NumPy Cheat Sheet

Array initialization

Create arrays from (potentially nested) Python lists:

Rank 1	a	np.array([1, 2, 3])
Rank 2	b	np.array([[1, 2, 3], [4, 5, 6]])
Force a datatype	c	np.array([0, 1, 2], dtype=np.int32)

Functions to create standard arrays (e.g. all zeros):

Zero-filled array	a	np.zeros((2,2))
One-filled array	b	np.ones((1,2))
Random array	d	np.random.rand((2,2))
Identity matrix	c	np.eye(2)
Increasing sequence	e	=np.linspace(2.0, 8.0, 10)

Note that the first three functions require a shape tuple argument, hence the double parentheses.

Data Types

Basic data types:

Unsigned 32 bit integer	np.uint32
Signed 64 bit integer	np.int64
Single precision floating point	np.float32
Double precision floating point	np.float64
Boolean	np.bool

Array indexing, slicing

Basic indexing notation:

Select the element at the 3rd index	a[3]
Select the element at row 2, column 0	b[2][0]

Slicing:

Select elements at index 0 and 1	a[0:2]
Select all elements in column 1	b[:,1:2]
Select first two rows and last two columns	b[:2,-2:]

Indexing using conditional expressions:

Select elements less than 4	b[b<4]

Indexing using a list of indices:

Select elements (1,1) and (2,1)	b[[1,2],[1,1]]

Standard arithmetic operations

Elementwise arithmetic operations:

Addition	d	e + f
Subtraction	d	e - f
Multiplication	d	e * f
Division	d	e / f
Square root	d	np.sqrt(e)
Exponentiation	d	np.exp(e)
Natural logarithm	d	np.log(e)
Cosine	d	=np.cos(e)

Other functions:

Dot/Matrix product	d	np.dot(e, f) # Shorter: e @ f
Compute sum of each column	d	np.sum(b, axis 0)
Compute max value of each row	d	np.max(b, axis=1)
Compute min value of array	d	np.min(b)
Transpose matrix	d	=e.T

Note that * and @ are different. The former does element-wise multiplication, while the latter is a dot or matrix-matrix/vector product depending on the input shapes.

Inspecting arrays

Basic definitions:

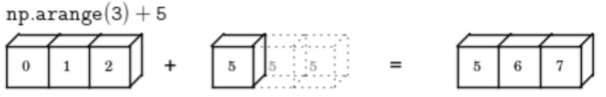
Array dimensions	a.shape
Number of array dimensions	a.ndim
Number of array elements	a.size
Number of array elements in a row	a.shape[0]
Data type of array elements	a.dtype
Convert an array to a different type	a.astype(np.float32)

Copying, sorting, reshaping

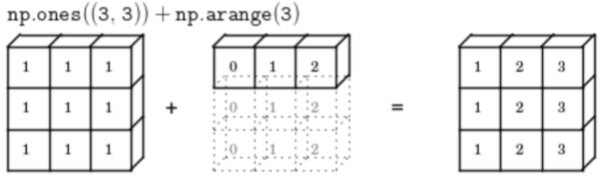
Create an array copy of b	c	np.copy(b)
Create view of array with dtype	c	a.view(int)
Sort array		np.sort(a)
Flatten array to rank 1		a.flatten()
Reshape array; the new shape must have the same number of entries.	d	=a.reshape(6, 1)

Broadcasting

Broadcasting enables operations that combine arrays of different shapes.



A two dimensional array multiplied by a one dimensional array results in broadcasting if number of 1D array elements matches the number of 2D array columns.



Broadcasting can stretch both arrays to form an output array larger than either of the initial arrays.