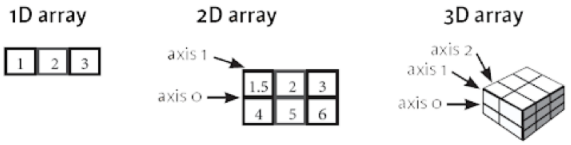
Numpy Cheat Sheet

Numpy

The NumPy library is the core library for scientific computing in Python.
It provides a high-performance multidimensional array object, and tools
forworking with these arrays

Use the following import convention:
import numpy as np

Numpy Arrays



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)
```

Initial Placeholders

```
 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 evenly spaced 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
```

I/O

Solving & Loading On Disk

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

Solving & Loading Text Files

```
np.loadtxt("myfile.txt")
np.genfromtxt("my_file.csv", delimiter=',')
np.savetxt("myarray.txt", a, delimiter=" ")
```

Asking For Help

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

Inspecting Your Array

```
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 Numpy
np.object #Python object type
np.string_ #Fixed-length string type
np.unicode_ #Fixed-length unicode type
```

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
```

Array Mathematics

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) #Element-wise cosine
np.log(a) #Element-wise natural logarithm
e.dot(f) #Dot product
 array([[ 7., 7.],
        [ 7., 7.]])
```

Comparison

```
a == b #Element-wise comparison
 array([[False, True, True],
        [False, False, False]], dtype=bool)
a < 2 #Element-wise comparison
 array([True, False, False], dtype=bool)
np.array_equal(a, b) #Array-wise comparison
```

Aggregate Functions

```
a.sum() #Array-wise sum
a.min() #Array-wise minimum value
b.max(axis=0) #Maximum value of an array row
b.cumsum(axis=1) #Cumulative sum of the elements
a.mean() #Mean
np.median(b) #Median
np.corrcoef(a) #Correlation coefficient
np.std(b) #Standard deviation
```

Indexing

Boolean Indexing

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

Fancy Indexing

```
b[[1, 0, 1, 0],[0, 1, 2, 0]] #Select elements (1,0),(0,1),(1,2) and (0,0)
 array([ 4. , 2. , 6. , 1.5])
b[[1, 0, 1, 0]][:,[0,1,2,0]] #Select a subset of the matrix's rows and columns

 array([[ 4. ,5. , 6. , 4. ],
 [ 1.5, 2. , 3. , 1.5],
 [ 4. , 5. , 6. , 4. ],
 [ 1.5, 2. , 3. , 1.5]])
```

Subsetting, Slicing

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 row 0 (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])
```

Array Manipulation

Transposing 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
```

Adding/Removing Elements

```
h.resize((2,6)) #Return a new array with 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
```

Combining 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
```

Splitting 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.]]])]
g
```