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(Autonomous College Affiliated to the University of Mumbai)  
NAAC ACCREDITED with "A" GRADE (CGPA : 3.18)



**DEPARTMENT OF INFORMATION TECHNOLOGY**

**COURSE CODE:** DJ19ITL406

**DATE:** 05-06-2022

**COURSE NAME:** Programing Laboratory 2 (Python)

**CLASS:** SYBTECH

**EXPERIMENT NO. 3**

**CO/LO: CO1, CO2.**

**AIM / OBJECTIVE:**

Write a Python program to implement Arrays / Numpy Array (1D, 2D) applications

**DESCRIPTION OF EXPERIMENT:**

## Introduction to NumPy

- NumPy is a Python package and it stands for numerical python
- Fundamental package for numerical computations in Python
- Supports N-dimensional array objects that can be used for processing multidimensional data
- Supports different data-types

### Array

- An array is a data structure that stores values of same data type
- Lists can contain values corresponding to different data types,
- Arrays in python can only contain values corresponding to same data type

### NumPy Array

- A numpy array is a grid of values, all of the same type, and is indexed by a tuple of nonnegative integers
- The number of dimensions is the rank of the array
- The shape of an array is a tuple of integers giving the size of the array along each dimension

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

We can create a NumPy ndarray object by using the array() function.

```
import numpy as np
```

```
# Create a 3x1 numpy array
```

```
a = np.array([1,2,3])
```

```
print(a)
```

```
# Print object type
```



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```
print(type(a))
# Print shape
print(a.shape) # 3,
# Print some values in a
print(a[0], a[1], a[2])
```

```
#Create a 2x2 numpy array
b = np.array([[1,2],[3,4]])
print(b)
# Print shape
print(b.shape)
# Print some values in b
print(b[0,0], b[0,1], b[1,1])
```

```
#Create Random Array
g = np.random.random((3,3))
```

```
# Indexing
import numpy as np
arr = np.array([1, 2, 3, 4])
print(arr[0])
```

#### #Data Types in Array

The NumPy array object has a property called `dtype` that returns the data type of the array

#### #Slicing

We pass slice instead of index like this: `[start:end]`.

We can also define the step, like this: `[start:end:step]`.

#### #Copy

The copy *owns* the data and any changes made to the copy will not affect original array, and any changes made to the original array will not affect the copy.



#Interating

As we deal with multi-dimensional arrays in numpy, we can do this using basic for loop of python

### QUESTIONS:

1. Create a Numpy array filled with all ones
2. Check whether a Numpy array contains a specified row
3. Compute mathematical operations on Array, Add & Multiply two matrices
4. Find the most frequent value in a NumPy array
5. Flatten a 2d numpy array into 1d array
6. Calculate the sum of all columns in a 2D NumPy array
7. Calculate the average, variance and standard deviation in Python using NumPy
8. Insert a space between characters of all the elements of a given NumPy array?
9. Plot line graph from NumPy array
10. Sort the values in a matrix

### CODE:

# 1.Create a Numpy array filled with all ones

```
import numpy as np

l=[]
n=int(input("enter number of ones "))
for i in range(0,n):
    l.append(1)
allones=np.array(l)
print(allones)
```

### OUTPUT:

```
... [1 1 1 1 1]
```



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# 2. Check whether a Numpy array contains a specified row

```
arr=np.array([[1,2,3],[4,5,6],[7,8,9]])
print(arr.shape)

row=[4,5,6]
row1=[12,25,36]
if row in arr:
    print("row exists")
else:
    print("row does not exists")

if row1 in arr:
    print("row1 exists")
else:
    print("row1 does not exists")
```

OUTPUT:

```
... (3, 3)
    row exists
    row1 does not exists
```

# 3. Compute mathematical operations on Array, Add & Multiply two matrices

```
mat1=np.array([[1,2,3],[4,5,6],[7,8,9]])
mat2=np.array([[1,0,0],[0,1,0],[0,0,1]])

print("Addition of matrices:\n",mat1+mat2)
print("multiplication of matrices:\n",mat1@mat2)
```

OUTPUT:

```
... Addition of matrices:
    [[ 2  2  3]
     [ 4  6  6]
     [ 7  8 10]]
multiplication of matrices:
    [[1 2 3]
     [4 5 6]
     [7 8 9]]
```



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# 4. Find the most frequent value in a NumPy array

```
import statistics as stats
iden=np.array([1,2,4,7,1,6,3,1,8,9,1,6,9,1])
print("most repeated element:",stats.mode(iden))
```

OUTPUT:

```
.. most repeated element: 1
```

# 5. Flatten a 2d numpy array into 1d array

```
mat=np.array([[1,2,3],[4,5,6],[7,8,9]])
#print(mat.reshape(1,9))
print(mat.flatten())
```

OUTPUT:

```
... [1 2 3 4 5 6 7 8 9]
```

# 6. Calculate the sum of all columns in a 2D NumPy array

```
mat=np.array([[1,2,3],[4,5,6],[7,8,9]])
print("columnwise sum : ",np.sum(mat, axis = 0))
```

OUTPUT:

```
... columnwise sum : [12 15 18]
```



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# 7. Calculate the average, variance and standard deviation in Python using NumPy

```
iden=np.array([1,2,4,7,1,6,3,1,8,9,1,6,9,1])

print("avg = ",np.mean(iden))
print("variance = ",np.var(iden))
print("standard deviation = ",np.std(iden))
```

OUTPUT:

```
... avg = 4.214285714285714
    variance = 9.45408163265306
    standard deviation = 3.0747490357186975
```

# 8. Insert a space between characters of all the elements of a given NumPy array?

```
this=np.array(["too","many","pending","assignments"])
print(np.char.join(" ", this))
```

OUTPUT:

```
... ['t o o' 'm a n y' 'p e n d i n g' 'a s s i g n m e n t s']
```

# 9. Plot line graph from NumPy array

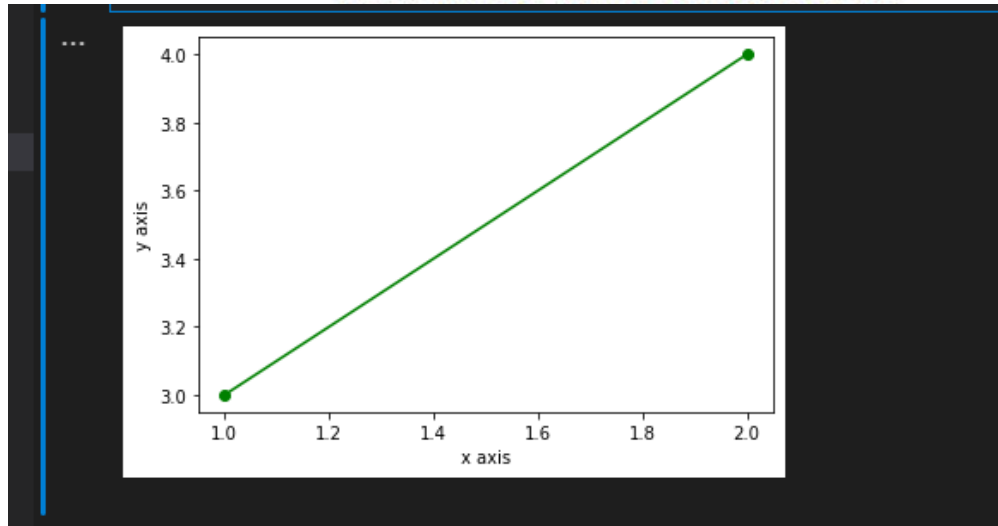
```
import matplotlib.pyplot as mp

x=np.array([1,2])
y=np.array([3,4])
mp.xlabel("x axis")
mp.ylabel("y axis")
mp.plot(x,y,"o-g")
mp.show()
```

OUTPUT:



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# 10.Sort the values in a matrix

```
mat=np.array([[9,8,7],[6,5,4],[3,2,1]])  
mat.sort()  
print(mat)
```

OUTPUT:

```
...  [[7 8 9]  
      [4 5 6]  
      [1 2 3]]
```

### OBSERVATIONS / DISCUSSION OF RESULT:

- 1)It was observed that numpy has a lot of built in function for various data calculations such as avg, variance and standard deviation.
- 2)It was observed that in order to sort a matrix in python, we first copy all the elements of the matrix in single dimension list and then sort the list using sort() and copy the elements back into the original matrix.
- 3)The function bincount works a little different than expected as it is supposed to return the occurrence of the elements in the array, it does so by making an array of the numbers from 0 to



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the largest element in the original array. So if the array is [1,2,2,1] then the array produced by `bincount` will be [0,2,2] where the first element represents the occurrence of 0 in the original array which is zero, the second element showing the occurrence of 1 which is 2 and so on. The drawback of this is that if the array contains a bigger number like 100 then the `bincount` will make an array of 100 elements which is not needed.

## CONCLUSION:

The experiment showed the different functions of `numpy` and how powerful it is at manipulating data. It also showed the way to plot a graph using `numpy` which is a handy tool to see the data growth etc.

## REFERENCES:

### Website References:

[1] <https://www.w3schools.com/python>