Chapter-1(Numpy)

1. Name 2 useful and powerful libraries of Python.
2. What statement is mandatory to use any library in the program?
3. Where should we give the import statement in the program?

1. What is an array?
2. What is a Numpy array?
3. How can we accesss an individual element of an array? Give example.
4. What is the first index of array?
5. Is Python list and Numpy array are same?
6. What are the 2 forms of Numpy array?
7. What is the other name for 1D array?
8. What is the other name for 2 D array or multi dimentional array?
9. Define 1D array.
10. Define 2D array.
11. How can we determine the number of elements in a 2D array?

1. How the array elements are stored in the memory?
2. Mention the 2 different ways in which the 2D array elements are stored in the memory?
3. Differentiate row major and column major format.
4. What is the other name for Numpy array?

1. Find the output:

(i)
```
import numpy as np
L=[11,12,13,14]
a= np.array(L)
print(a)
```

(ii)
```
import numpy as np
a= np.array([[11,2,3,4],[10,20,30,40]])
print(a)
print(a[1][2])
print(a[1,2])
```

1. What are axes?

1. What is a rank in array?
2. What is a shape in array?
3. Can a ndarray store data of different types (or) heterogeneous data?
4. What is the default data type of numpy data?
5. What is an itemsize in array?
6. Write syntax to know the shape,dtype and itemsize of an array?
7. What will the type() function return for an ndarray?
8. Find the output:

```
import numpy as np
a1=np.array([10,11,12,13])
a2=np.array([[2,4,6],[1,3,5]])
print(type(a1))
print(a1.shape)
print(a2.shape)
print(a1.dtype)
print(a1.itemsize)
```

1. Write the similarities and differences between python list and ndarray.
2. Find the output:

```
import numpy as np
a1=np.array([1,2,3,4])
print(a1[0])
print(a1[-2])
```

3. Can we change the size of the numpy array?

1. Can Python List store data of different types?
2. Which occupies more memory space: list or array?
3. Which among the following supports vectorized operation: list or array?
4. Find the output:

(i)
```
import numpy as np
a=np.array([1,2,3,4])
print(a+2)
a[1:3]=-4
print(a)
```

(ii)
```
L=[1,2,3,4]
print(L+2)
```

(iii)
```
L=[1,2,3,4]
L[1:3]=-4
print(L)
```

5. Write the advantages of numpy arrays over python lists.
1. Name some basic datatypes of numpy.
1. What is the default datatype of the elements of an ndarray when created as

```
a= np.array([2,1,4.5])
```

1. Give example to create an ndarray by specifying datatype.
2. Find the output:

```
a=np.array([1,2,3,4],dtype=np.int64)
print(a.dtype)
print(a.itemsize)
```

1. Is it advisable to create ndarrays by giving dictionaries or strings in array()? If no, why?
2. Name the function which will successfully create ndarray with indexed elements.
3. When the fromiter() is preferred over array()?
4. Give syntax for fromiter() function and explain its arguments.
5. What is the use of count argument in fromiter() function?
6. Is dtype argument must in fromiter()?
7. What will be the values of ndarray when created with dictionary in fromiter()?
8. Find the output:

(i)
```
a= {1:'a',2:'b',3:'c'}
a1=np.fromiter(a,dtype=np.int32)
print(a1)
print(a1[0])
```

(ii)
```
a="this"
a1=np.fromiter(a,dtype='U2')
print(a1)
print(a1[0])
```

(iii)
```
a=['a','b','c']
a1=np.fromiter(a,dtype='U1')
print(a1)
```

(iv)
```
a=[1.5,2.5,3.5]
a1=np.fromiter(a,dtype='U1")
print(a1)
```

1. What should we do to pick a smaller set of elements from a sequence using fromiter()?
2. Find the output:

```
a="this"
a1=np.fromiter(a,dtype="U1",count=2)
print(a1)
```

3. What is the use of arange()?
4. Give syntax for arrange and explain its arguments.
5. What is the default value for start,stop argument in arange()?

6. Find the output:
   (i) a= np.arange(4)
   print(a)
   (ii) a= np.arange(1,7,2,np.float32)
   print(a)
7. Is the stop value is also included in output in arange()?
1. Write the use of linspace()?
2. Give syntax for linspace() and explain its arguments.
3. Find the output:
   a= np.linspace(2.5,5,6)
   print(a)
4. Is the stop value included in output in linspace()?
1. Give example for creating a 2D ndarray using array() [pass list and also tuple)
2. Name the function needed to use with arange() to create a 2D array.
3. Find the output:
   s=np.arange(6)
   s1=s.reshape(3,2)
   print(s1)
4. Find the error:
   s=np.arange(6)
   s1=s.reshape(3,3)
   print(s1)
1. Give an example by combining arange() and reshape() in single statement.
2. Explain how numpy arrays are stored internally.
3. What information does the header part holds when the numpy array is stored in memory?
4. What are strides related to numpy.
5. When we use getsizeof() function to a numpy array, it shows more bytes than the actual data bytes. Why?
1. Name some methods to create a 2D ndarray other than array() and arange().
2. Give syntax to create 2D array using empty() and explain its arguments.
3. What is the purpose of order argument in empty().What do 'C' and 'F' stands for? What is the default value of order argument?
4. What will be the contents of the array when created with empty()?
5. Give example to create a 2D array using empty().
1. What is the use of zeros()?
2. Give syntax for zeros() and explain its arguments.
3. Find the output:
   import numpy as np
   a=np.zeros([4,4])
   print(a)
   b=np.ones([2,2])
   print(b)
   c=np.empty_like(b)
   print(c)
   d=np.np.zeros_like(b)
   print(d)
   e=np.ones_like(a)
   print(e)
1. What will the following functions do?
   (i) np.eye(3) (ii) np.full((4,4),2) (iii) np.random.rand(3,2) (iv) np.random.rand(2,3)*100
   (v) np.random.randint(10,size(2,4))
2. Find the output:
   import numpy as np

```
a=np.array([1,2,3,4])
print(a[1])
b=np.array([1,2],[3,4],[5,6])
print(b[1,2])
print(b[2][2])
print(b[-2][-2])
```

1. What is array slicing?
2. Find the output:

```
import numpy as np
a=np.array([2,5,7,9,2,4])
print(a[1:4:2])
print(a[1:-3])
print(a[:3])
print(a[3:])
```

1. Find the output:

```
import numpy as np
a=np.array([[0,2,4,6],[8,10,12,14],[16,18,20,22],[24,26,28,30]])
print(a)
print(a[:3,3:])
print(a[1::2,:3])
print(a[-3:-1,-4::2])
print(a[::-1,::-1])
```

1. Name some functions used to join or concate numpy arrays.
2. Name the function used to join the arrays horizontally.
3. Name the function used to join the arrays vertically.
4. Give example for hstack() and vstack()
5. What will happen if the arrays to be joined using hstack() / vstack() mismatch in size()
6. Find the output:

```
import numpy as np
l1=[10,11,12]
l2=[[1,2,3],[4,5,6]]
l3=[[6],[7]]
a1=np.vstack((l1,l2))
print(a1)
print(a1.shape)
a2=np.hstack((l2,l3))
print(a2)
print(a2.shape)
```

7. Find the error:

```
import numpy as np
l1=[1,2,3,4]
l2=[4,5,6]
a=np.vstack((l1,l2))
l3=[7,8,9]
b=np.vstack(l2,l3)
print(b)
```

8. Find the output:

```
import numpy as np
a1=np.array([[1,2],[3,4]])
a2=np.array([[5,6],[7,8]])
a3=np.vstack((a1,a2))
print(a3)
a4=np.hstack((a1,a2))
```

```
print(a4)
```

1. What is the difference in joining arrays using hstack(), vstack() aand concatenate()?
2. Give syntax for concatenate() and explain its arguments.
3. What will happen if we skip the axis argument in concatenate()?
4. Find the output:

```
import numpy as np
a1=np.array([[1,2,3],[4,5,6],[7,8,9]])
a2=np.array([[11,12,13],[14,15,16]])
```

(i)
```
a3=np.concatenate((a1,a2),axis=0)
print(a3)
```

(ii)
```
a3=np.concatenate((a1,a2),axis=1)
print(a3)
```

(iii)
```
a3=np.concatenate((a1,a2),axiss=None)
print(a3)
```

5. What happens when you transpose an array? Give example.
6. What happens when you give None as axis value in concatenate()?
7. When the subsets of the array will be contiguous and when it will not be contiguous?
8. What is a subset of an array?
9. Mention the 2 different ways in obtaining the subsets of an array.
10. Name the different split functions in numpy.
11. Differentiate hsplit() and vsplit() by giving examples.
12. Give syntax for hsplit() and vsplit() and explain its arguments.
13. Care should be taken while choosing n value in hsplit() and vsplit(). Why?

1. Find the output:

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

(i)
```
print(np.hsplit(a,2))
print(np.hsplit(a,4))
```

(ii)
```
print(np.hsplit(a,3))
```

(iii)
```
print(np.vsplit(a,2))
```

(iv)
```
print(np.vssplit(a,3))
```

(v)
```
a1,a2=np.hsplit(a,2)
print(a1)
print(a2)
```

1. Give syntax for split() function and explain its arguments.
2. Differentiate split() from hsplit() and vsplit().
3. Mention the 2 different ways in which we can give the second argument in split().
4. Find the output:

```
import numpy as np
a1=np.array(1,2,3,4,5,6,7,8,9,10)
print(a1)
print(np.split(a1,2))
print(np.split(a1,[2,5]))
a2=np.array([[1,2,3,4],[5,6,7,8],[9,10,11,12],[13,14,15,16]])
print(a2)
print(np.split(a2,2))
print(np.split(a2,2,axis=1))
print(np.split(a2,[1,3]))
print(np.split(a2,[1,3],axis=1))
N1,N2,N3=np.split(a2,[1,3],axis=1)
print(N1,N2,N3)
```

1. How can we extract non-contiguous subset of a Numpy array?

2. Give syntax for extract() and explain its working.
3. How to frame a condition to extract a non-contiguous subset of a numpy array.Give example.
4. Find the output:

```
import numpy as np
a=np.array([[2,4,6],[8,10,12]])
print(a)
con=np.square(a)>10
print(con)
print(np.extract(con,a))
b=np.extract(con,a)
print(b)
```

5. Name the numpy functions used to obtain contiguous subsets.
6. Name the numpy functions used to obtain non-contiguous subsets.

1. Write the use of the following numpy functions:
   Sin(x),cos(x),
   tan(x),around(x),rint(x),fix(x),floor(x),ceil(x),trunk(x),exp(x),exp2(x),log(x),log10(x),log2(x),add(x,n),multiply(x,n),divide(x,n),subtract(x,n),mod(x,n),remainder(x,n),sqrt(x),cbrt(x),square(x),absolute(x),fabs(x)
1. Give syntax for compress() and explain its arguments.
2. What is the default value of axis argument in compress()?
3. What will happen if we skip the axis argument in compress()?
4. When will the compress() and extract() work similar?
5. Find the output:

```
import numpy as np
a=np.array([[1,2,3,4,5,6],[7,8,9,1,2,3],[4,5,6,7,8,9]])
con=np.array([True,False,False])
new=np.compress(con,a,axis=0)
print(new)
new=np.compress(con,a,axis=1)
print(new)
new=np.compress(con,a)
print(new)
```

1. Explain the 2 different ways of performing arithmetic operations on 2D arrays by giving examples.
2. What is vectorised operation?
3. Find the output:

```
import numpy as np
a=np.array([[0,1,2],[3,4,5]])
```

(i)
```
b=a+0.5
print(b)
c=a+b
print(c)
```

(ii)
```
b=np.add(a,0.5)
print(b)
c=np.add(a,b)
print(c)
```

1. What is covariance?
2. How will you comment on the relation between 2 datasets based on the covariance?
3. Give syntax for cov().
4. Give an example program to find covariance.
5. Write the formula to find the covariance.

1. Give example to find the covariance between the data stored in 3 different rows of an array.
2. What is correlation?
3. Compare correlation and covariance.

4. Among correlation and covariance which deals with qualitative analysis and which one deals with quantitative analysis.
5. Name the function used to find correlation coefficient.
6. Give syntax for corrcoef().Can the 2 arrays given as argument vary in shape?

1. Write program to find the correlation coefficient of 2 1D arrays.Which index of the resultant array will give the correlation coefficient?
2. Write the formula to find correlation coefficient.
3. What is regression? What is linear regression?
4. Give the equation to show the relationship between x and y in regression.
5. What is error per point in regression?
6. What is total error in regression?
7. In y=ax+b, which is independent and which is dependent variable.
8. What is the relation between linear regression and scatter plot?

1. Name the numpy function to find linear regression.
2. Give syntax for polyfit() and explain its arguments.
3. Give example using polyfit().
4. Write program to find and plot the linear regression line for the 2 set of data:
   [10,20,30,40,50]
   [400,800,1100,1700,2100]