GitHub Link: https://github.com/sxn01020/Assignment_3ML.git

Video Link: https://youtu.be/fQgXBdvGQHU

Question1(a):

```
[44] #importing numpy
     import numpy as np

     #Creating a Random vector of size 15 in the range 1-20 and printing it
     vector=np.random.randint(1,21,15)
     print("Random vector of size 15 having only integers in the range 1-20: \n",vector)

     #Reshaping array into 3 by 5 and printing the array
     arr=vector.reshape((3,5))
     print("\nAfter reshaping the array into 3x5: \n",arr)

     #Printing shape of the array
     print("\nThe shape of the array is:",arr.shape)

     #Returning the array after calculating the maximum element across each row in the array and replacing it by 0
     arr[np.arange(len(arr)),arr.argmax(axis=1)]=0
     print("\nAfter replacing the maximum elements in the array with 0, the array will be: \n",arr)

     #Creating a 2 dimensional array of size 4x3 and also printing the shape, type and data type of the array
     arr1=np.array([[0,1],[2,3]])
     print("\nThe shape of the array is: ",arr1.shape)
     print("The type of the array is: ",type(arr1))
     print("The data type of the array is: ",arr1.dtype)
```

```
Random vector of size 15 having only integers in the range 1-20:
 [10  4  5  1 12  2 10  8  5  3 19 12  7  2 17]

After reshaping the array into 3x5:
 [[10  4  5  1 12]
 [ 2 10  8  5  3]
 [19 12  7  2 17]]

The shape of the array is: (3, 5)

After replacing the maximum elements in the array with 0, the array will be:
 [[10  4  5  1  0]
 [ 2  0  8  5  3]
 [ 0 12  7  2 17]]

The shape of the array is:  (2, 2)
The type of the array is:  <class 'numpy.ndarray'>
The data type of the array is:  int64
```

Explanation:

1. Importing numpy and creating alias np on numpy to use np instead of numpy and then Creating a vector of size 15 with integers in the range 1-20 using numpy.random.randint().
2. Reshaping the vector into an array of size 3x5 and printing the array.
3. Calculating the shape of the reshaped array and then printing the shape using shape.
4. Calculating the maximum elements from the array across each row and then replacing it with zeros.
5. Creating a 2 dimensional array and then calculating the shape using shape, type of the array using type, data type using dtype.

Question1(b):

```
[45]  #Importing numpy
      import numpy as np

      #Given square array is
      sq_arr=np.array([[3,-2],[1,0]])

      #Calculating the Eigen Values and Eigen Vectors of the given square array
      eig_val,eig_vec=np.linalg.eig(sq_arr)

      #Printing the Eigen Values and Eigen Vectors of the given square array
      print("Eigen values of the given square array is: \n",eig_val)
      print("\nEigen vectors of the given square array is: \n",eig_vec)

      Eigen values of the given square array is:
       [2. 1.]

      Eigen vectors of the given square array is:
       [[0.89442719 0.70710678]
        [0.4472136  0.70710678]]
```

Explanation:

1. Importing numpy and creating alias np on numpy to use np instead of numpy and then creating an array using the input.
2. Calculating eigen values and eigen vectors using linalg.eig.
3. Printing the eigen values and eigen vectors.

Question1(c):

```
[46]  #Importing numpy
      import numpy as np

      #Given array
      arr=np.array([[0,1,2],[3,4,5]])

      #Computing the sum of the diagonal element of the given array
      #We can also calculate it as np.sum(np.diag(arr))
      print("The sum of diagonal elements of the given array is:",np.trace(arr))

      The sum of diagonal elements of the given array is: 4
```

Explanation:

1. Importing numpy and creating alias np on numpy to use np instead of numpy and then creating an array from the given input.
2. Calculating the sum of the diagonal elements of the array using trace.

Question1(d):

```
[47] #Importing numpy
     import numpy as np

     #Creating an array with elements from 1 to 6
     arr=np.arange(1,7)
     print("The array with elements 1 to 6 is: \n",arr)

     #Reshaping the array into 3x2
     print("\nThe array after reshaping it into a size of 3x2 is:\n",arr.reshape(3,2))

     #Reshaping the array into 2x3
     print("\nThe array after reshaping it into a size of 2x3 is:\n",arr.reshape(2,3))
```

```
The array with elements 1 to 6 is:
 [1 2 3 4 5 6]

The array after reshaping it into a size of 3x2 is:
 [[1 2]
 [3 4]
 [5 6]]

The array after reshaping it into a size of 2x3 is:
 [[1 2 3]
 [4 5 6]]
```

Explanation:

1. Importing numpy and creating alias np on numpy to use np instead of numpy and then creating a 1 dimensional array with elements 1 to 6.
2. Reshaping the array created above into an array of size 3 by 2.
3. Reshaping the array created above into an array of size 2 by 3.

Question2:

```
#Importing matplotlib
import matplotlib.pyplot as plt

#Given sample data
prog_lang=["Java","Python","PHP","JavaScript","C#","C++"]
popularity=[22.2,17.6,8.8,8,7.7,6.7]

#Creating an array explode to create an emphasis on Java cut
explode=[0.1,0,0,0,0,0]

#Creating a pie chart with autopct for percentage values, to give a shadow to the cart,
plt.pie(popularity, labels=prog_lang, autopct='%1.1f%%',explode=explode, shadow=True,
        wedgeprops={'edgecolor': 'black'})

#Adding a title to the pie chart
plt.title('Popularity of Programming Languages')

#Diplaying the pie chart
plt.show()
```
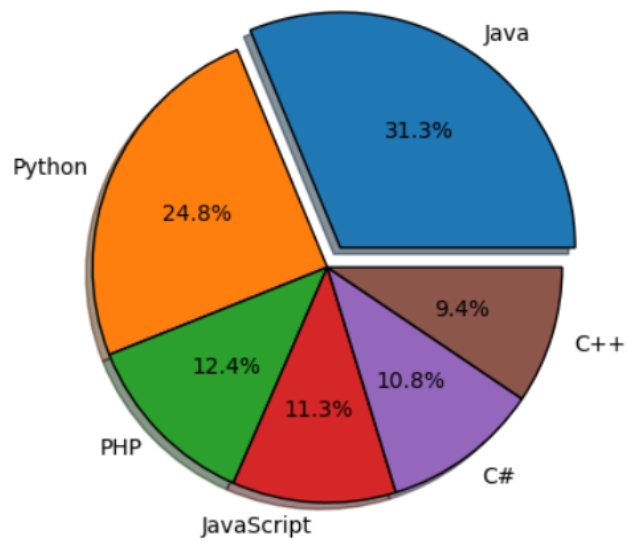
Popularity of Programming Languages

Explanation:

1. Importing pyplot using matplotlib.pyplot and creating alias plt on matplotlib.pyplot to use plt instead of matplotlib.pyplot.
2. Creating lists with the input data.
3. Creating a list called explode to create an emphasis on Java cut
4. Creating a pie chart using the input data, autopct, explode, shadow and wedgeprops.
5. Adding title to the pie chart using plt.title
6. Displaying the pie chart using plt.show.