NUMPY (LIBRARY)

What is Numpy?

↳ NumPy is a Python library used for working with arrays.

↳ It also has functions for working in domain of linear algebra, fourier transform, and matrices.

↳ NumPy was created in 2005 by Travis Oliphant. It is an open source project and you can use it freely.

↳ NumPy stands for Numerical Python.

Why we use NumPy?

↳ In Python we have lists that serve the purpose of arrays, but they are slow to process.

↳ NumPy aims to provide an array object that is up to 50x faster than traditional Python lists.

↳ The array object in NumPy is called ndarray, it provides a lot of supporting functions that make working with ndarray very easy.

↳ Arrays are very frequently used in data science, where speed and resources are very important.

Why is NumPy faster than list?

↳ NumPy arrays are stored at one continuous place in memory unlike lists, so processes can access and manipulate them very efficiently.

↳ This behavior is called locality of reference in computer science.

↳ This is the main reason why NumPy is faster than lists. Also it is optimized to work with latest CPU architectures.

Numpy is partially written in python, mostly writt in c and c++

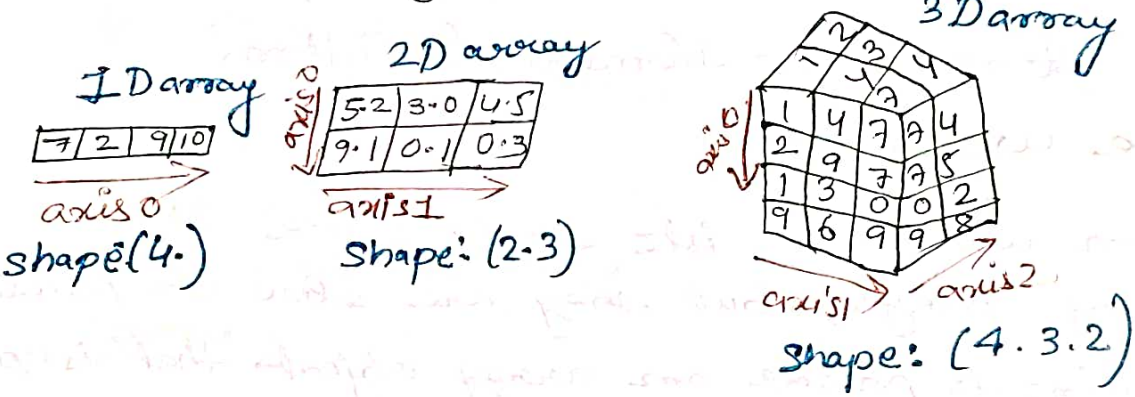
A normal numpy program

The version string is stored under (__version__) attribute.

```
import numpy as np
print(np.__version__)
```

NumPy Creating Arrays

NumPy is used to work with arrays. The array object in NumPy is called ndarray.



type(): This built in Python function tells us the type of the object passed to it. Like in above code it shows that arr is numpy.ndarray type.

Use a tuple to create a Numpy array:

```
import numpy as np
arr = np.array((1, 2, 3, 4, 5))
print(arr)
```

Output

[1, 2, 3, 4]

Dimensions in Arrays

A dimension in arrays is one level of array depth (nested arrays).

Nested array: are arrays that have arrays as their elements.

0-D Arrays

0-D arrays, or scalars, are the elements in an array. Each value in an array is a 0-D array.

```
import numpy as np
arr = np.array(42)
print(arr)
```

1-D Arrays

An array that has 0-D arrays as its elements is called uni-dimensional or 1-D array. These are the most common and basic arrays.

```
import numpy as np
arr = np.array([1,2,3,4,5])
print(arr)
```

2-D Arrays

An array that has 1-D arrays as its elements is called a 2-D array. These are often used to represent matrix or 2nd order tensors. Numpy has a whole sub module dedicated towards matrix operations called numpy.mat

```
import numpy as np
arr = np.array([[1,2,3],[4,5,6]])
print(arr)
```

3-D arrays

An array that has 2-D arrays (matrices) as its elements is called 3-D array. These are often used to represent a 3rd order tensor.

```
arr = np.array([[[1,2,3],[4,5,6]],[[1,2,3],[4,5,6]]])
```

Output

```
[[[1 2 3]
  [4 5 6]]
 [[1 2 3]
  [4 5 6]]]
```

NumPy Arrays provides the ndim attribute that returns an integer that tells us how many dimensions the array have.

Higher Dimensional Arrays

An array can have any number of dimensions. When the array is created, you can define the number of dimensions by using the ndmin argument.