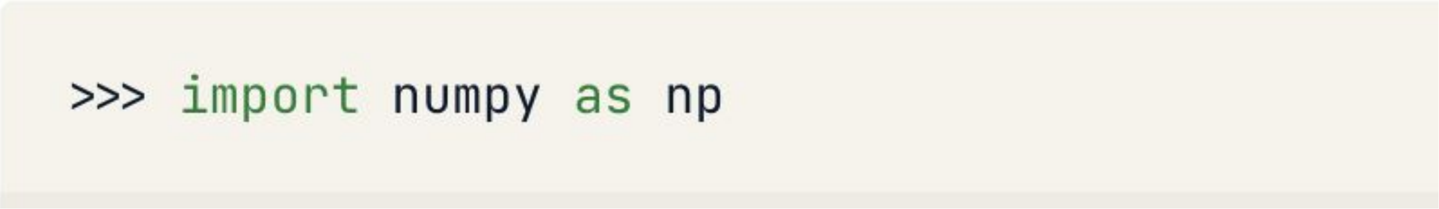
Introduction to Numpy

- Small cheat sheet for begineers

Where it is used ? Background

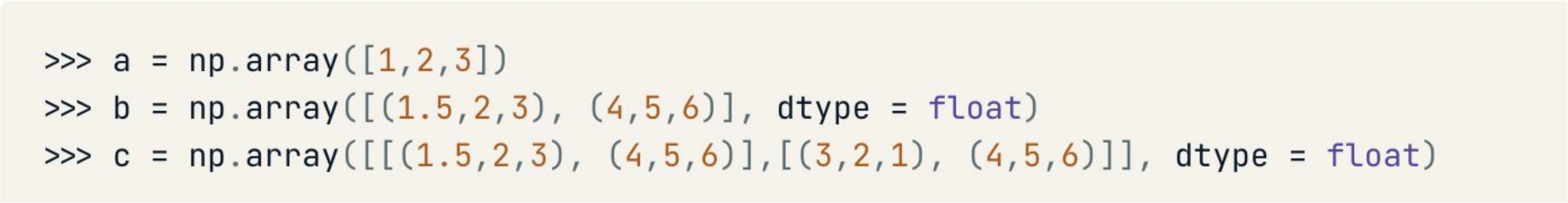
- The Pandas data manipulation library builds on NumPy, but instead of the arrays, it makes use of two other fundamental data structures: Series and DataFrames,
- SciPy builds on Numpy to provide a large number of functions that operate on NumPy arrays, and
- The machine learning library Scikit-Learn builds not only on NumPy, but also on SciPy and Matplotlib.

Import Statement



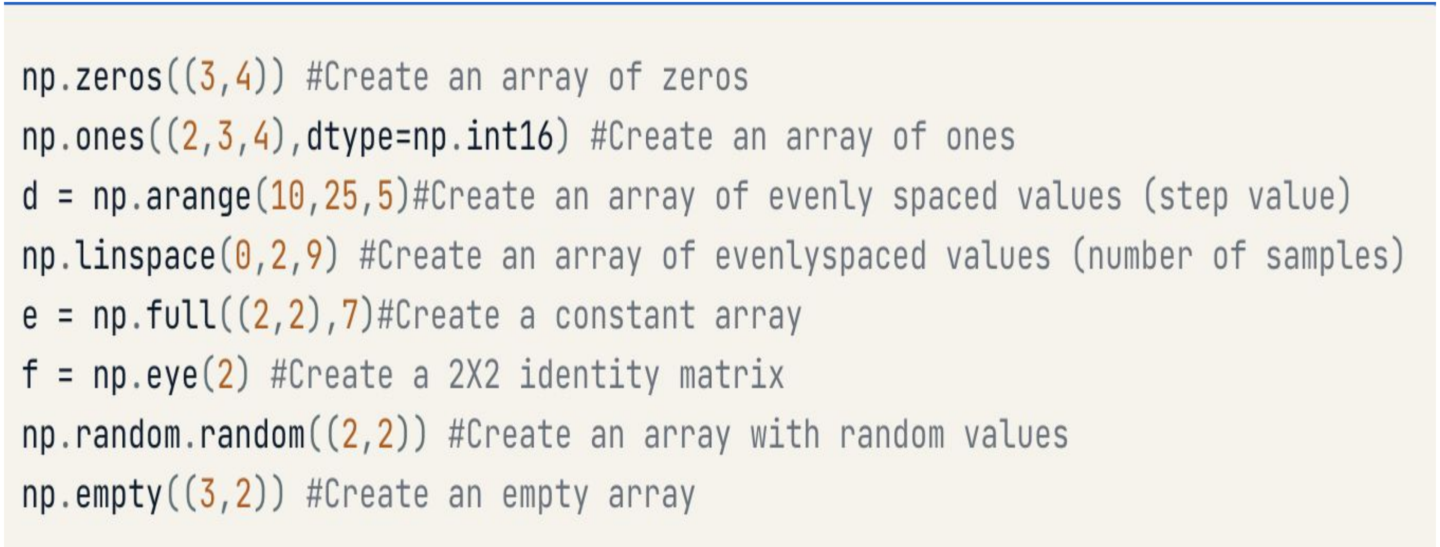
```
>>> import numpy as np
```

Creating Arrays



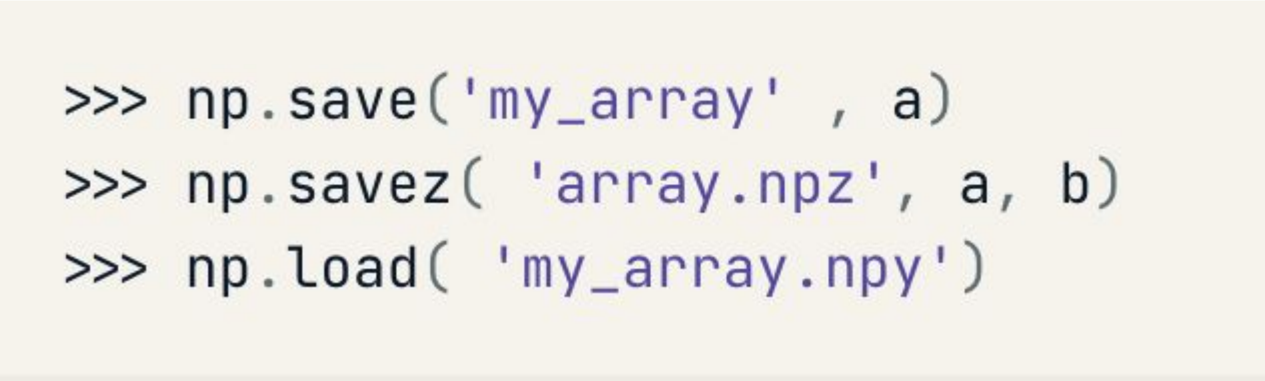
```
>>> a = np.array([1,2,3])
>>> b = np.array([(1.5,2,3), (4,5,6)], dtype = float)
>>> c = np.array([[(1.5,2,3), (4,5,6)],[(3,2,1), (4,5,6)]], dtype = float)
```

Some Important functions of Numpy



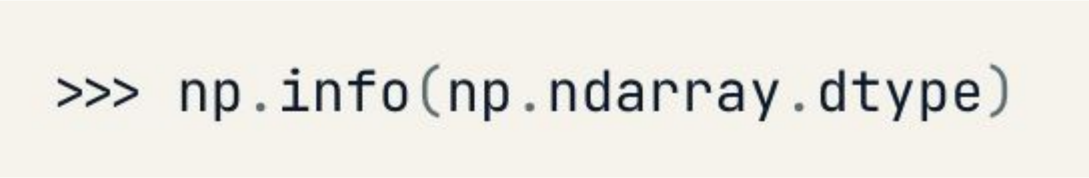
```
np.zeros((3,4)) #Create an array of zeros
np.ones((2,3,4),dtype=np.int16) #Create an array of ones
d = np.arange(10,25,5)#Create an array of evenly spaced values (step value)
np.linspace(0,2,9) #Create an array of evenlyspaced values (number of samples)
e = np.full((2,2),7)#Create a constant array
f = np.eye(2) #Create a 2X2 identity matrix
np.random.random((2,2)) #Create an array with random values
np.empty((3,2)) #Create an empty array
```

Save the files



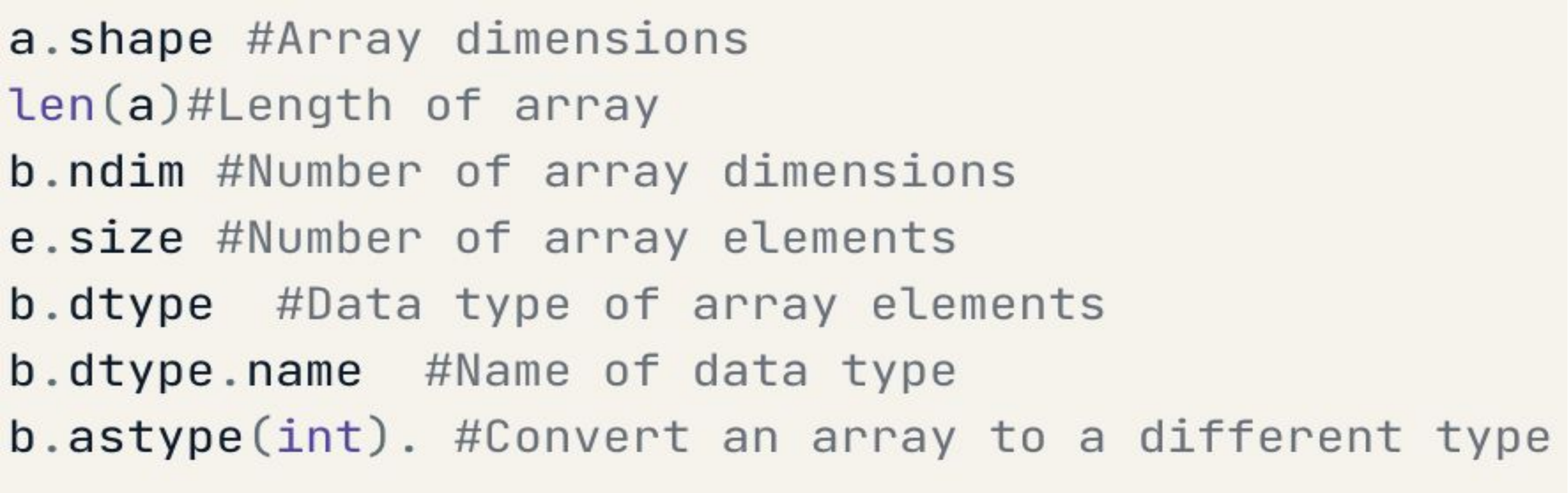
```
>>> np.save('my_array' , a)
>>> np.savez( 'array.npz', a, b)
>>> np.load( 'my_array.npy')
```

Help function



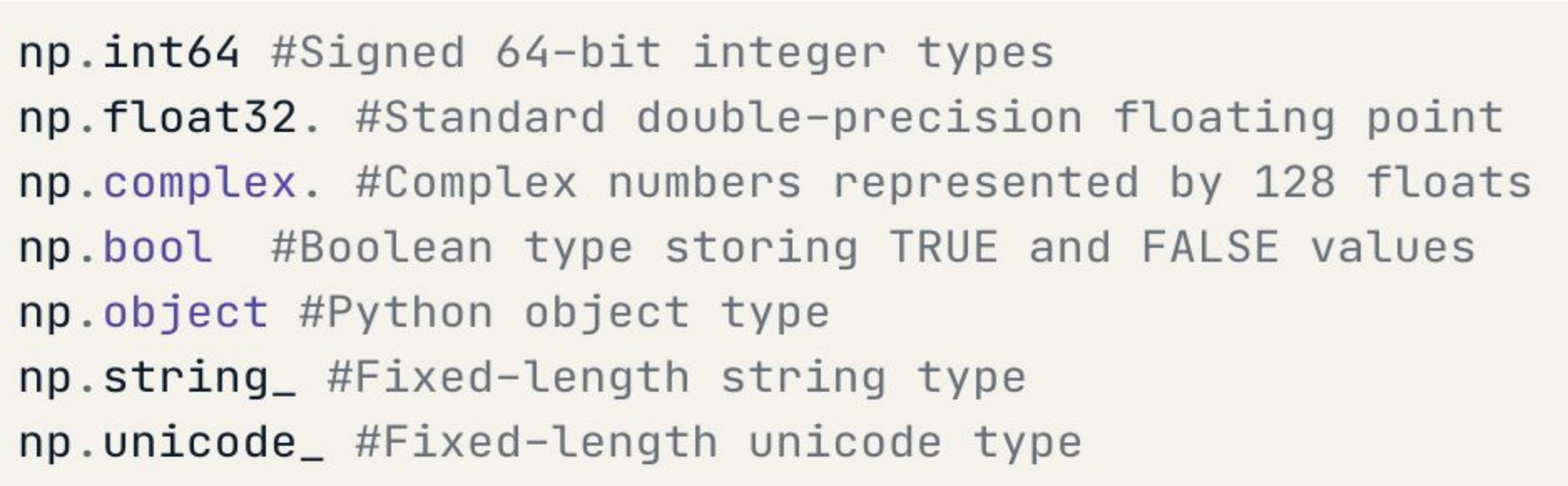
```
>>> np.info(np.ndarray.dtype)
```

Explore the Numpy arrays



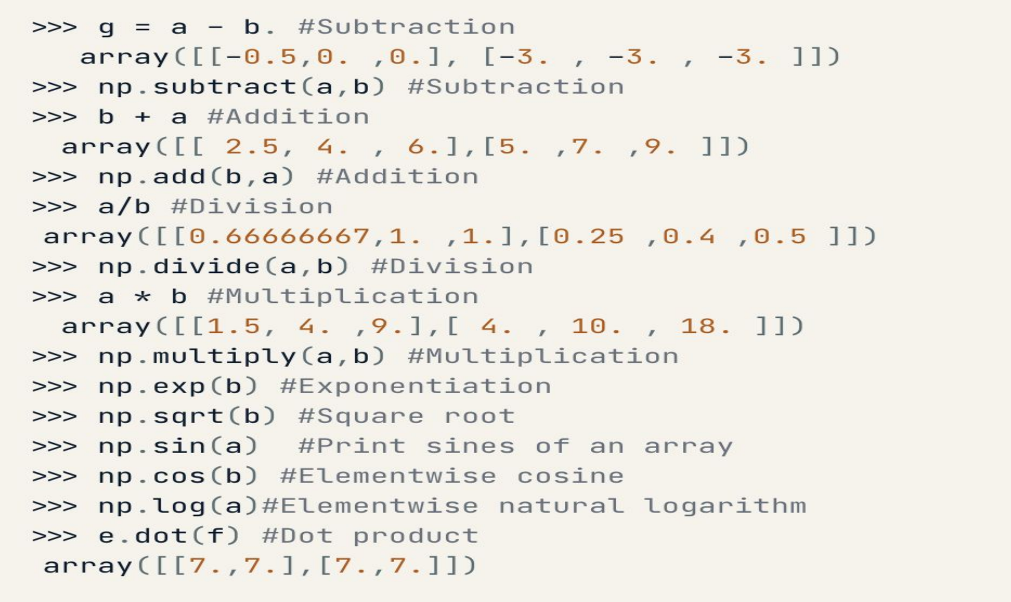
```
a.shape #Array dimensions
len(a)#Length of array
b.ndim #Number of array dimensions
e.size #Number of array elements
b.dtype  #Data type of array elements
b.dtype.name  #Name of data type
b.astype(int). #Convert an array to a different type
```

Data Types



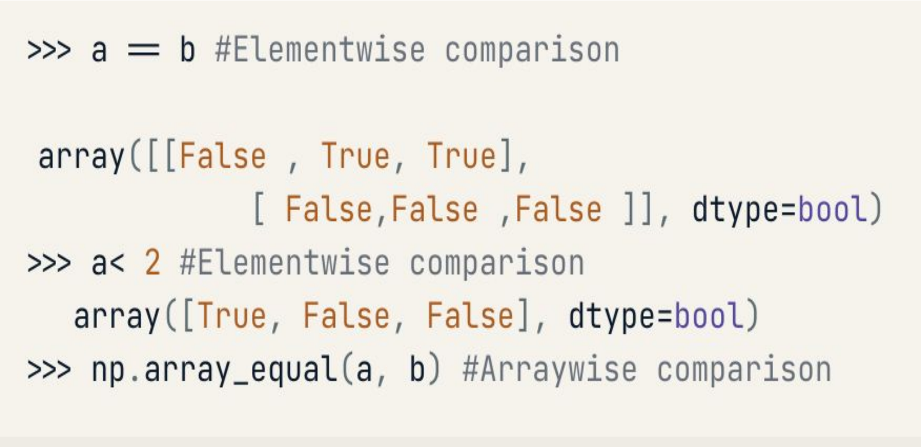
```
np.int64 #Signed 64-bit integer types
np.float32. #Standard double-precision floating point
np.complex. #Complex numbers represented by 128 floats
np.bool  #Boolean type storing TRUE and FALSE values
np.object #Python object type
np.string_ #Fixed-length string type
np.unicode_ #Fixed-length unicode type
```

Arithmetic Operations



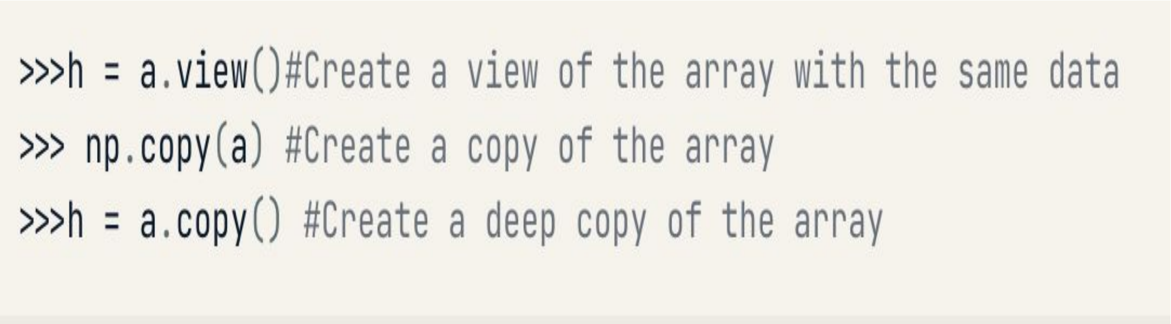
```
>>> g = a - b. #Subtraction
   array([[-0.5,0.  ,0.], [-3.  , -3.  , -3.  ]])
>>> np.subtract(a,b) #Subtraction
>>> b + a #Addition
  array([[ 2.5, 4.  , 6.],[5.  ,7.  ,9.  ]])
>>> np.add(b,a) #Addition
>>> a/b #Division
 array([[0.66666667,1.  ,1.],[0.25 ,0.4 ,0.5 ]])
>>> np.divide(a,b) #Division
>>> a * b #Multiplication
  array([[1.5, 4.  ,9.],[ 4.  , 10.  , 18.  ]])
>>> np.multiply(a,b) #Multiplication
>>> np.exp(b) #Exponentiation
>>> np.sqrt(b) #Square root
>>> np.sin(a)  #Print sines of an array
>>> np.cos(b) #Elementwise cosine
>>> np.log(a)#Elementwise natural logarithm
>>> e.dot(f) #Dot product
 array([[7.,7.],[7.,7.]])
```

Comparision



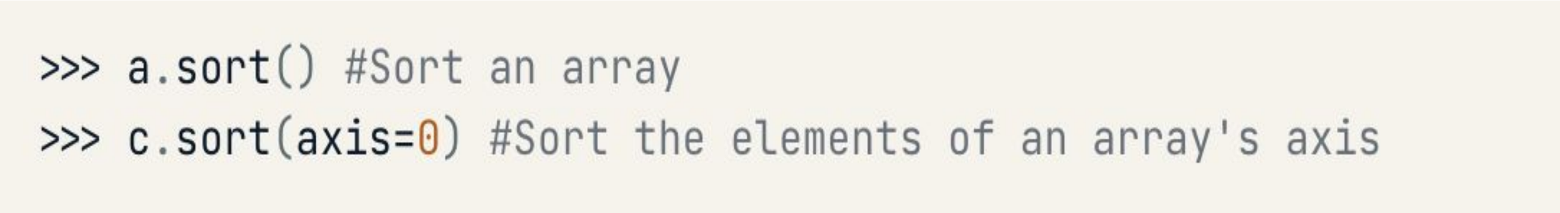
```
>>> a == b #Elementwise comparison

 array([[False , True, True],
             [ False,False ,False ]], dtype=bool)
>>> a< 2 #Elementwise comparison
   array([True, False, False], dtype=bool)
>>> np.array_equal(a, b) #Arraywise comparison
```

Copying Arrays



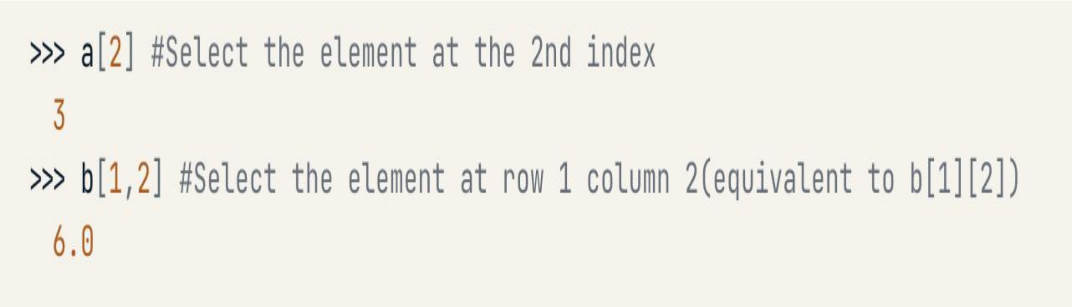
```
>>>h = a.view()#Create a view of the array with the same data
>>> np.copy(a) #Create a copy of the array
>>>h = a.copy() #Create a deep copy of the array
```

Sorting Arrays



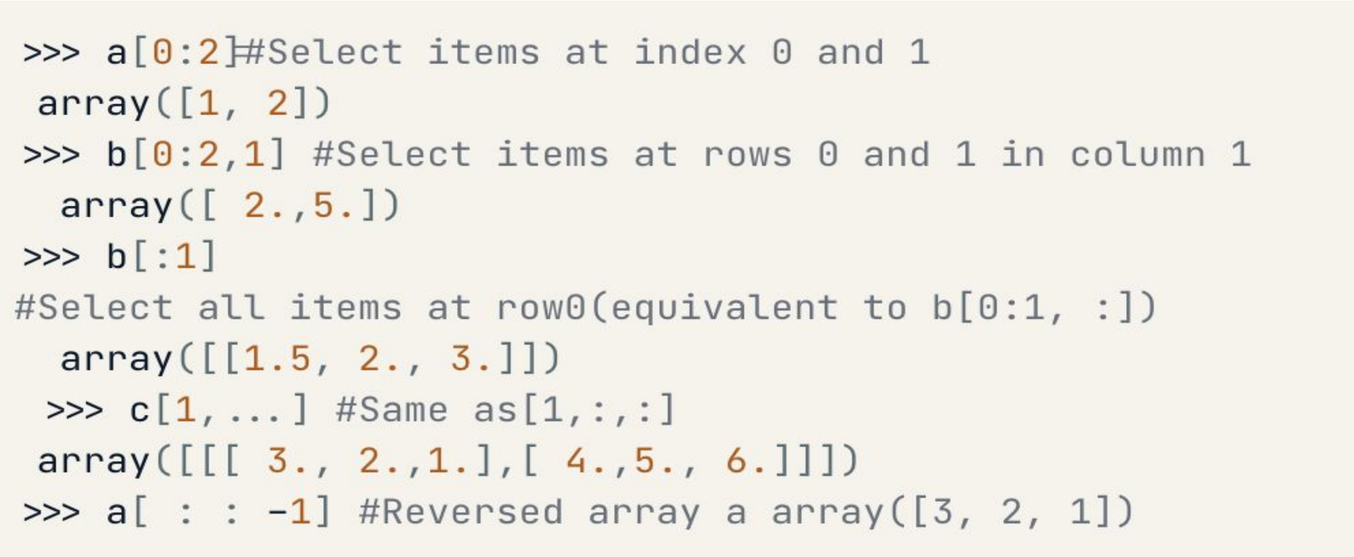
```
>>> a.sort() #Sort an array
>>> c.sort(axis=0) #Sort the elements of an array's axis
```

Subsetting



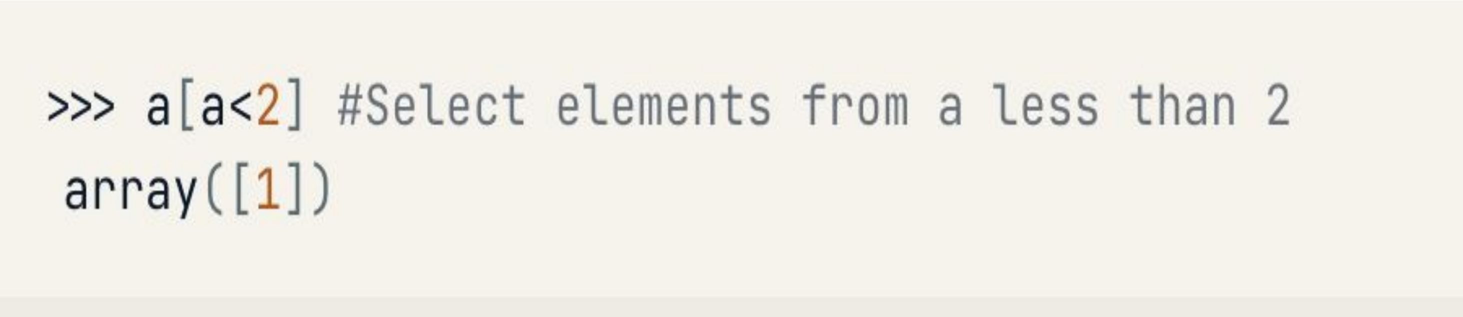
```
>>> a[2] #Select the element at the 2nd index
 3
>>> b[1,2] #Select the element at row 1 column 2(equivalent to b[1][2])
 6.0
```

Slicing



```
>>> a[0:2]#Select items at index 0 and 1
 array([1, 2])
>>> b[0:2,1] #Select items at rows 0 and 1 in column 1
  array([ 2.,5.])
>>> b[:1]
#Select all items at row0(equivalent to b[0:1, :])
  array([[1.5, 2., 3.]])
 >>> c[1,...] #Same as[1,:,:]
 array([[[ 3., 2.,1.],[ 4.,5., 6.]]])
>>> a[ : : -1] #Reversed array a array([3, 2, 1])
```

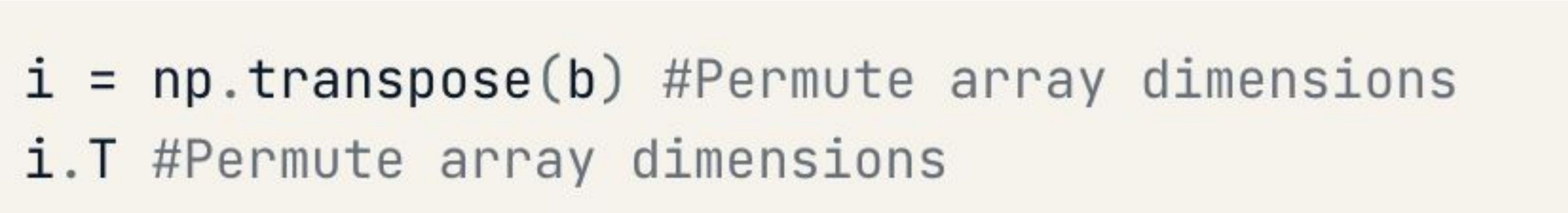
Boolean Indexing



```
>>> a[a<2] #Select elements from a less than 2
 array([1])
```

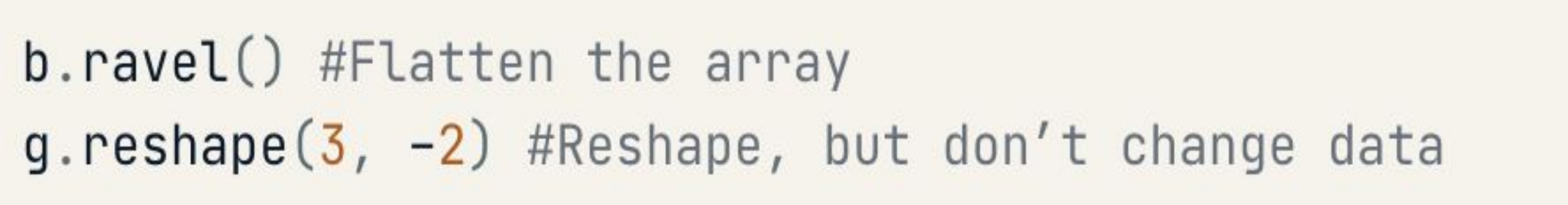
Array Manipulation

Transpose Array



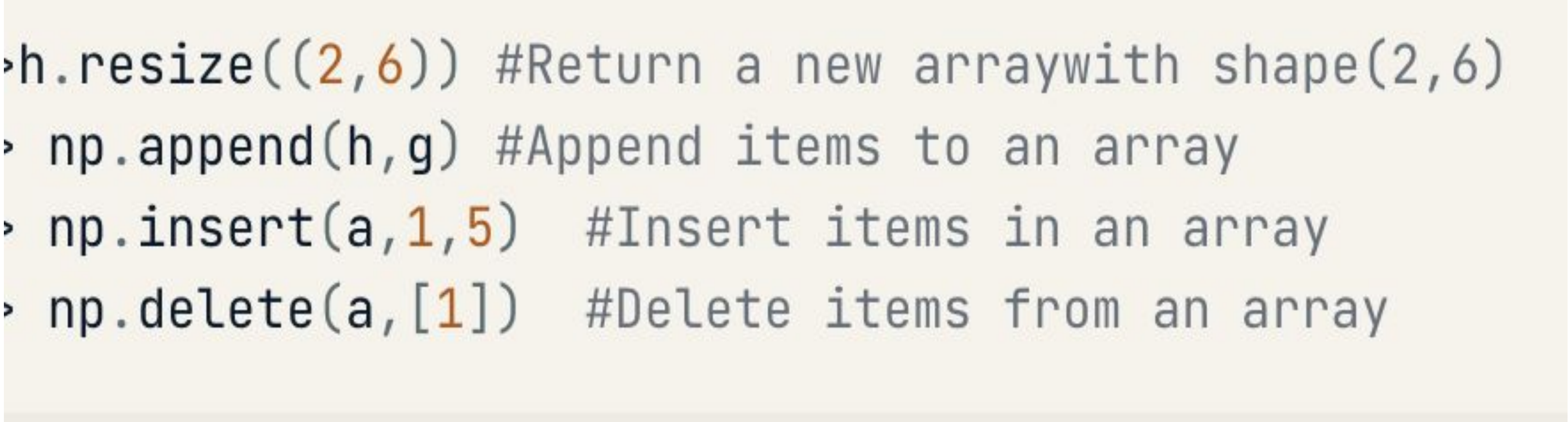
```
i = np.transpose(b) #Permute array dimensions
i.T #Permute array dimensions
```

Changing Array Shape



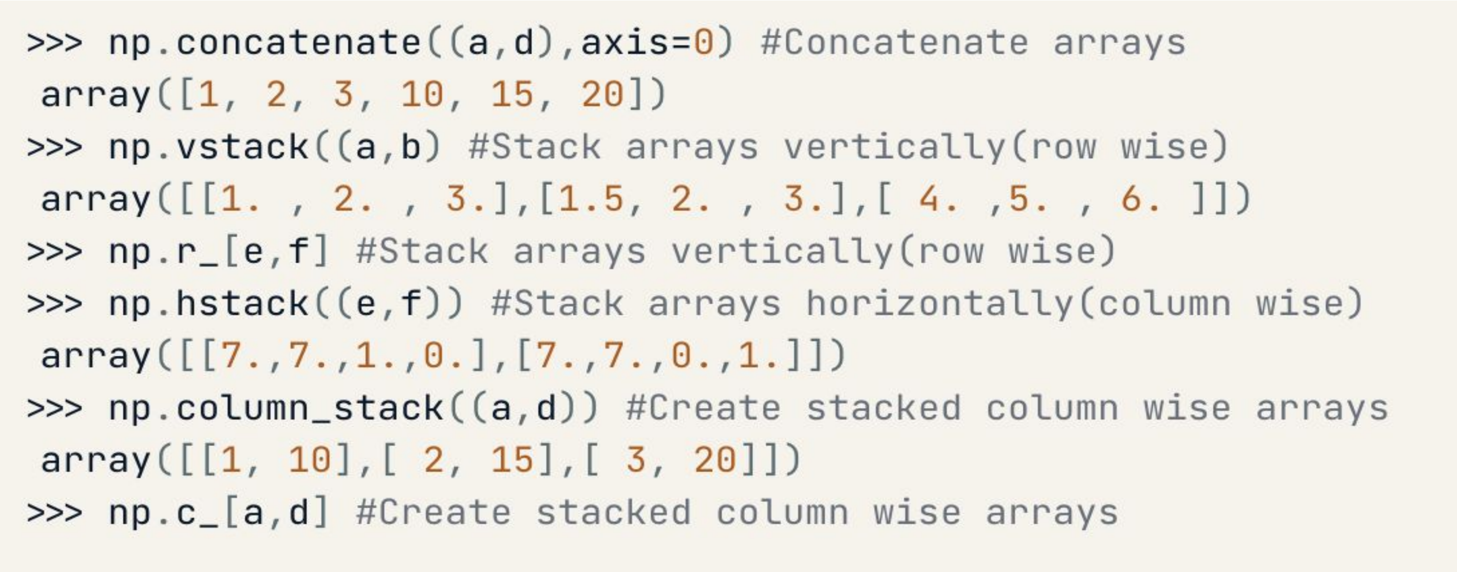
```
b.ravel() #Flatten the array
g.reshape(3, -2) #Reshape, but don’t change data
```

Insert , delete and Update operations



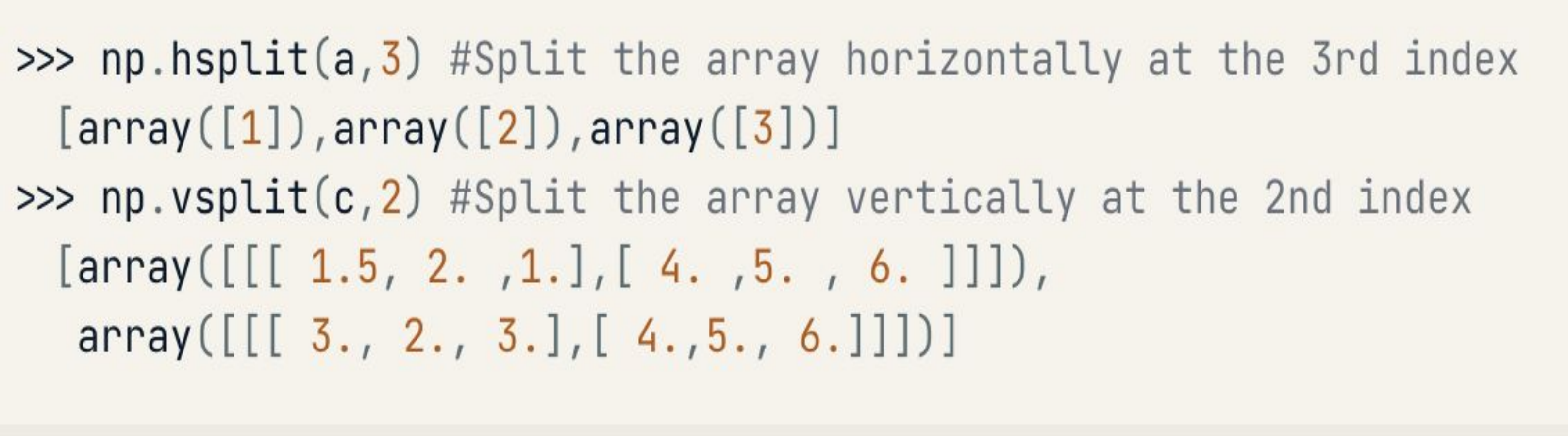
```
>h.resize((2,6)) #Return a new arraywith shape(2,6)
> np.append(h,g) #Append items to an array
> np.insert(a,1,5)  #Insert items in an array
> np.delete(a,[1])  #Delete items from an array
```

Concatenating two arrays (Adding two arrays)



```
>>> np.concatenate((a,d),axis=0) #Concatenate arrays
 array([1, 2, 3, 10, 15, 20])
>>> np.vstack((a,b) #Stack arrays vertically(row wise)
 array([[1. , 2. , 3.],[1.5, 2. , 3.],[ 4. ,5. , 6. ]])
>>> np.r_[e,f] #Stack arrays vertically(row wise)
>>> np.hstack((e,f)) #Stack arrays horizontally(column wise)
 array([[7.,7.,1.,0.],[7.,7.,0.,1.]])
>>> np.column_stack((a,d)) #Create stacked column wise arrays
 array([[1, 10],[ 2, 15],[ 3, 20]])
>>> np.c_[a,d] #Create stacked column wise arrays
```

Split Arrays



```
>>> np.hsplit(a,3) #Split the array horizontally at the 3rd index
  [array([1]),array([2]),array([3])]
>>> np.vsplit(c,2) #Split the array vertically at the 2nd index
  [array([[[ 1.5, 2.  ,1.],[ 4.  ,5.  , 6.  ]]]),
   array([[[ 3., 2., 3.],[ 4.,5., 6.]]])]
```