DATA SCIENCE LAB RECORD

(20MCA241)

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S3RMCA-A

Roll No:44

Date:24/11/2021

Program - 1

Aim:

Perform all matrix operations using python (using numpy).

Program:

```
import numpy

x=numpy.array([[2,4],[7,5]])

y=numpy.array([[5,6],[4,7]])

print("Matrix Addition")

print(numpy.add(x,y))

print("Matrix Subraction")

print(numpy.subtract(x,y))

print("Matrix multiplication")

print(numpy.multiply(x,y))

print("Matrix product")

print(numpy.dot(x,y))

print("Matrix square root")

print(numpy.sqrt(x))

print("Matrix divison")

print(numpy.divide(x,y))

print("Matrix sum of element")

print(numpy.sum(x))
```

print("Matrix sum of elements (x-axis)")

print(numpy.sum(x,axis=0))

print("Matrix Transpose of x")

print(x.T)

OUTPUT

```
matrixoper
C:\Users\ajcemca\PycharmProjects\DSMLlab\venv\Scripts\python.exe C:/Users/ajcemca/PycharmProjects/DSMLlab/matrixoper.py
Matrix Addition
[[ 7 10]
 [11 12]]
Matrix Subraction
[[-3 -2]
 [ 3 -2]]
Matrix multiplication
[[10 24]
 [28 35]]
Matrix product
[[26 40]
 [55 77]]
Matrix square root
[[1.41421356 2.        ]
 [2.64575131 2.23606798]]
Matrix divison
[[0.4        0.66666667]
 [1.75       0.71428571]]
Matrix sum of element
18
Matrix sum of elements (x-axis)
[9 9]
Matrix Transpose of x
[[2 7]
 [4 5]]
```

Date:01/12/2021

Program - 2

Aim:

Perform SVD(Singular Value Decomposition)

Program:

```
from  numpy import array

from scipy.linalg import svd

a=array([[1,2,3,4],[7,8,3,5],[4,6,9,10]])

print(a)

u,s,vt=svd(a)

print("Decomposed Matrix\n",u)

print("Inverse Matrix\n",s)

print("Transpose matrix\n",vt)
```

OUTPUT

```
C:\Users\ajcemca\PycharmProjects\pythonProject\venv\Scrip
[[ 1  2  3  4]
 [ 7  8  3  5]
 [ 4  6  9 10]]
Decomposed Matrix
 [[-0.27122739  0.25018762  0.92943093]
 [-0.575834   -0.81593689  0.05159647]
 [-0.77126579  0.52120355 -0.36537097]]
Inverse Matrix
 [19.40153082  5.77253959  0.5083193 ]
Transpose matrix
 [[-0.38074978 -0.50391495 -0.48875402 -0.60184619]
 [-0.5849343  -0.50236097  0.5185905   0.36952567]
 [-0.336162    0.15621646 -0.67921184  0.63345308]
 [-0.63235795  0.68505445  0.17565499 -0.31617898]]

Process finished with exit code 0
```

Program - 3

Aim:

Program to implement k-NN classification using any standard dataset available in the public domain and find the accuracy of the algorithm

Program:

```
from sklearn.neighbors import  KNeighborsClassifier

from sklearn.model_selection import  train_test_split

from sklearn.datasets import load_iris

from sklearn.metrics import accuracy_score


idata=load_iris()

x=idata.data

y=idata.target

x_train,x_test,y_train,y_test=train_test_split( x,y,test_size=0.3,random_state=55)

knn=KNeighborsClassifier(n_neighbors=3)

knn.fit(x_train,y_train)

y_p=knn.predict(x_test)

print(knn.predict(x_test))

print("Accuracy score : ",accuracy_score(y_test,y_p))
```

OUTPUT

```
C:\Users\ajcemca\PycharmProjects\pythonProject\venv\Scripts\python.exe C:/Users/aj
[0 0 0 2 2 0 2 2 0 0 0 1 2 0 2 2 1 0 1 2 1 2 1 2 1 1 2 1 2 1 0 0 2 2 0 1 1
 0 2 1 2 0 1 0 1]
Accuracy score :  0.9555555555555556

Process finished with exit code 0
```

Program - 4

Aim:

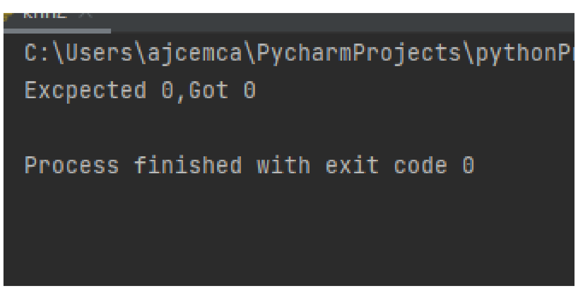
Program to implement k-NN classification using any random data set without using inbuilt packages.

Program:

```
from math import sqrt

def e_dis(r1,r2):

  dist=0.0

  for i in range(len(r1)-1):

      dist+=(r1[i]-r2[i])**2

  return sqrt(dist)

def get_ne(train,test_row,num_neig):

  distances=list()

  for train_row in train:

      dist=e_dis(test_row,train_row)

      distances.append([test_row,train_row])

  distances.sort(key=lambda tup:tup[1])

  neighbors=list()

  for i in range(num_neig):

      neighbors.append(distances[i][0])

  return neighbors

def predict_classif(train,test_row,num_neig):

  neighbors = get_ne(train,test_row,num_neig)

  out_val=[row[-1] for row in neighbors]
```

```
    prediction=max(set(out_val),key=out_val.count)
    return prediction

dataset=[[2.734,2.55,0],
        [1.45,3.36,0],
        [2.334, 2.355, 0],
        [1.45, 3.36, 0],
        [2.334, 2.55, 0],
        [1.45, 3.336, 0],
        [3.334, 3.55, 1],
        [1.45, 3.36, 1],
        [3.734, 4.55, 1],
        [3.45, 4.36, 1],
        [4.734, 5.55, 1],
        [3.45, 5.36, 1]]
prediction=predict_classif(dataset,dataset[0],3)
print('Excpected %d,Got %d'%(dataset[0][-1],prediction))
```

OUTPUT



```
C:\Users\ajcemca\PycharmProjects\pythonP
Excpected 0,Got 0

Process finished with exit code 0
```

Date:08/12/2021

Program - 5

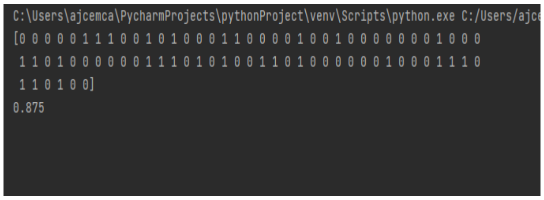
Aim:

Program to implement Naïve Bayes Algorithm using any standard dataset available in the public domain and find the accuracy of the algorithm

Program:

```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import confusion_matrix,accuracy_score

dataset=pd.read_csv('Social_Network_Ads.csv')
x=dataset.iloc[:,[2,3]].values
y=dataset.iloc[:,-1].values

x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.30)


sc=StandardScaler()
x_train=sc.fit_transform(x_train)
x_test=sc.transform(x_test)

classifier=GaussianNB()
classifier.fit(x_train,y_train)

y_pred=classifier.predict(x_test)
print(y_pred)

ac = accuracy_score(y_test,y_pred)
print(ac)
```

OUTPUT



```
C:\Users\ajcemca\PycharmProjects\pythonProject\venv\Scripts\python.exe C:/Users/ajce
[0 0 0 0 0 1 1 1 0 0 1 0 1 0 0 0 1 1 0 0 0 0 1 0 0 1 0 0 0 0 0 0 0 1 0 0 0
 1 1 0 1 0 0 0 0 0 0 1 1 1 0 1 0 1 0 0 1 1 0 1 0 0 0 0 0 0 1 0 0 0 1 1 1 0
 1 1 0 1 0 0]
0.875
```

Program - 6

Aim:

Program to implement linear regression techniques using any standard dataset available in the public domain and evaluate its performance.

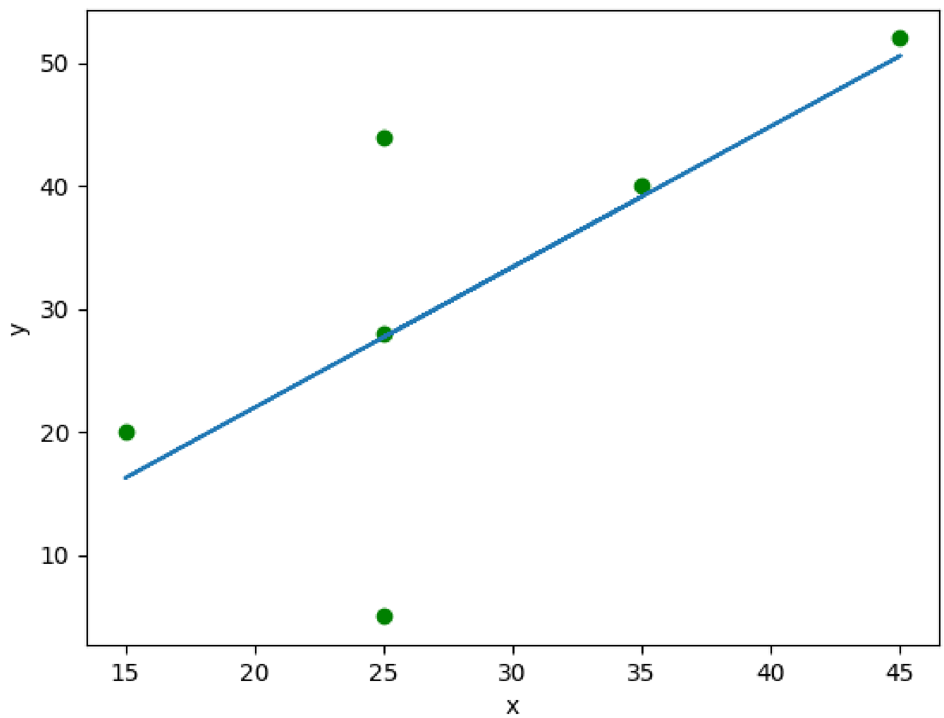
Program(inbuilt):

```
import  numpy as np

import matplotlib.pyplot as plt

from sklearn.linear_model import LinearRegression

x=np.array([5,15,25,35,45,55]).reshape((-1,1))

y=np.array([5,20,14,32,22,38])

print(x)

print(y)

model=LinearRegression()

model.fit(x,y)

r_sq=model.score(x,y)

print('coefficent of determination: ',r_sq)

print('intercept: ',model.intercept_)

print('slope : ',model.coef_)

y_pred=model.predict(x)

print('Predicted response: ',y_pred)

plt.scatter(x,y,color="g")

plt.plot(x,y_pred)

plt.xlabel('x')

plt.ylabel('y')
```

plt.show()

OUTPUT

```
C:\Users\ajcemca\PycharmProjects\pythonProject\venv\Scripts\python.exe C:/Users/ajcemca/Pycharm
[[ 5]
 [15]
 [25]
 [35]
 [45]
 [55]]
[ 5 20 14 32 22 38]
coefficent of determination:  0.7158756137479542
intercept:  5.633333333333329
slope :  [0.54]
Predicted response:  [ 8.33333333 13.73333333 19.13333333 24.53333333 29.93333333 35.33333333]
```



Program:7 (Without inbuilt):

Aim:
Program to implement linear regression techniques using any standard dataset available in the public domain and evaluate its performance.

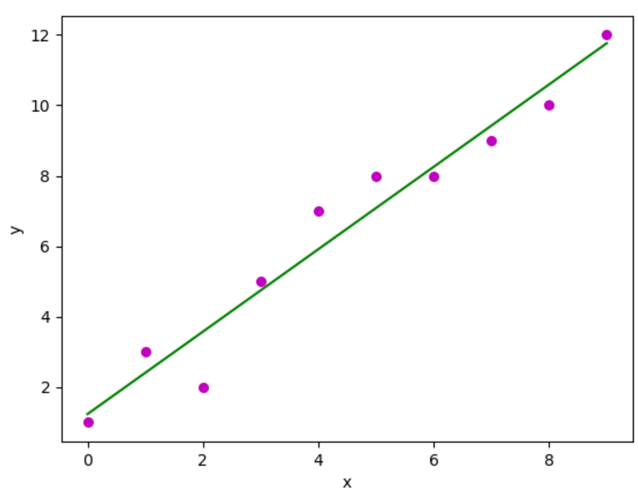
Program:

```
import numpy as np

import matplotlib.pyplot as plt

def estimate_coef(x,y):

   n=np.size(x)

   m_x=np.mean(x)

   m_y=np.mean(y)

   SS_xy=np.sum(y*x) - n *m_y* m_x

   SS_xx=np.sum(x*x) - n *m_x* m_x

   b_1=SS_xy / SS_xx

   b_0=m_y - b_1* m_x

   return (b_0,b_1)


def plot_regr_line(x,y,b):

   plt.scatter(x,y,color="m",marker="o",s=30)

   y_pred=b[0]+b[1]*x

   plt.plot(x,y_pred,color="g")

   plt.xlabel('x')

   plt.ylabel('y')

   plt.show()
```

```
def main():
  x = np.array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
  y = np.array([1, 3, 2, 5, 7, 8, 8, 9, 10, 12])


  b = estimate_coef(x, y)
  print("Estimated coefficients:\nb_0 = {}  \
         \nb_1 = {}".format(b[0], b[1]))
  plot_regr_line(x, y, b)


if __name__=="__main__":
  main()
```

OUTPUT

```
C:\Users\ajcemca\PycharmProjects\py
Estimated coefficients:
b_0 = 1.2363636363636363
b_1 = 1.1696969696969697
```



Date:15-12-2021

Program - 8

Aim:

Program to implement multiple regression techniques using any standard dataset available in the public domain and evaluate its performance.

Program:

```
import pandas

df=pandas.read_csv("cars.csv")

x=df[['Weight','Volume']]

y=df['CO2']

from sklearn import linear_model

regr=linear_model.LinearRegression()

regr.fit(x,y)

predictedco2=regr.predict([[2300,1300]])

print(predictedco2)
```

OUTPUT

```
  warnings.warn(
[107.2087328]
[0.00755095 0.00780526]
```

Date:15-12-2021

Program - 9

Aim:

Program to implement multiple regression techniques using any standard dataset available in the public domain and evaluate its performance.

```
import matplotlib.pyplot as plt

from sklearn import datasets,linear_model,metrics


boston=datasets.load_boston()


x=boston.data

y=boston.target


from sklearn.model_selection import train_test_split

x_train,x_test,y_train,y_test=train_test_split( x,y,test_size=0.4,random_state=1)


reg=linear_model.LinearRegression()

reg.fit(x_train,y_train)


pre=reg.predict(x_test)

print("Prediction : ",pre)

print('Coefficients: ',reg.coef_)

print('Variance Score:{}'.format(reg.score(x_test,y_test)))
```

OUTPUT

```
Prediction :  [32.65503184 28.0934953  18.02901829 21.47671576 18.8254387  19.87997758
 32.42014863 18.06597765 24.42277848 27.00977832 27.04081017 28.75196794
 21.15677699 26.85200196 23.38835945 20.66241266 17.33082198 38.24813601
 30.50550873  8.74436733 20.80203902 16.26328126 25.21805656 24.85175752
 31.384365   10.71311063 13.80434635 16.65930389 36.52625779 14.66750528
 21.12114902 13.95558618 43.16210242 17.97539649 21.80116017 20.58294808
 17.59938821 27.2212319   9.46139365 19.82963781 24.30751863 21.18528812
 29.57235682 16.3431752  19.31483171 14.56343172 39.20885479 18.10887551
 25.91223267 20.33018802 25.16282007 24.42921237 25.07123258 26.6603279
  4.56151258 24.0818735  10.88682673 26.88926656 16.85598381 35.88704363
 19.55733853 27.51928921 16.58436103 18.77551029 11.13872875 32.36392607
 36.72833773 21.95924582 24.57949647 25.14868695 23.42841301  6.90732017
 16.56298149 20.41940517 20.80403418 21.54219598 33.85383463 27.94645899
 25.17281456 34.65883942 18.62487738 23.97375565 34.6419296  13.34754896
 20.71097982 30.0803549  17.13421671 24.30528434 19.25576671 16.98006722
 27.00622638 41.85509074 14.11131512 23.25736073 14.66302672 21.86977175
 23.02527624 29.0899182  37.11937872 20.53271022 17.36840034 17.71399314]
Coefficients:  [-1.12386867e-01  5.80587074e-02  1.83593559e-02  2.12997760e+00
 -1.95811012e+01  3.09546166e+00  4.45265228e-03 -1.50047624e+00
  3.05358969e-01 -1.11230879e-02 -9.89007562e-01  7.32130017e-03
 -5.44644997e-01]
Variance Score:0.763417443213847
```

Date:22-12-2021

Program - 10

Aim:

Program to implement decision trees using any standard dataset available in the public domain and find the accuracy of the algorithm

Program:

```
import pandas as pd

import numpy as np

import seaborn as sns

import matplotlib.pyplot as plt


from sklearn.preprocessing import LabelEncoder

from sklearn.model_selection import train_test_split


from sklearn.tree import DecisionTreeClassifier

from sklearn.metrics import classification_report,confusion_matrix


from sklearn.tree import plot_tree

df=sns.load_dataset('iris')

print(df.head())

print(df.info())

df.isnull().any()

print(df.shape)


sns.pairplot(data=df,hue='species')
```

```
plt.savefig("pne.png")

sns.heatmap(df.corr())
plt.savefig("one.png")
target=df['species']
df1=df.copy()
df1=df1.drop('species',axis=1)
print(df1.shape)
print(df1.head())

x=df1
print(target)

le=LabelEncoder()
target=le.fit_transform(target)
print(target)
y=target

x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42)

print("Training split input",x_train.shape)
print("Testing split input",x_test.shape)

dtree=DecisionTreeClassifier()
```

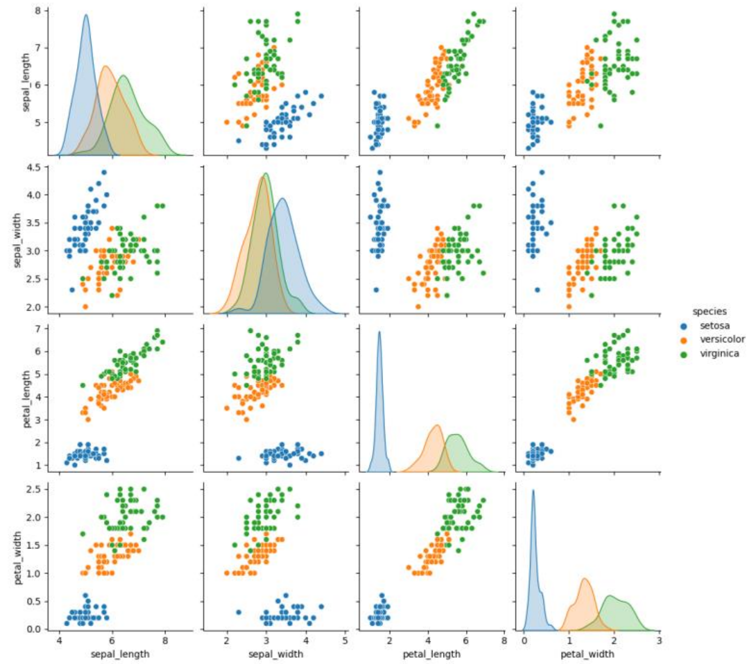
```
dtree.fit(x_train,y_train)

print("Decision tree classifier created")

y_pred=dtree.predict(x_test)
print("classsification report \n",classification_report(y_test,y_pred))
cm=confusion_matrix(y_test,y_pred)
plt.figure(figsize=(5,5))

sns.heatmap(data=cm,linewidth=5,annot=True,square=True,cmap='Blues')

plt.ylabel('Actual label')
plt.xlabel('Predictd label')

all_sample_title='Accuracy Score:{0}'.format(dtree.score(x_test,y_test))

plt.savefig("two.png")

plt.figure(figsize=(20,20))
dec_tree=plot_tree(decision_tree=dtree,feature_names=df1.columns,
    class_names=["setosa","vercicikor","verginica"],filled=True,precision=4,rounded=True)
plt.savefig("three.png")
```

OUTPUT

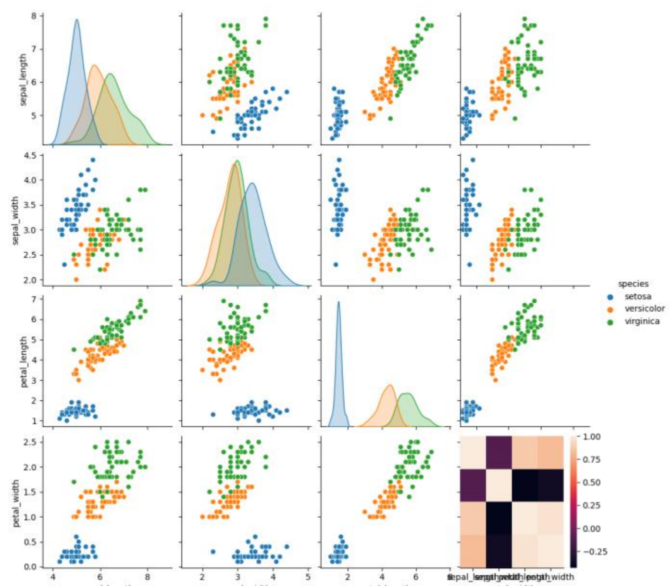
```
C:\Users\ashis\PycharmProjects\pythonProject1\venv\Scripts\python.exe C:/Users/ashis/PycharmProjects/pythonProject1/venv/d
   sepal_length  sepal_width  petal_length  petal_width species
0           5.1          3.5           1.4          0.2  setosa
1           4.9          3.0           1.4          0.2  setosa
2           4.7          3.2           1.3          0.2  setosa
3           4.6          3.1           1.5          0.2  setosa
4           5.0          3.6           1.4          0.2  setosa
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----
 0   sepal_length  150 non-null    float64
 1   sepal_width   150 non-null    float64
 2   petal_length  150 non-null    float64
 3   petal_width   150 non-null    float64
 4   species       150 non-null    object
dtypes: float64(4), object(1)
memory usage: 6.0+ KB
None
(150, 5)
(150, 4)
   sepal_length  sepal_width  petal_length  petal_width
0           5.1          3.5           1.4          0.2
1           4.9          3.0           1.4          0.2
2           4.7          3.2           1.3          0.2
3           4.6          3.1           1.5          0.2
4           5.0          3.6           1.4          0.2
0         setosa
1         setosa
```

```
2         setosa
3         setosa
4         setosa
          ...
145    virginica
146    virginica
147    virginica
148    virginica
149    virginica
Name: species, Length: 150, dtype: object
[0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2
 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
 2 2]
Training split input (120, 4)
Testing split input (30, 4)
Decision tree classifier created
classsification report
               precision    recall  f1-score   support

           0       1.00      1.00      1.00        10
           1       1.00      1.00      1.00         9
           2       1.00      1.00      1.00        11

    accuracy                           1.00        30
   macro avg       1.00      1.00      1.00        30
weighted avg       1.00      1.00      1.00        30
```

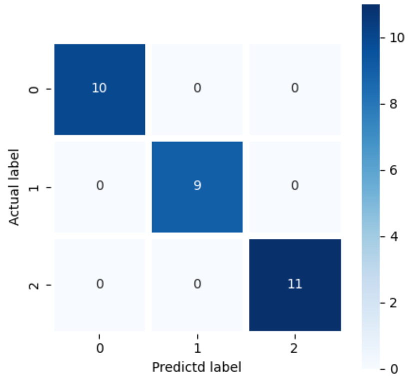
Pne.png



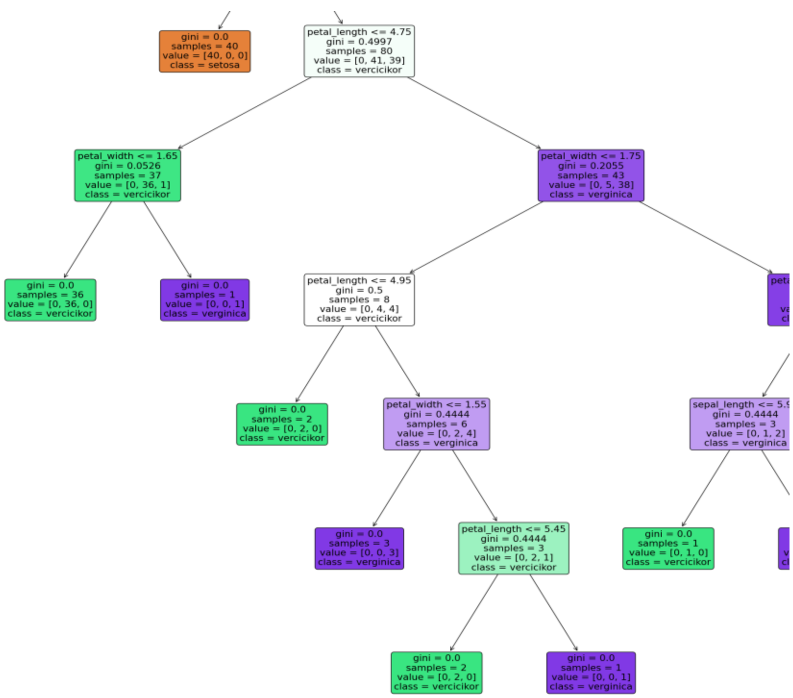
One.png



Two.png



Three.png



Date:05-01-2022

Program - 11

Aim:

Program to implement k-means clustering technique using any standard dataset available in the public domain

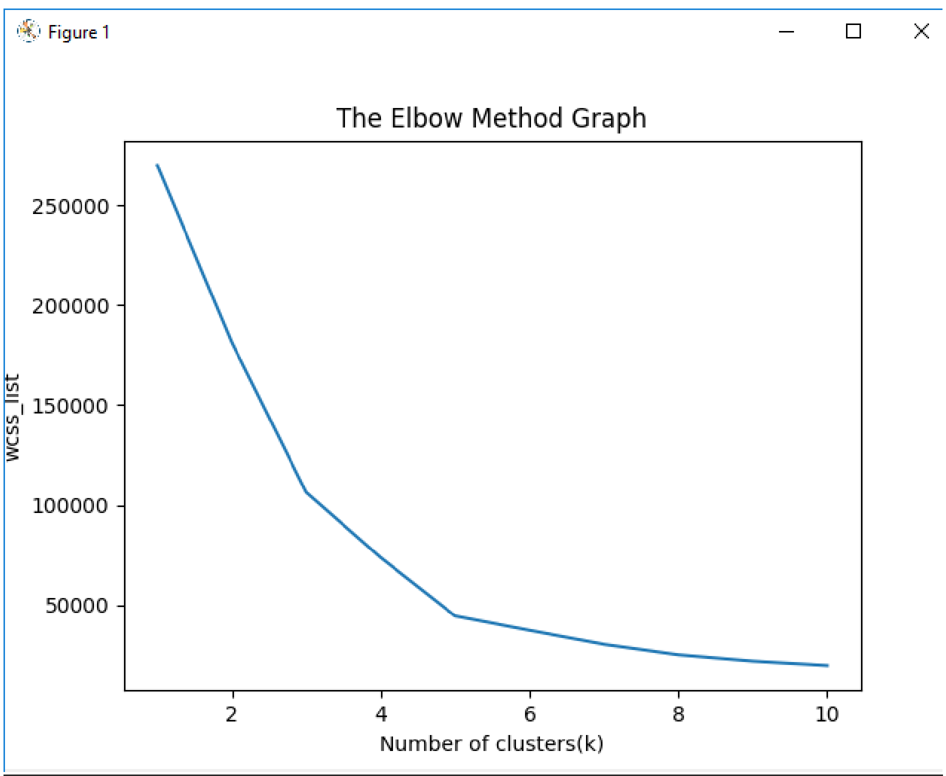
Program:

```
import numpy as nm

import matplotlib.pyplot as mtp

import pandas as pd

dataset = pd.read_csv('Mall_Customers.csv')

x=dataset.iloc[:,[3,4]].values

print(x)

from sklearn.cluster import KMeans

wcss_list=[]

for i in range(1,11):

  kmeans=KMeans(n_clusters=i,init='k-means++',random_state=42)

  kmeans.fit(x)

  wcss_list.append(kmeans.inertia_)

mtp.plot(range(1,11),wcss_list)

mtp.title('The Elbow Method Graph')

mtp.xlabel('Number of clusters(k)')

mtp.ylabel('wcss_list')

mtp.show()

kmeans=KMeans(n_clusters=5,init='k-means++',random_state=42)

y_predict=kmeans.fit_predict(x)
```

```
print(y_predict)

mtp.scatter(x[y_predict ==0,0],x[y_predict ==0,1],s=100,c='blue',label='cluster 1')
mtp.scatter(x[y_predict ==1,0],x[y_predict ==1,1],s=100,c='green',label='cluster 2')
mtp.scatter(x[y_predict ==2,0],x[y_predict ==2,1],s=100,c='red',label='cluster 3')
mtp.scatter(x[y_predict ==3,0],x[y_predict ==3,1],s=100,c='cyan',label='cluster 4')
mtp.scatter(x[y_predict ==4,0],x[y_predict ==4,1],s=100,c='magenta',label='cluster 5')
mtp.scatter(kmeans.cluster_centers_[:,0],kmeans.cluster_centers_[:,1],s=300,c='black',label='cluster')
mtp.title('Clusters of customers')
mtp.xlabel('Annual Income (K$)')
mtp.ylabel('Spending Score(1-100)')
mtp.legend()
mtp.show()
```

OUTPUT

```
C:\Users\ajcemca\PycharmProje
[[ 15  39]
 [ 15  81]
 [ 16   6]
 [ 16  77]
 [ 17  40]
 [ 17  76]
 [ 18   6]
 [ 18  94]
 [ 19   3]
 [ 19  72]
 [ 19  14]
 [ 19  99]
 [ 20  15]
 [ 20  77]
 [ 20  13]
```



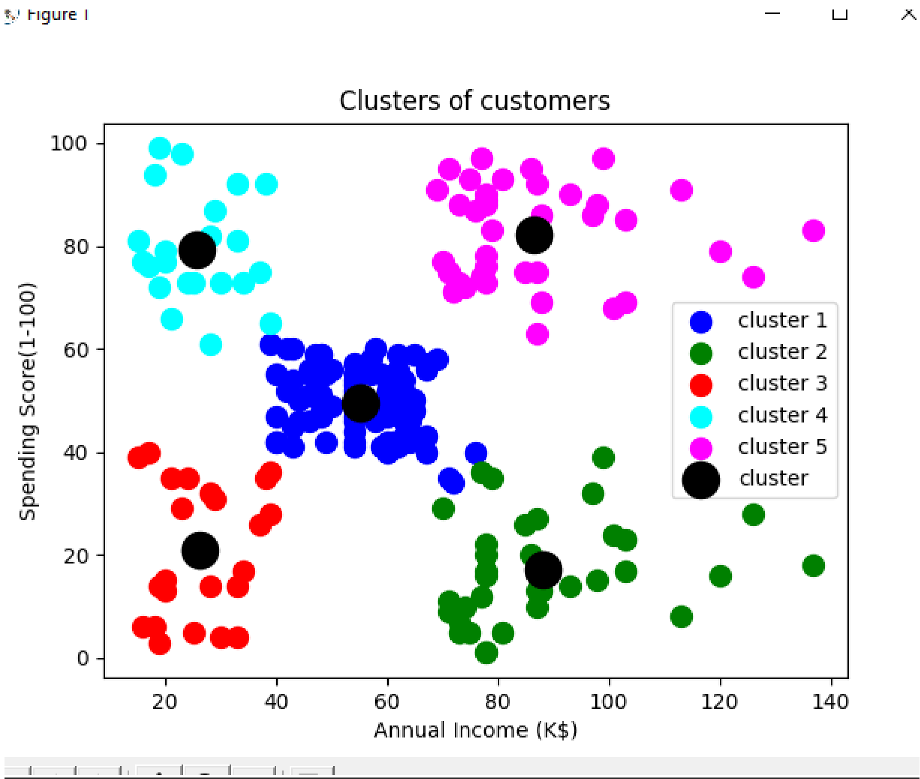


Figure 1
Clusters of customers
Spending Score(1-100)
Annual Income (K$)
0
20
40
60
80
100
20
40
60
80
100
120
140
cluster 1
cluster 2
cluster 3
cluster 4
cluster 5
cluster

Date:05-01-2022

Program - 12

Aim:

Program to implement k-means clustering technique using any standard dataset available in the public domain (Using world_country_and_usa_states_latitude_and_longitude_values.csv)

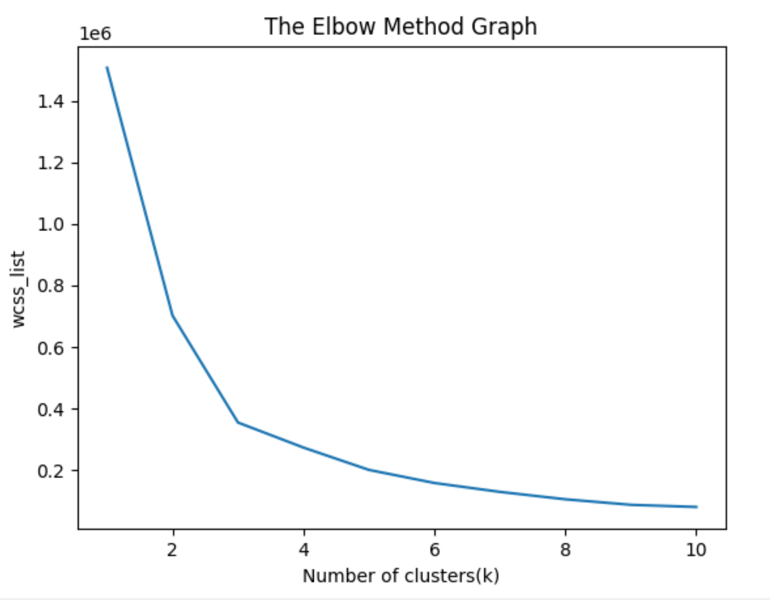
PROGRAM

```
import numpy as nm
import matplotlib.pyplot as mtp
import pandas as pd

dataset = pd.read_csv('world_country_and_usa_states_latitude_and_longitude_values.csv')
x=dataset.iloc[:,[1,2]].values
print(x)

from sklearn.cluster import KMeans
wcss_list=[]
for i in range(1,11):
  kmeans=KMeans(n_clusters=i,init='k-means++',random_state=42)
  kmeans.fit(x)
  wcss_list.append(kmeans.inertia_)
mtp.plot(range(1,11),wcss_list)
mtp.title('The Elbow Method Graph')
mtp.xlabel('Number of clusters(k)')
mtp.ylabel('wcss_list')
mtp.show()

kmeans=KMeans(n_clusters=3,init='k-means++',random_state=42)
y_predict=kmeans.fit_predict(x)
print(y_predict)

mtp.scatter(x[y_predict ==0,0],x[y_predict ==0,1],s=100,c='blue',label='cluster 1')
mtp.scatter(x[y_predict ==1,0],x[y_predict ==1,1],s=100,c='green',label='cluster 2')
mtp.scatter(x[y_predict ==2,0],x[y_predict ==2,1],s=100,c='red',label='cluster 3')
mtp.scatter(kmeans.cluster_centers_[:,0],kmeans.cluster_centers_[:,1],s=300,c='black',label='cluster')
mtp.title('Clusters of customers')
mtp.xlabel('Annual Income (K$)')
mtp.ylabel('Spending Score(1-100)')
mtp.legend()
```

mtp.show()

OUTPUT

```
C:\Users\ajcemca\PycharmProjects\Rmca_DLMLLab_28
[[ 4.25462450e+01  1.60155400e+00]
 [ 2.34240760e+01  5.38478180e+01]
 [ 3.39391100e+01  6.77099530e+01]
 [ 1.70608160e+01 -6.17964280e+01]
 [ 1.82205540e+01 -6.30686150e+01]
 [ 4.11533320e+01  2.01683310e+01]
 [ 4.00690990e+01  4.50381890e+01]
 [ 1.22260790e+01 -6.90600870e+01]
 [-1.12026920e+01  1.78738870e+01]
 [-7.52509730e+01 -7.13890000e-02]
 [-3.84160970e+01 -6.36166720e+01]
 [-1.42709720e+01 -1.70132217e+02]
 [ 4.75162310e+01  1.45500720e+01]
 [-2.52743980e+01  1.33775136e+02]
 [ 1.25211100e+01 -6.99683380e+01]
 [ 4.01431050e+01  4.75769270e+01]
 [ 4.39158860e+01  1.76790760e+01]
 [ 1.31938870e+01 -5.95431980e+01]
 [ 2.36849940e+01  9.03563310e+01]
```



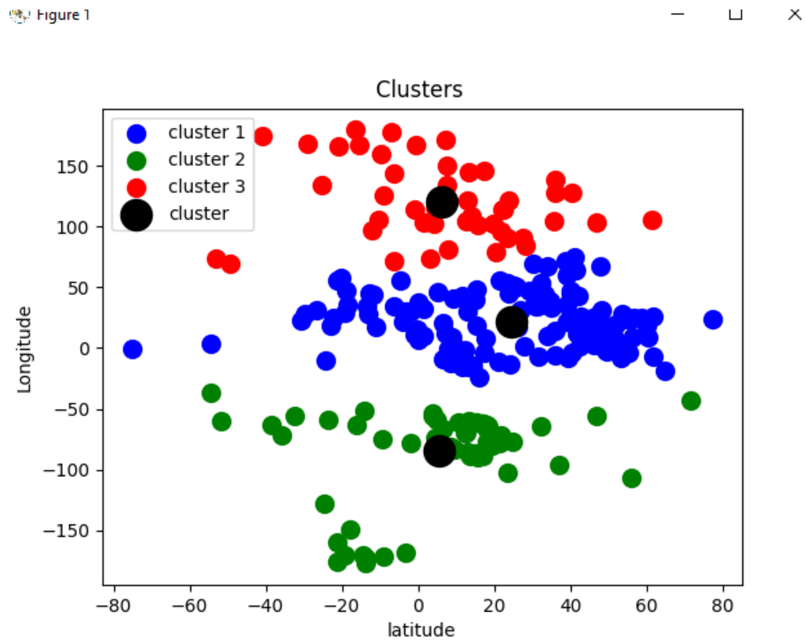


Figure 1
Clusters
cluster 1
cluster 2
cluster 3
cluster
Longitude
latitude
150
100
50
0
−50
−100
−150
−80
−60
−40
−20
0
20
40
60
80