20MCA241 DATA SCIENCE LAB

Lab Report Submitted By

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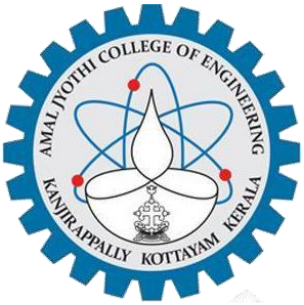
Reg. No.: AJC20MCA-2016

In Partial fulfillment for the Award of the Degree Of

MASTER OF COMPUTER APPLICATIONS (2 Year)
(MCA)
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY



AMAL JYOTHI COLLEGE OF ENGINEERING
KANJIRAPPALLY

[Affiliated to APJ Abdul Kalam Technological University, Kerala. Approved by AICTE, Accredited by NAAC with 'A' grade. Koovappally, Kanjirappally, Kottayam, Kerala – 686518]

2020-2022

DEPARTMENT OF COMPUTER APPLICATIONS

AMAL JYOTHI COLLEGE OF ENGINEERING

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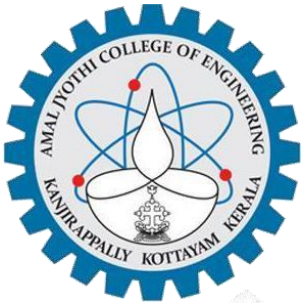


CERTIFICATE

This is to certify that the Lab report, "**20MCA241 DATA SCIENCE LAB"** is the bonafide work of **ANCY ALEXANDER (Reg.No:AJC20MCA-2016)** in partial fulfillment of the requirements for the award of the Degree of Master of Computer Applications under APJ Abdul Kalam Technological University during the year 2021-22.

Ms. Shelly Shiju George

Lab In-Charge

CONTENT

PROGRAM NO : 01 **Date:24/11/2021**

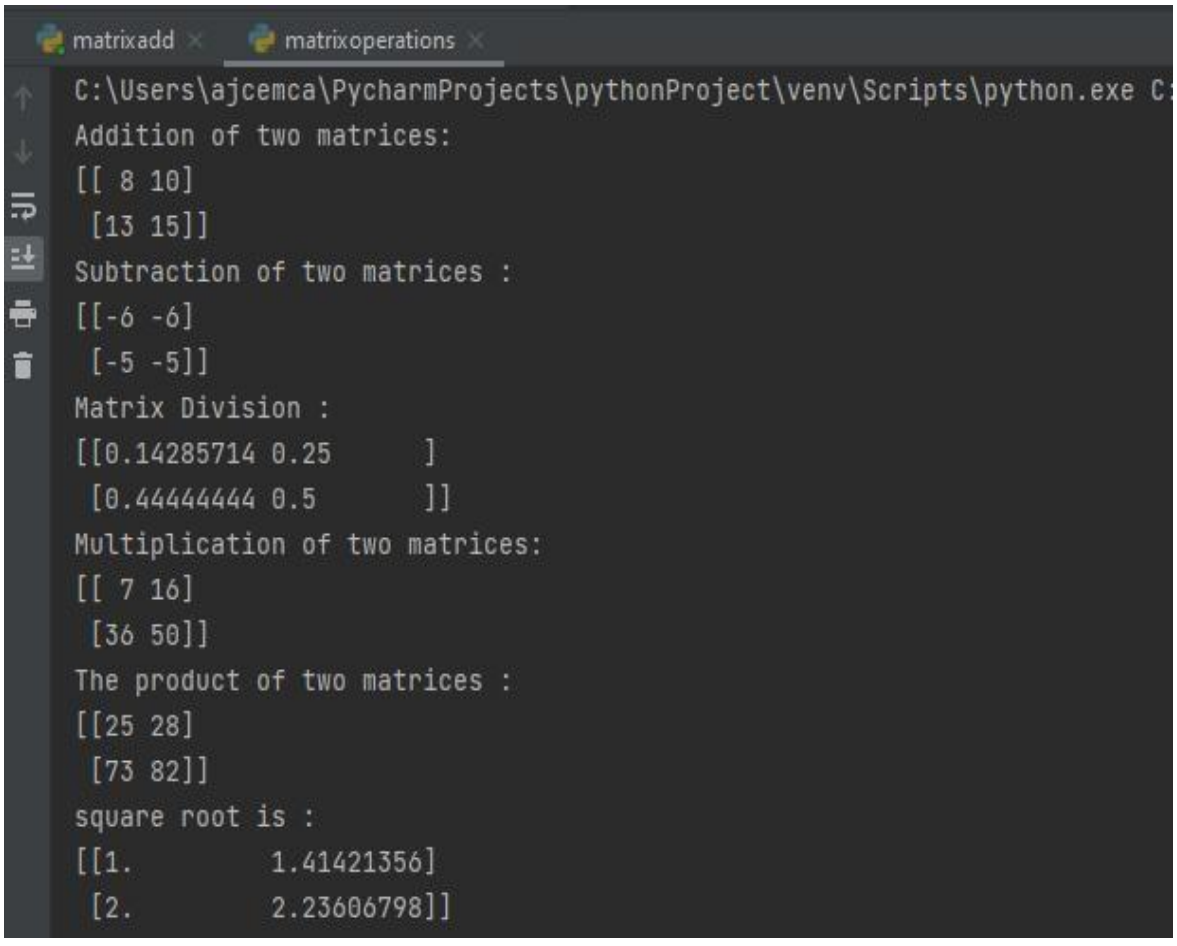
AIM : Perform all matrix operation using python.

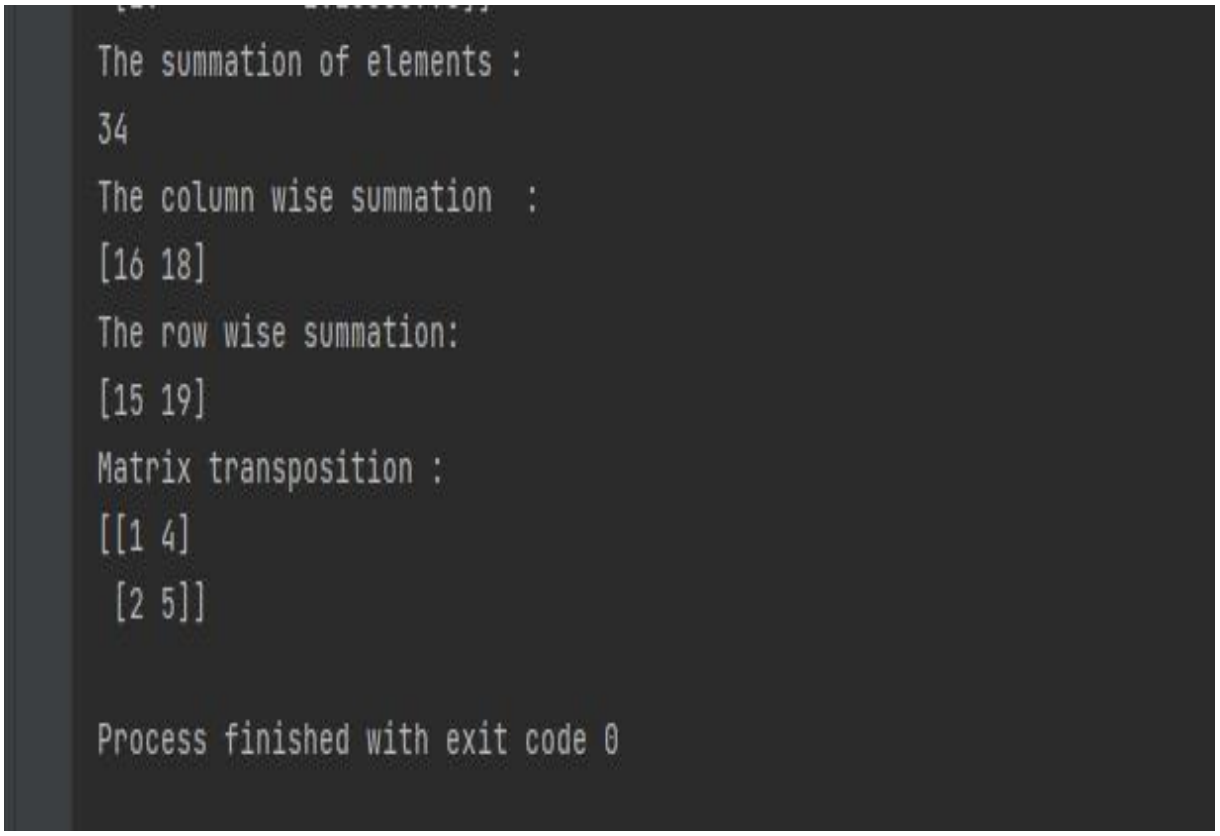
PROGRAM CODE

```
import numpy as np
import random
def PrintMatrix(matrix_in):
    for x in range(0, matrix_in.shape[0]):
        for y in range(0, matrix_in.shape[1]):
            print("%d \t" % (matrix_in[x][y]), end='')
            if (y % 3 > 1):
                print("\n")
def FillMatrix(matrix_in):
    for x in range(0, matrix_in.shape[0]):
        for y in range(0, matrix_in.shape[1]):
            matrix_in[x][y] = random.randrange(2, 10) + 2
matrix1 = np.ndarray((3,3))
matrix2 = np.ndarray((3,3))
FillMatrix(matrix1)
FillMatrix(matrix2)
add_results = np.add(matrix1,matrix2)
sub_results=np.subtract(matrix1,matrix2)
mult_results=np.multiply(matrix1,matrix2)
div_results=np.divide(matrix1,matrix2)
dot_results=np.dot(matrix1,matrix2)
sqrt1_results=np.sqrt(matrix1)
sqrt2_results=np.sqrt(matrix2)
trans_results=add_results.T
print("Matrix1:")
PrintMatrix(matrix1)
print("Matrix2:")
PrintMatrix(matrix2)
print("Adding")
```

```
PrintMatrix(add_results)
print("Subtraction")
PrintMatrix(sub_results)
print("Multiplication")
PrintMatrix(mult_results)
print("Dot Operation")
PrintMatrix(dot_results)
print("squareroot Operation")
print("matrix 1")
PrintMatrix(sqrt1_results)
print("matrix 2")
PrintMatrix(sqrt2_results)
print("Transpose")
PrintMatrix(trans_results)
```

OUTPUT




The summation of elements :
34
The column wise summation :
[16 18]
The row wise summation:
[15 19]
Matrix transposition :
[[1 4]
[2 5]]
Process finished with exit code 0

PROGRAM NO : 02 **Date :01/12/2021**

AIM: Program to perform SVD (Singular value Decomposition) using Python.

PROGRAM CODE

```
from scipy. linalg import svd
from numpy import array
A= ([[1,2,5], [2,0,1], [1,4,4]])
print(A)
X, B, T=svd(A)
print("decomposition")
print(X)
print("inverse")
print(B)
print("transpose")
print(T)
```

OUTPUT

```
C:\Users\ajcemca\PycharmProjects\pythonProject\venv\Scripts\python.exe C:/Users/ajcemca/P
[[ 6  5  2  4  5]
 [ 8  1  3  7  8]
 [ 4  2  7 10  9]
 [ 4  8  7  3  2]
 [ 9 10  7  1  5]]

Decomposition:  [[-0.35795072 -0.02542133 -0.35295795 -0.81761681 -0.27955048]
 [-0.44565919  0.43286247 -0.5080382   0.21004848  0.55838589]
 [-0.51111683  0.54319395  0.53762478  0.10442387 -0.37915059]
 [-0.37713702 -0.41338921  0.52445691 -0.25045479  0.59084209]
 [-0.51940969 -0.58824615 -0.23069986  0.46233152 -0.34235535]]

Inverse Matrix:  [27.79740326 11.37180805  5.80585429  1.97387889  1.17567493]

Transpose of Matrix:  [[-0.50151017 -0.41258672 -0.42833223 -0.40699508 -0.47869223]
 [-0.12879435 -0.68568089 -0.17247434  0.57439219  0.39189278]
 [-0.69068651  0.11903128  0.61827978  0.30156104 -0.18861269]
 [ 0.17809954 -0.53169979  0.61250768 -0.52937497  0.17370194]
 [ 0.47236877 -0.25048114  0.1713142   0.36503657 -0.74264842]]

Process finished with exit code 0
```

PROGRAM NO : 03 **Date :01/12/2021**

AIM :Program to implement k-NN Classification using any standard dataset available in the public domain and find the accuracy of the algorithm using in build function.

PROGRAM CODE

```
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
iris = load_iris()
x=iris.data
y=iris.target
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=42)
knn=KNeighborsClassifier(n_neighbors=7)
knn.fit(x_train,y_train)
print(knn.predict(x_test))
V=knn.predict(x_test)
result=accuracy_score (y_test, V)
print ("accuracy:", result)
```

OUTPUT

```
C:\Users\ajcemca\PycharmProjects\pythonProject\venv\Scripts\python.exe C:/Users/ajc
[1 1 0 1 0 1 0 0 2 0 0 2 1 2 1 2 1 0 2 2 0 1 0 0 0 0 1 2 0 2 1 2 0 0 0 1 0
 1 1 2 0 2 2 2 1 2 0 2 1 2 0 0 2 0 2 2 2 0 0 1 2 1 0 2 2 2 0 2 1 1 2 1 0 0
 2 1 0 2 0 0 1 0 2 0 2 1 2 0 2 0 2 0 0 2 2 1 0 1 0 2 2 2 0 0 0 2 2 1 1 1 2
 1 1 1 2 1 1 2 1 2 1 0 1 0 1 0 2 2 1 0 1 1 1 1 2 0 0 1 0 1 2 0 2 1 1 2 2 1
 1]

Process finished with exit code 0
```

```
C:\Users\ajcemca\PycharmProjects\pythonProject\venv\Scripts\python.exe C:
[1]
Accuracy: 1.0

Process finished with exit code 0
```

PROGRAM NO : 03 **Date :01/12/2021**

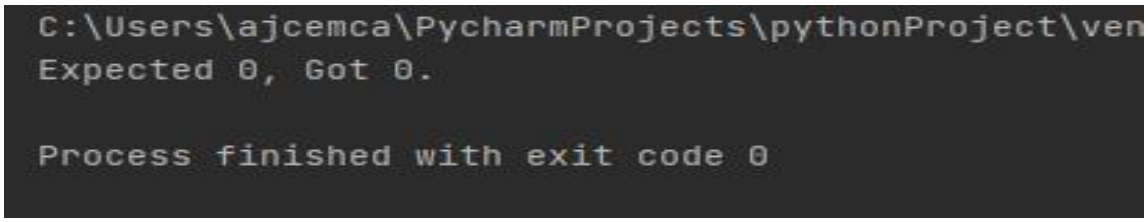
AIM : Program to implement k-NN Classification using any random dataset without using in-build functions.

PROGRAM CODE

```
from math import sqrt
def euclidean_distance(row1, row2):
    distance = 0.0
    for i in range(len(row1) - 1):
        distance += (row1[i] - row2[i]) ** 2
    return sqrt(distance)
# Locate the most similar neighbors
def get_neighbors(train, test_row, num_neighbors):
    distances = list()
    for train_row in train:
        dist = euclidean_distance(test_row, train_row)
        distances.append((train_row, dist))
    distances.sort(key=lambda tup: tup[1])
    neighbors = list()
    for i in range(num_neighbors):
        neighbors.append(distances[i][0])
    return neighbors
# Make a classification prediction with neighbors
def predict_classification(train, test_row, num_neighbors):
    neighbors = get_neighbors(train, test_row, num_neighbors)
    output_values = [row[-1] for row in neighbors]
    prediction = max(set(output_values), key=output_values.count)
    return prediction

# Test distance function
dataset = [[2.781, 2.550,0],
        [1.465, 2.326,3],
        [3.398, 4.429,5],
```

```
        [1.388, 1.857,11],
        [3.064, 3.393,3],
        [7.624, 2.235,4],
        [5.338, 2.775,8]]
prediction = predict_classification(dataset, dataset[0], 3)

print('Expected %d, Got %d.' % (dataset[0][-1], prediction))
```

OUTPUT



PROGRAM NO : 05 **Date :08/12/2021**

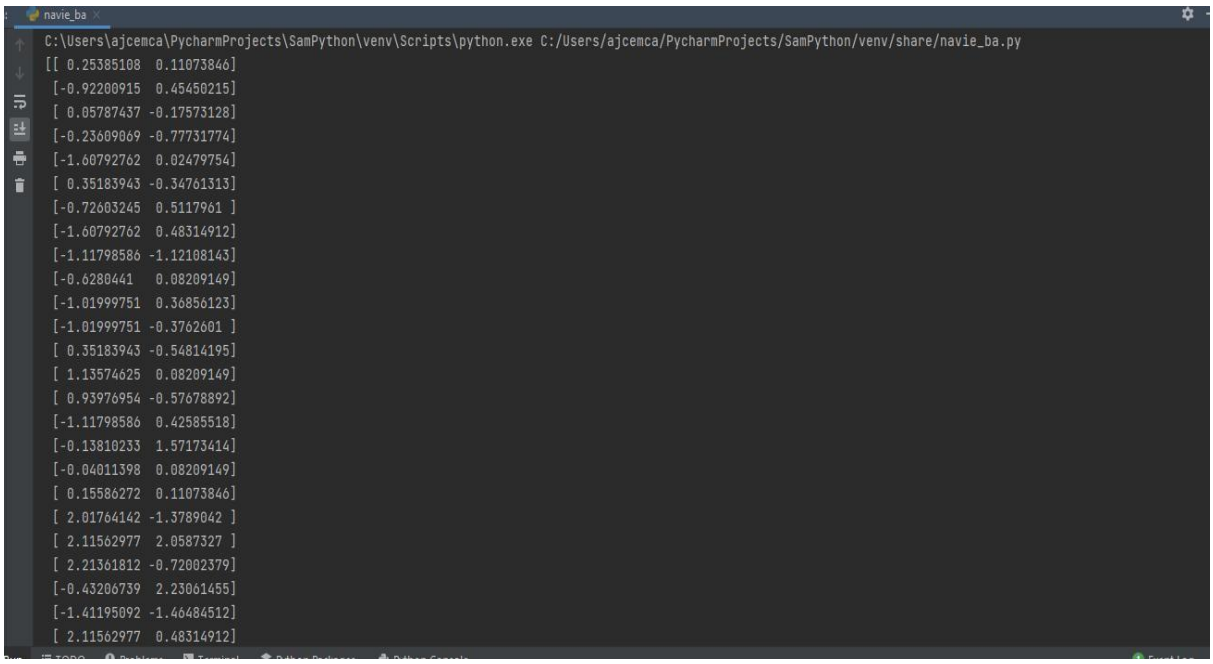
AIM : Program to implement Naïve Bayes Algorithm using any standard dataset available in the public domain and find the accuracy of the algorithm.

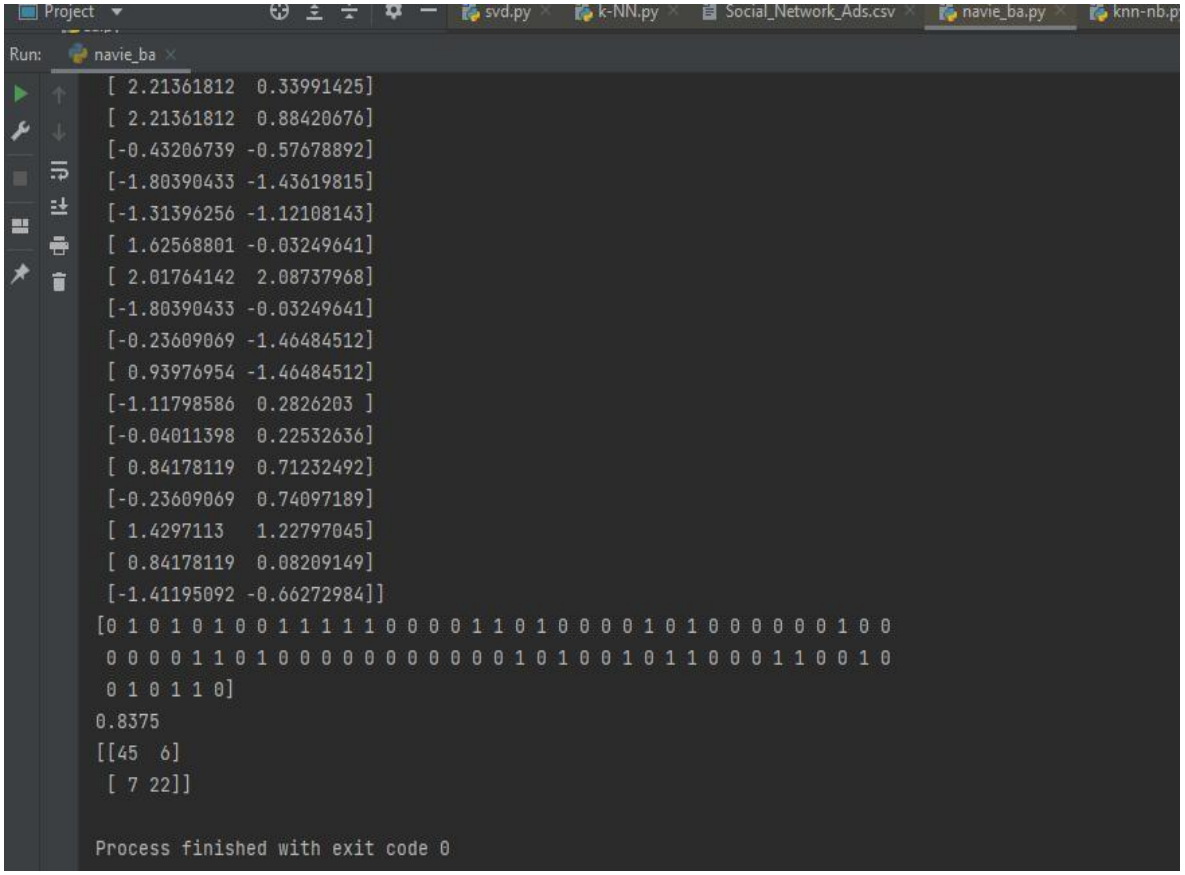
PROGRAM CODE

```
import pandas as pd
dataset = pd.read_csv('Social_Network_Ads.csv')
x = dataset.iloc[:, [2,3]].values
y = dataset.iloc[:,-1].values
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=10)
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
x_train = sc.fit_transform(x_train)
x_test = sc.transform(x_test)
from sklearn.naive_bayes import GaussianNB
gnb = GaussianNB()
gnb.fit(x_train, y_train)
y_pred = gnb.predict(x_test)
print(y_pred)
from sklearn import metrics
print("Accuracy", metrics.accuracy_score(y_test, y_pred) * 100)
import numpy as nm
import matplotlib.pyplot as mtp
from matplotlib.colors import ListedColormap
x_set, y_set = x_train, y_train
X1, X2 = nm.meshgrid(nm.arange(start = x_set[:, 0].min() - 1, stop = x_set[:, 0].max() + 1, step =
0.01),
  nm.arange(start = x_set[:, 1].min() - 1, stop = x_set[:, 1].max() + 1, step = 0.01))
mtp.contourf(X1, X2, gnb.predict(nm.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
alpha = 0.75, cmap = ListedColormap(('purple', 'green')))
mtp.xlim(X1.min(), X1.max())
mtp.ylim(X2.min(), X2.max())
```

```
for i, j in enumerate(nm.unique(y_set)):
  mtp.scatter(x_set[y_set == j, 0], x_set[y_set == j, 1],
  c = ListedColormap(('purple', 'green'))(i), label = j)
mtp.title('Naive Bayes (Training set)')
mtp.xlabel('Age')
mtp.ylabel('Estimated Salary')
mtp.legend()
mtp.show()
x_set, y_set = x_test, y_test
X1, X2 = nm.meshgrid(nm.arange(start = x_set[:, 0].min() - 1, stop = x_set[:, 0].max() + 1, step =
0.01),
 nm.arange(start = x_set[:, 1].min() - 1, stop = x_set[:, 1].max() + 1, step = 0.01))
mtp.contourf(X1, X2, gnb.predict(nm.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
alpha = 0.75, cmap = ListedColormap(('purple', 'green')))
mtp.xlim(X1.min(), X1.max())
mtp.ylim(X2.min(), X2.max())
for i, j in enumerate(nm.unique(y_set)):
mtp.scatter(x_set[y_set == j, 0], x_set[y_set == j, 1],
c = ListedColormap(('purple', 'green'))(i), label = j)
mtp.title('Naive Bayes (test set)')
mtp.xlabel('Age')
mtp.ylabel('Estimated Salary')
mtp.legend()
mtp.show()
```

OUTPUT


navie_ba
C:\Users\ajcemca\PycharmProjects\SamPython\venv\Scripts\python.exe C:/Users/ajcemca/PycharmProjects/SamPython/venv/share/navie_ba.py
[[0.25385108 0.11073846]
 [-0.92200915 0.45450215]
 [0.05787437 -0.17573128]
 [-0.23609069 -0.77731774]
 [-1.60792762 0.02479754]
 [0.35183943 -0.34761313]
 [-0.72603245 0.5117961]
 [-1.60792762 0.48314912]
 [-1.11798586 -1.12108143]
 [-0.6280441   0.08209149]
 [-1.01999751 0.36856123]
 [-1.01999751 -0.3762601]
 [0.35183943 -0.54814195]
 [1.13574625 0.08209149]
 [0.93976954 -0.57678892]
 [-1.11798586 0.42585518]
 [-0.13810233 1.57173414]
 [-0.04011398 0.08209149]
 [0.15586272 0.11073846]
 [2.01764142 -1.3789042]
 [2.11562977 2.0587327]
 [2.21361812 -0.72002379]
 [-0.43206739 2.23061455]
 [-1.41195092 -1.46484512]
 [2.11562977 0.48314912]


Project
svd.py
k-NN.py
Social_Network_Ads.csv
navie_ba.py
knn-nb.p
Run:
navie_ba
[2.21361812 0.33991425]
[2.21361812 0.88420676]
[-0.43206739 -0.57678892]
[-1.80390433 -1.43619815]
[-1.31396256 -1.12108143]
[1.62568801 -0.03249641]
[2.01764142 2.08737968]
[-1.80390433 -0.03249641]
[-0.23609069 -1.46484512]
[0.93976954 -1.46484512]
[-1.11798586 0.2826203]
[-0.04011398 0.22532636]
[0.84178119 0.71232492]
[-0.23609069 0.74097189]
[1.4297113   1.22797045]
[0.84178119 0.08209149]
[-1.41195092 -0.66272984]]
[0 1 0 1 0 1 0 0 1 1 1 1 1 0 0 0 0 1 1 0 1 0 0 0 0 1 0 1 0 0 0 0 0 0 1 0 0
 0 0 0 0 1 1 0 1 0 0 0 0 0 0 0 0 0 0 0 1 0 1 0 0 1 0 1 1 0 0 0 1 1 0 0 1 0
 0 1 0 1 1 0]
0.8375
[[45 6]
 [7 22]]
Process finished with exit code 0

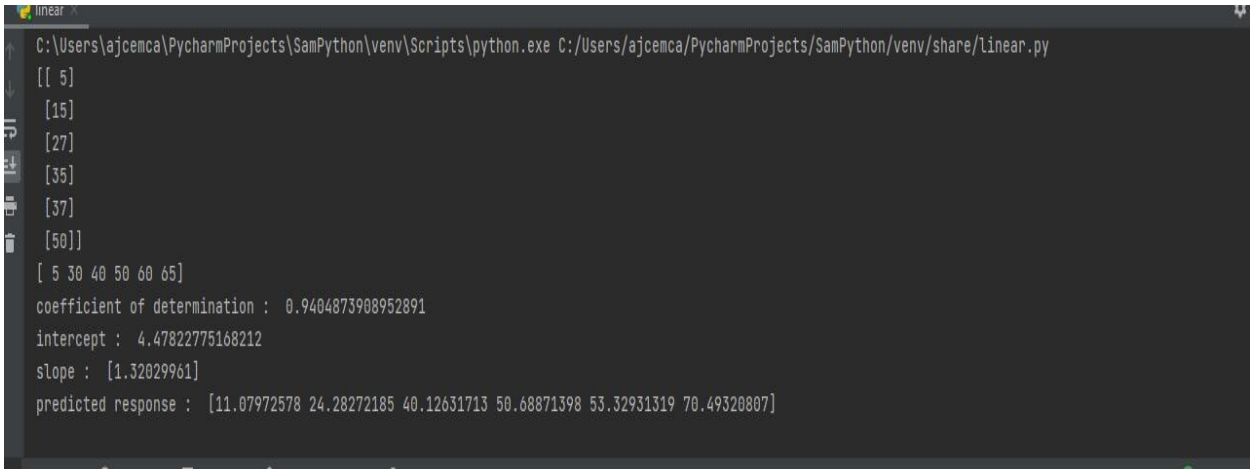
PROGRAM NO : 06 **Date :08/12/2021**

AIM : Program to implement linear and multiple regression techniques using any standard dataset available in the public domain.

PROGRAM CODE

```
import numpy as np
from sklearn.linear_model import LinearRegression
x = np.array([2,6,7,8]).reshape((-1,1))
y = np.array([16,7,8,9])
model = LinearRegression()
model.fit(x,y)
r_sq = model.score(x,y)
print("Score: ",r_sq)
print("Intercept: ",model.intercept_)
print("Slope: ",model.coef_)
y_pred = model.predict(x)
print("Y-prediction : ",y_pred)
```

OUTPUT



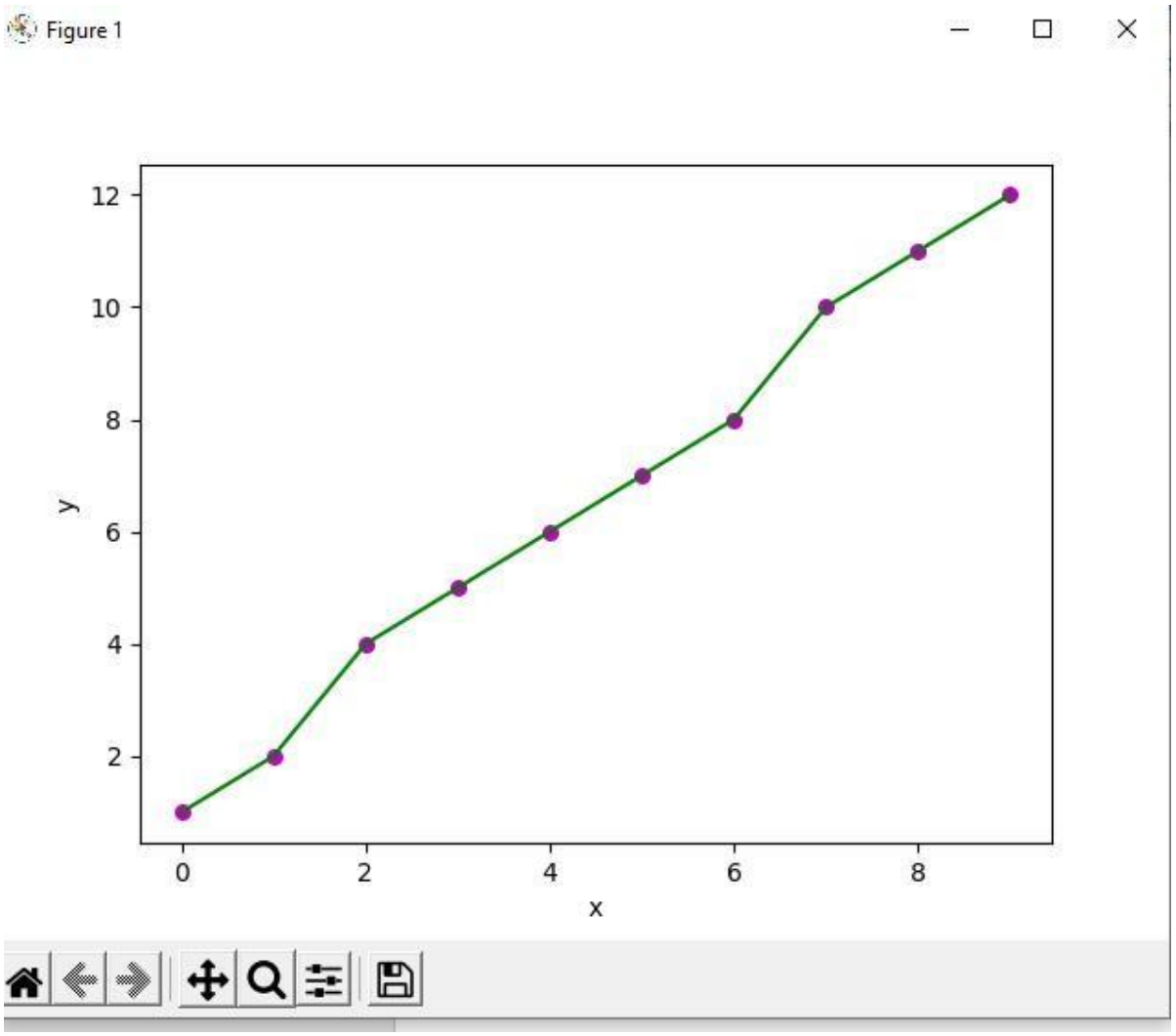
PROGRAM NO : 06 **Date :08/12/2021**

AIM : Program to implement Linear and Multiple regression techniques using any standard dataset available in public domain and evaluate its performance.

PROGRAM CODE

```
import numpy as np
import matplotlib.pyplot as plt
x = np.array([2,6,7,8])
y = np.array([16,7,8,9])
n = np.size(x)
n_x = np.mean(x)
n_y = np.mean(y)
SS_xy  =  np.sum(y*x)-n*  n_y*n_x
SS_xx  =  np.sum(x*x)-n*  n_x*n_x
b_1 = SS_xy/SS_xx
b_0 = n_y - b_1*n_x
y_pred = b_1 * x + b_0
print(y_pred)
plt.scatter(x, y, color='red')
plt.plot(x, y_pred, color='green')
plt.xlabel('X')
plt.ylabel('y')
plt.show()
```

OUTPUT



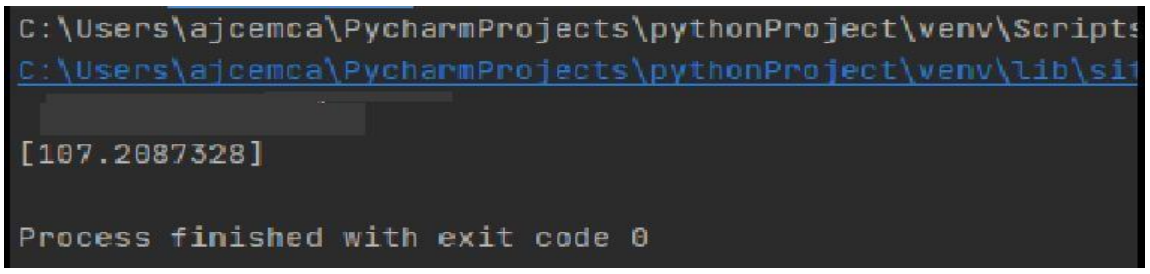
PROGRAM NO : 08 **Date :15/12/2021**

AIM : Program to implement Linear and Multiple regression techniques using cars dataset available in public domain and evaluate its performance

PROGRAM CODE

```
import pandas

from sklearn import linear_model

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

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

y = df['CO2']

regr = linear_model.LinearRegression()

regr.fit(X, y)

#predict the CO2

predictedCO2 = regr.predict([[2300, 1300]])

print(predictedCO2)
```

OUTPUT



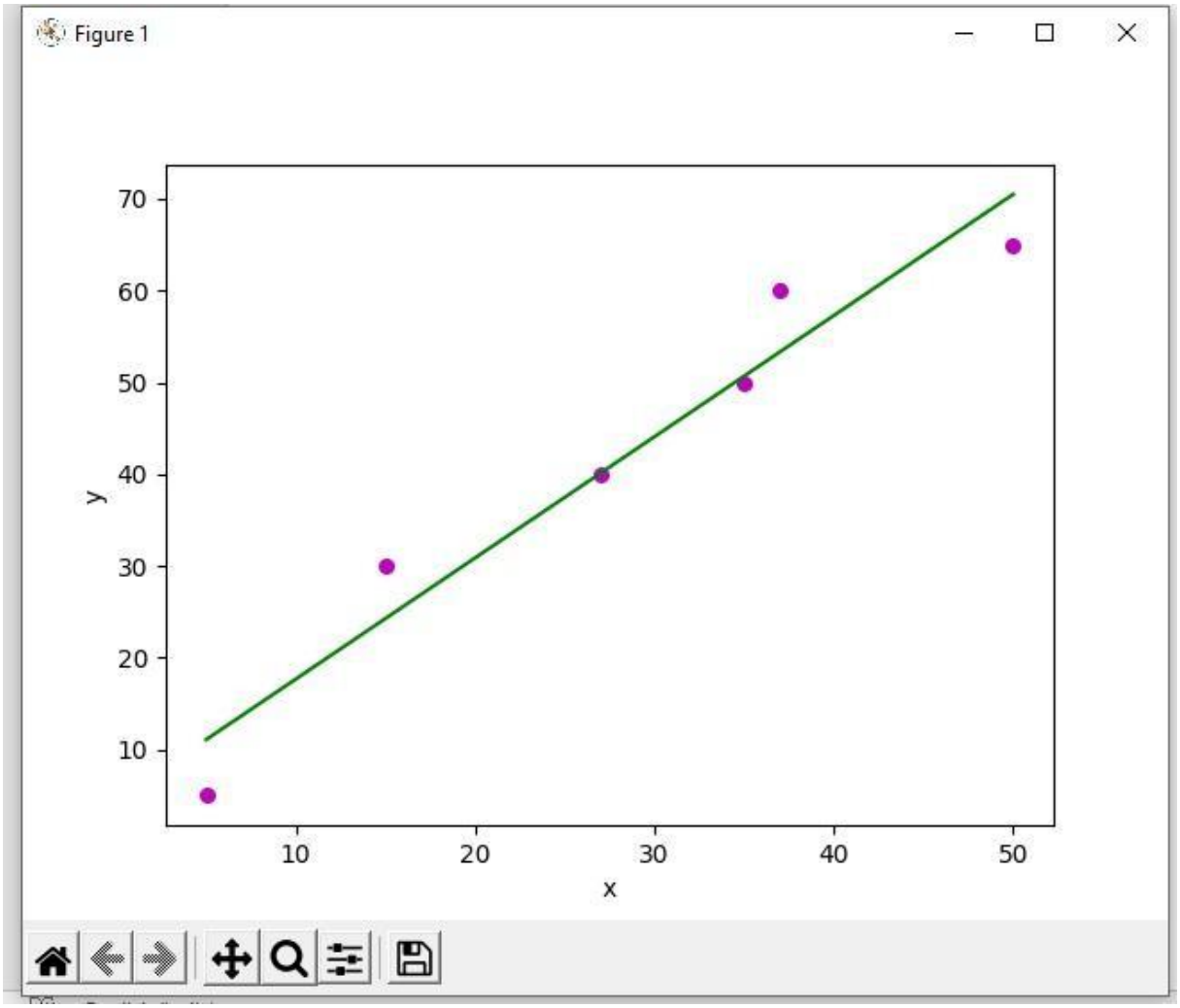
PROGRAM NO : 08 **Date :15/12/2021**

AIM : Program to implement multiple linear regression techniques using Boston dataset available in the public domain and evaluate its performance and plotting graph.

PROGRAM CODE

```
import matplotlib.pyplot as plt

import numpy as np

from sklearn import datasets, linear_model, metrics

from sklearn.metrics import r2_score

boston = datasets.load_boston(return_X_y=False)

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)

V=reg.predict(X_test)

result=r2_score(y_test, V)

print("accuracy :", result)

print('Coefficients: ', reg.coef_)

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

OUTPUT




```
Coefficients:  [-8.95714048e-02  6.73132853e-02  5.04649248e-02  2.18579583e+00
 -1.72053975e+01  3.63606995e+00  2.05579939e-03 -1.36602886e+00
  2.89576718e-01 -1.22700072e-02 -8.34881849e-01  9.40360790e-03
 -5.04008320e-01]
Variance score: 0.7209056672661767
```

PROGRAM NO : 10 **Date :22/12/2021**

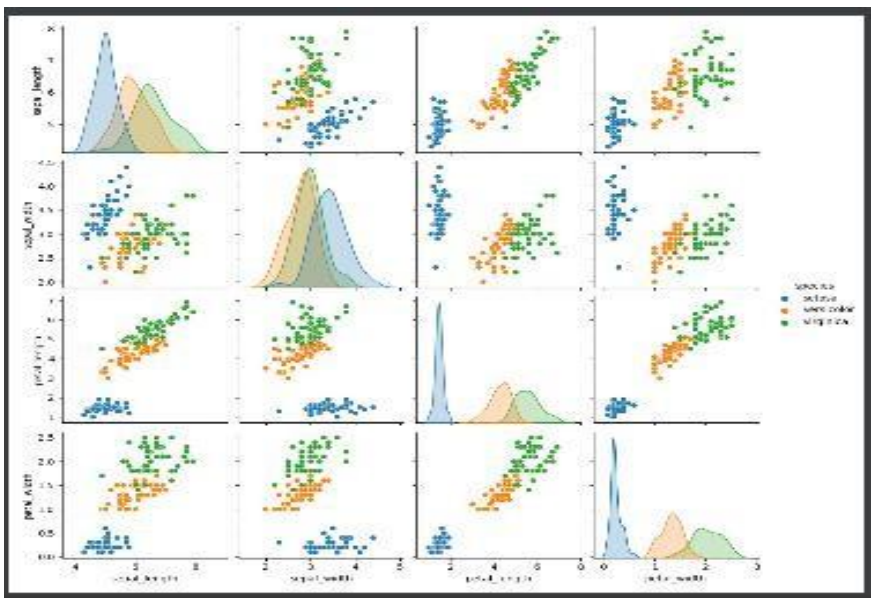
AIM : Program to implement decision tree using any standard dataset available in the public domain and find the accuracy of the algorithm

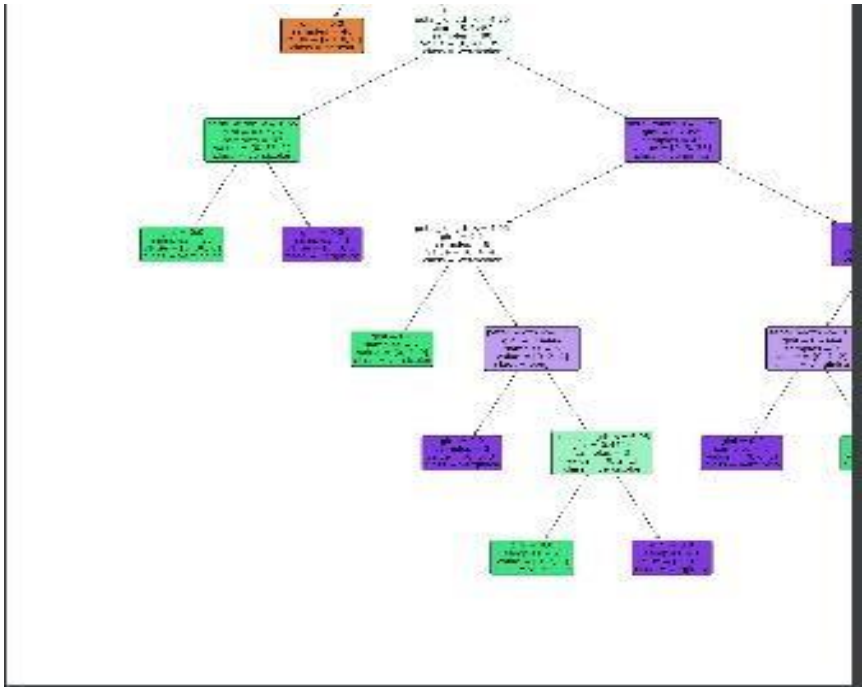
PROGRAM CODE

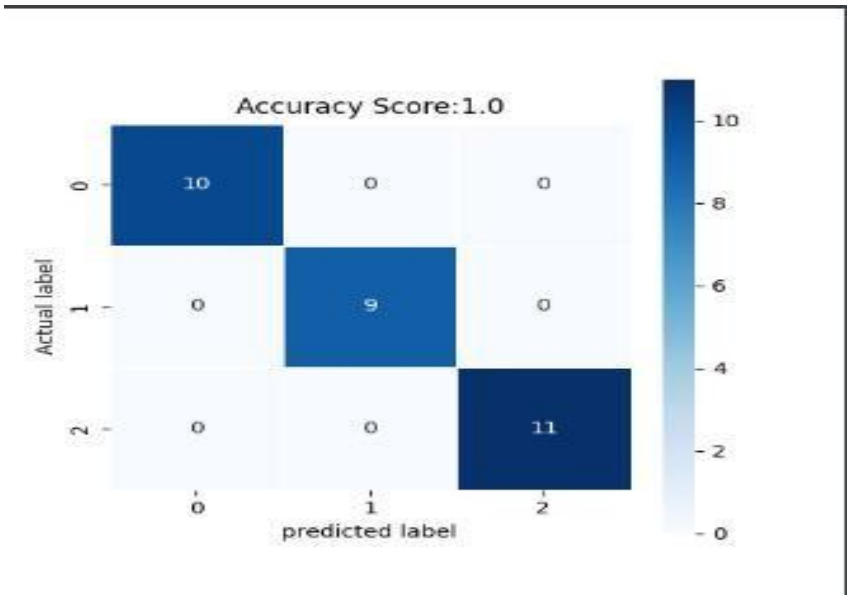
```
Import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import classification_report, confusion_matrix
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("next.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("test split input",x_test.shape)
dtree=DecisionTreeClassifier()
dtree.fit(x_train, y_train)
print("decision tree classifer created")
y_pred = dtree.predict(x_test)
print("classification report-\n",classification_report(y_test,y_pred))
cm = confusion_matrix(y_test,y_pred)
plt.figure(figsize=(5,5))
sns.heatmap(data=cm,linewidths=.5,annot=True,square=True,cmap='Blues')
plt.ylabel('Actual label')
plt.xlabel('predicted label')
all_sample_title = 'Accuracy Score:{0}'.format(dtree.score(x_test,y_test))
plt.title(all_sample_title,size=12)
plt.savefig("two.png")
plt.figure(figsize=(20,20))
dec_tree=plot_tree(decision_tree=dtree,feature_names=df1.columns,class_names=["setosa","vercic
olor","verginica"],filled=True ,precision=4,rounded=True)
plt.savefig("three.png")
```

OUTPUT






Accuracy Score:1.0
Actual label
predicted label
10
0
0
0
9
0
0
0
11
0
1
2
10
8
6
4
2
0

PROGRAM NO : 11 **Date :05/01/2022**

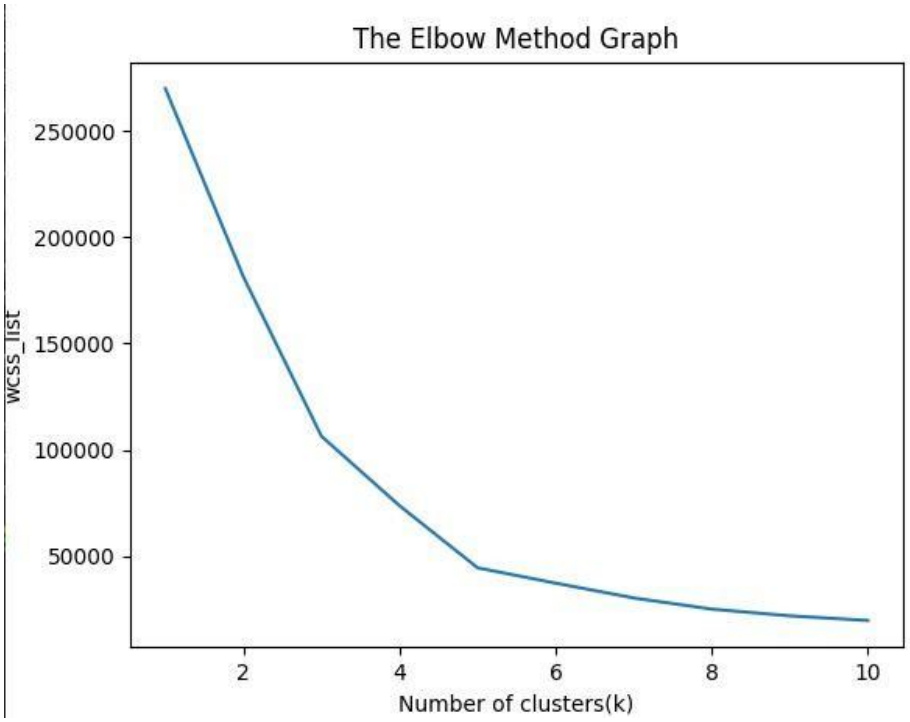
AIM : Program to implement K-Means clustering technique using any standard dataset available in the public domain

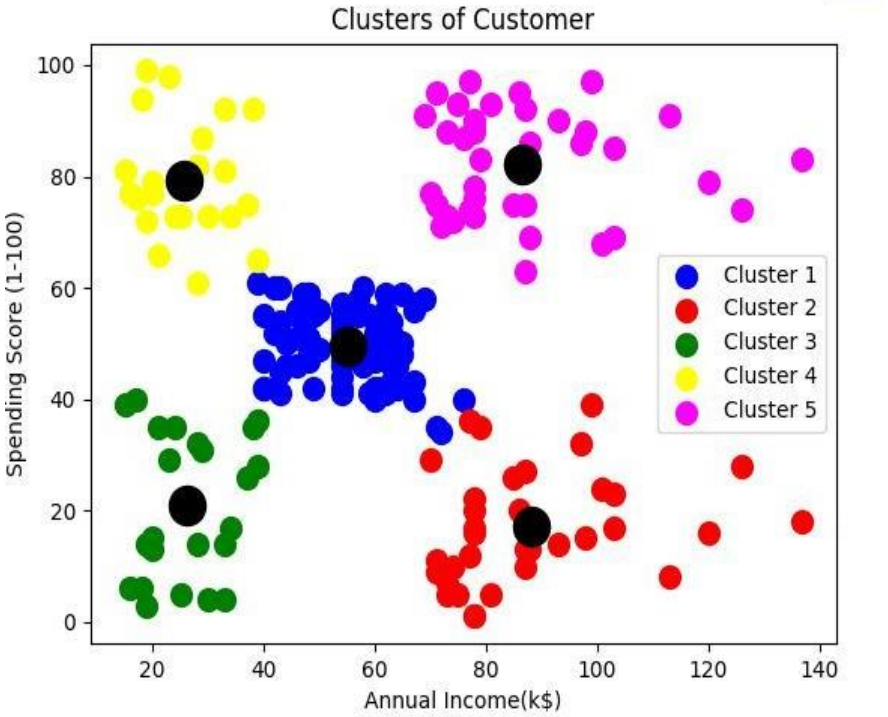
PROGRAM CODE

```
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('predict=',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='red',label='Cluster 2')

mtp.scatter(x[y_predict==2,0],x[y_predict==2,1],s=100,c='green',label='Cluster 3')

mtp.scatter(x[y_predict==3,0],x[y_predict==3,1],s=100,c='yellow',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')

mtp.title('Clusters of Customer')

mtp.xlabel('Annual Income(k$)')

mtp.ylabel('Spending Score (1-100)')

mtp.legend();

mtp.show()
```

OUTPUT


The Elbow Method Graph
wcss_list
250000
200000
150000
100000
50000
2
4
6
8
10
Number of clusters(k)


Clusters of Customer
Spending Score (1-100)
100
80
60
40
20
0
20
40
60
80
100
120
140
Annual Income(k$)
Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5

PROGRAM NO : 12 **Date :05/01/2022**

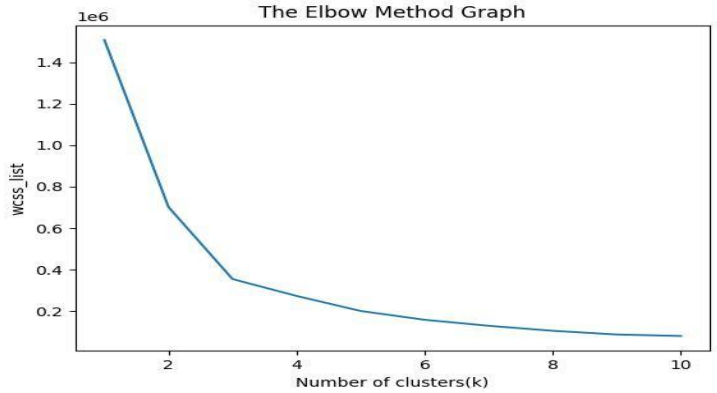
AIM : Program to implement K-Means clustering technique using any standard dataset available in the public domain.

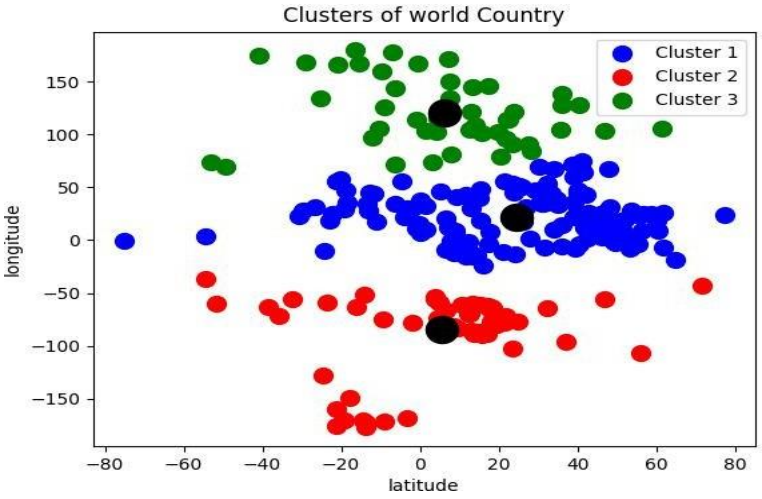
PROGRAM CODE

```
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('predict=',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='red',label='Cluster 2')

mtp.scatter(x[y_predict==2,0],x[y_predict==2,1],s=100,c='green',label='Cluster 3')

mtp.scatter(kmeans.cluster_centers_[:,0],kmeans.cluster_centers_[:,1],s=300,c='black')

mtp.title('Clusters of world Country')

mtp.xlabel('latitude')

mtp.ylabel('longitude')

mtp.legend();

mtp.show()
```

OUTPUT





PROGRAM NO : 13 **Date :02/02/2022**

AIM : Programs on convolutional neural network to classify images from any standard dataset in the public domain.

PROGRAM CODE

```
import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

import tensorflow as tf

from tensorflow import keras

np.random.seed(42)

# tf.set.random. seed(42)

fashion_mnist = keras.datasets.fashion_mnist

(X_train, y_train), (X_test, y_test) = fashion_mnist.load_data()

print(X_train.shape, X_test.shape)

X_train = X_train / 255.0

X_test = X_test / 255.0

plt.imshow(X_train[1], cmap='binary')

plt.show()

np.unique(y_test)

class_names = ['T-Shirt/Top', 'Trouser', 'Pullover', 'Dress', 'Coat', 'Sandal', 'Shirt', 'Sneaker', '8ag', 'Ankle Boot']

n_rows = 5

n_cols = 10

plt.figure(figsize=(n_cols * 1.4, n_rows * 1.6))
```

```
for row in range(n_rows):
    for col in range(n_cols):
        index = n_cols * row + col
        plt.subplot(n_rows, n_cols, index + 1)
        plt.imshow(X_train[index], cmap='binary', interpolation='nearest')
        plt.axis('off')
        plt.title(class_names[y_train[index]])
plt.show()
model_CNN = keras.models.Sequential()
model_CNN.add(keras.layers.Conv2D(filters=32, kernel_size=7, padding='same',
activation='relu', input_shape=[28, 28, 1]))
model_CNN.add(keras.layers.MaxPooling2D(pool_size=2))
model_CNN.add(keras.layers.Conv2D(filters=64, kernel_size=3, padding='same',
activation='relu'))
model_CNN.add(keras.layers.MaxPooling2D(pool_size=2))
model_CNN.add(keras.layers.Conv2D(filters=32, kernel_size=3, padding='same',
activation='relu'))
model_CNN.add(keras.layers.MaxPooling2D(pool_size=2))

model_CNN.summary()
model_CNN.add(keras.layers.Flatten())
model_CNN.add(keras.layers.Dense(units=128, activation='relu'))
model_CNN.add(keras.layers.Dense(units=64, activation='relu'))
model_CNN.add(keras.layers.Dense(units=10, activation='softmax'))
model_CNN.summary()
```

```
 model_CNN.compile(loss='sparse_categorical_crossentropy', optimizer='adam',
metrics=['accuracy'])

 X_train = X_train[..., np.newaxis]

X_test = X_test[..., np.newaxis]

history_CNN = model_CNN.fit(X_train, y_train, epochs=2, validation_split=0.1)

pd.DataFrame(history_CNN.history).plot()

plt.grid(True)

plt.xlabel('epochs')

plt.ylabel('loss/accuracy')

plt.title('Training and validation plot')

plt.show()

test_loss, test_accuracy = model_CNN.evaluate(X_test, y_test)

print(' Test Loss :{}, Test Accuracy : {}'.format(test_loss, test_accuracy))
```

OUTPUT

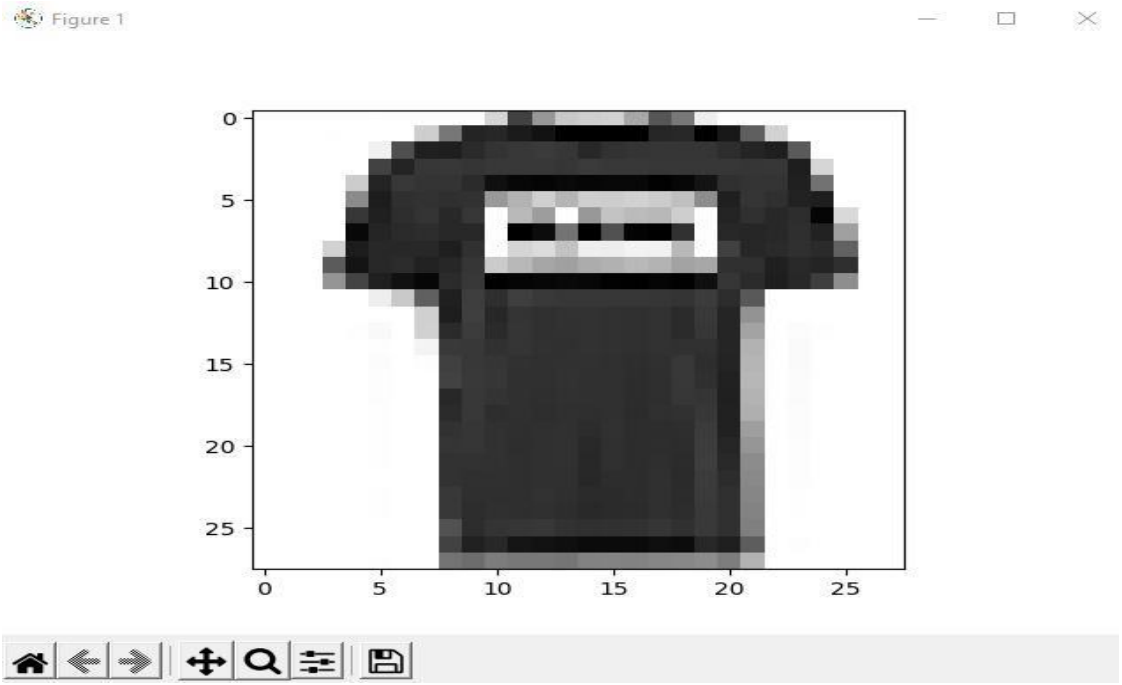
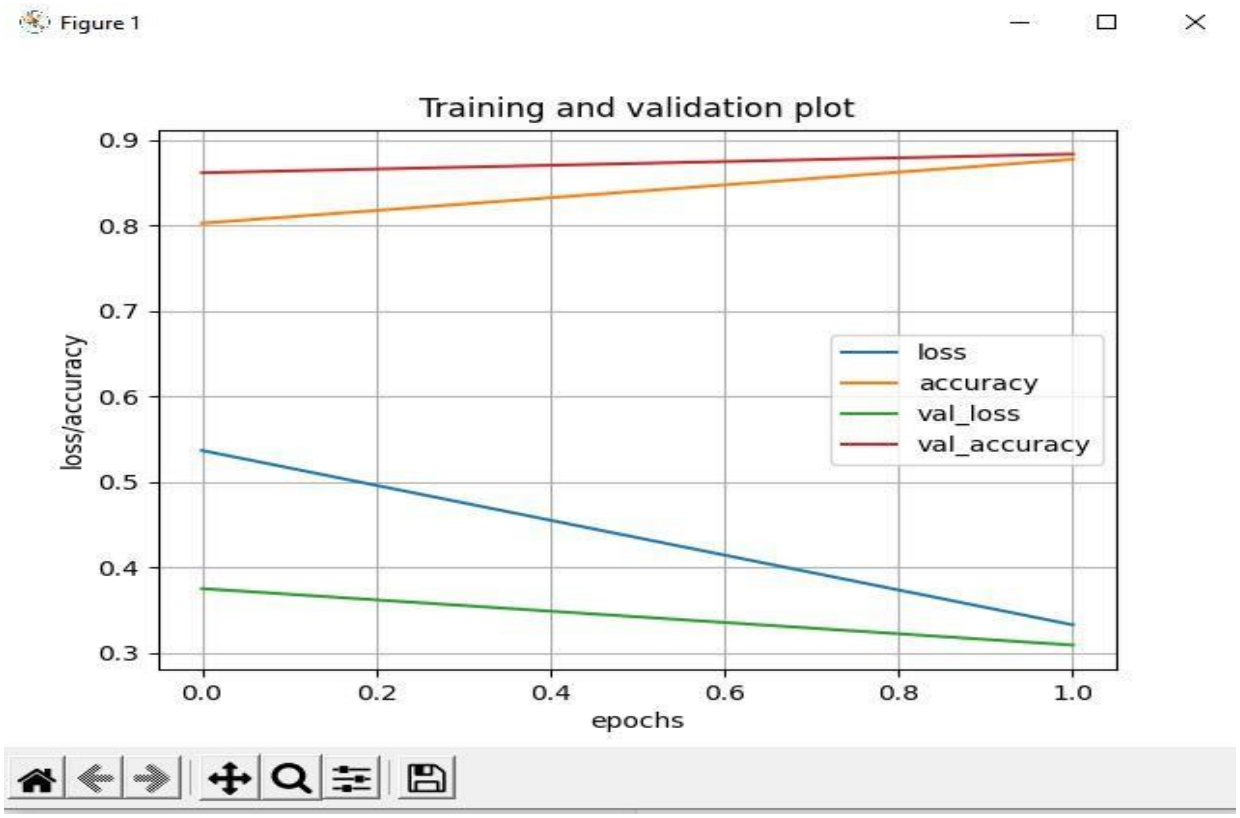


Figure 1
0
5
10
15
20
25
0
5
10
15
20
25


Figure 1
Ankle Boot
T-Shirt/Top
T-Shirt/Top
Dress
T-Shirt/Top
Pullover
Sneaker
Pullover
Sandal
Sandal
T-Shirt/Top
Ankle Boot
Sandal
Sandal
Sneaker
Ankle Boot
Trouser
T-Shirt/Top
Shirt
Coat
Dress
Trouser
Coat
8ag
Coat
Dress
T-Shirt/Top
Pullover
Coat
Coat
Sandal
Dress
Shirt
Shirt
T-Shirt/Top
8ag
Sandal
Pullover
Trouser
Shirt
Shirt
Sneaker
Ankle Boot
Sandal
Ankle Boot
Pullover
Sneaker
Dress
T-Shirt/Top
Dress




```
 conv2d_2 (Conv2D)           (None, 7, 7, 32)          18464

 max_pooling2d_2 (MaxPooling  (None, 3, 3, 32)         0
 2D)

 flatten (Flatten)           (None, 288)               0

 dense (Dense)               (None, 128)               36992

 dense_1 (Dense)             (None, 64)                8256

 dense_2 (Dense)             (None, 10)                650

=================================================================
Total params: 84,458
Trainable params: 84,458
Non-trainable params: 0
_________________________________________________________________
Epoch 1/2
1688/1688 [==============================] - 104s 61ms/step - loss: 0.5369 - accuracy: 0.8024 - val_loss: 0.3755 - val_accuracy: 0.8613
Epoch 2/2
1688/1688 [==============================] - 103s 61ms/step - loss: 0.3332 - accuracy: 0.8770 - val_loss: 0.3096 - val_accuracy: 0.8832
```

PROGRAM NO : 14 **Date :16/02/2022**

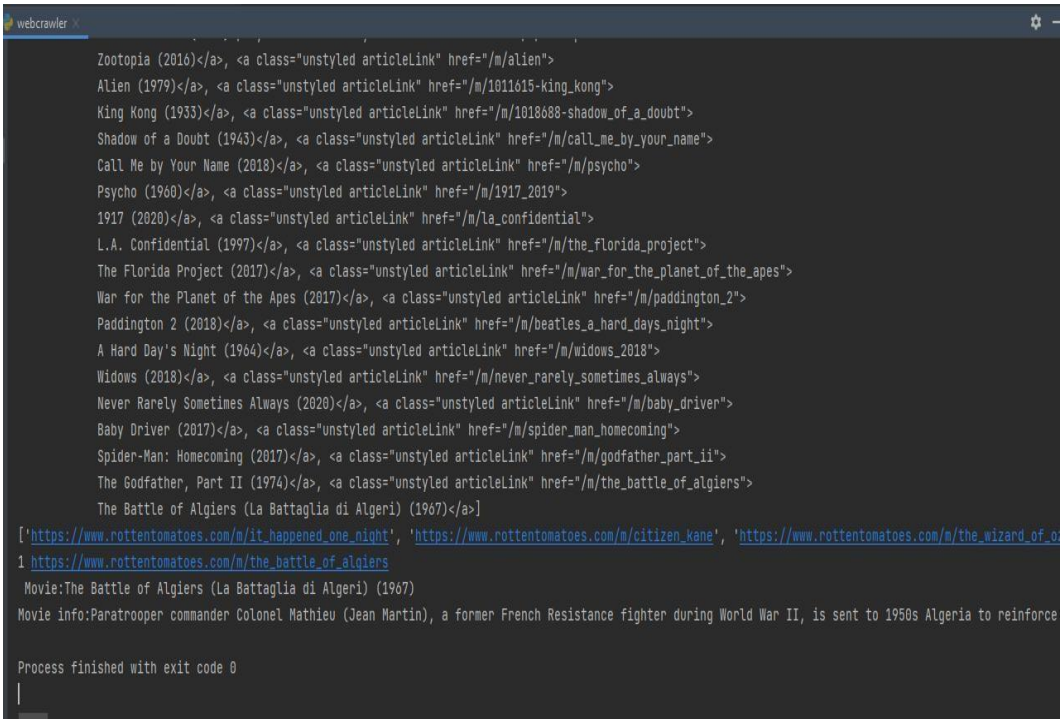
AIM : Program to implement a simple web crawler using python.

PROGRAM CODE

```
import requests

import lxml

from bs4 import BeautifulSoup

#import beautifulsoup4

url = "https://www.rottentomatoes.com/top/bestofrt/"

headers = { 'User-Agents' : 'Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/63.0.3239.132 Safari/537.36 QIHU 36OSE'}

f = requests.get(url, headers = headers)

movies_list = []

soup = BeautifulSoup(f.content, 'html.parser')

movies = soup.find('table', {'class' : 'table'}) .find_all('a')

print(movies)

num = 0

for anchor in movies:

        urls = 'https://www.rottentomatoes.com' + anchor['href']

   movies_list.append(urls)

print(movies_list)

num +=1

movie_url=urls

#movie_url=movies_lst

movie_f=requests.get(movie_url,headers=headers)
```

```
movie_soup=BeautifulSoup(movie_f.content,'lxml')
movie_content=movie_soup.find('div',{
    'class':'movie_synopsis clamp clamp-6 js-clamp'
})
print(num,urls,'\n','Movie:' + anchor.string.strip())
print('Movie info:' + movie_content.string.strip())
```

OUTPUT



PROGRAM NO : 15 **Date :16/02/2022**

AIM : Program to implement a simple web crawler using python.

PROGRAM CODE

```
from bs4 import BeautifulSoup
import requests
pages_crawled =[ ]
def crawler(url):
        page =requests.get(url)
   soup=BeautifulSoup(page.text,'html.parser')
   links=soup.find_all('a')
        for link in links:
        if 'href' in link.attrs:
        if link['href'].startswith('/wiki') and ':' not in link['href']:
        if link['href'] not in pages_crawled:
            new_link = f"https://en.wikipedia.org{link['href']}"
            pages_crawled.append(link['href'])
            try:
               with open('data.csv','a') as file:
                    file.write(f'{soup.title.text}:{link["href"]}\n')
                crawler(new_link)
            except:
               continue

crawler('https://en.wikipedia.org')
```

OUTPUT


Reader Mode
Wikipedia, the free encyclopedia; Main Page; /wiki/Wikipedia
Wikipedia, the free encyclopedia; Main Page; /wiki/Free_content
Wikipedia, the free encyclopedia; Main Page; /wiki/Encyclopedia
Wikipedia, the free encyclopedia; Main Page; /wiki/English_language
Wikipedia, the free encyclopedia; Main Page; /wiki/SS_Choctaw
Wikipedia, the free encyclopedia; Main Page; /wiki/Cargo_ship
Wikipedia, the free encyclopedia; Main Page; /wiki/Great_Lakes
Wikipedia, the free encyclopedia; Main Page; /wiki/Lake_freighter
Wikipedia, the free encyclopedia; Main Page; /wiki/Whaleback
Wikipedia, the free encyclopedia; Main Page; /wiki/Alexander_McDougall_(ship_designer)
Wikipedia, the free encyclopedia; Main Page; /wiki/American_Ship_Building_Company
Wikipedia, the free encyclopedia; Main Page; /wiki/Cleveland
Wikipedia, the free encyclopedia; Main Page; /wiki/Michigan
Wikipedia, the free encyclopedia; Main Page; /wiki/Detroit
Wikipedia, the free encyclopedia; Main Page; /wiki/Escanaba,_Michigan
Wikipedia, the free encyclopedia; Main Page; /wiki/Marquette,_Michigan
Wikipedia, the free encyclopedia; Main Page; /wiki/Glossary_of_nautical_terms#upbound
Wikipedia, the free encyclopedia; Main Page; /wiki/Iron_ore
Wikipedia, the free encyclopedia; Main Page; /wiki/Lake_Huron
Wikipedia, the free encyclopedia; Main Page; /wiki/New_Presque_Isle_Light
Wikipedia, the free encyclopedia; Main Page; /wiki/Glossary_of_nautical_terms#canaller
Wikipedia, the free encyclopedia; Main Page; /wiki/National_Register_of_Historic_Places

PROGRAM NO : 16 **Date :16/02/2022**

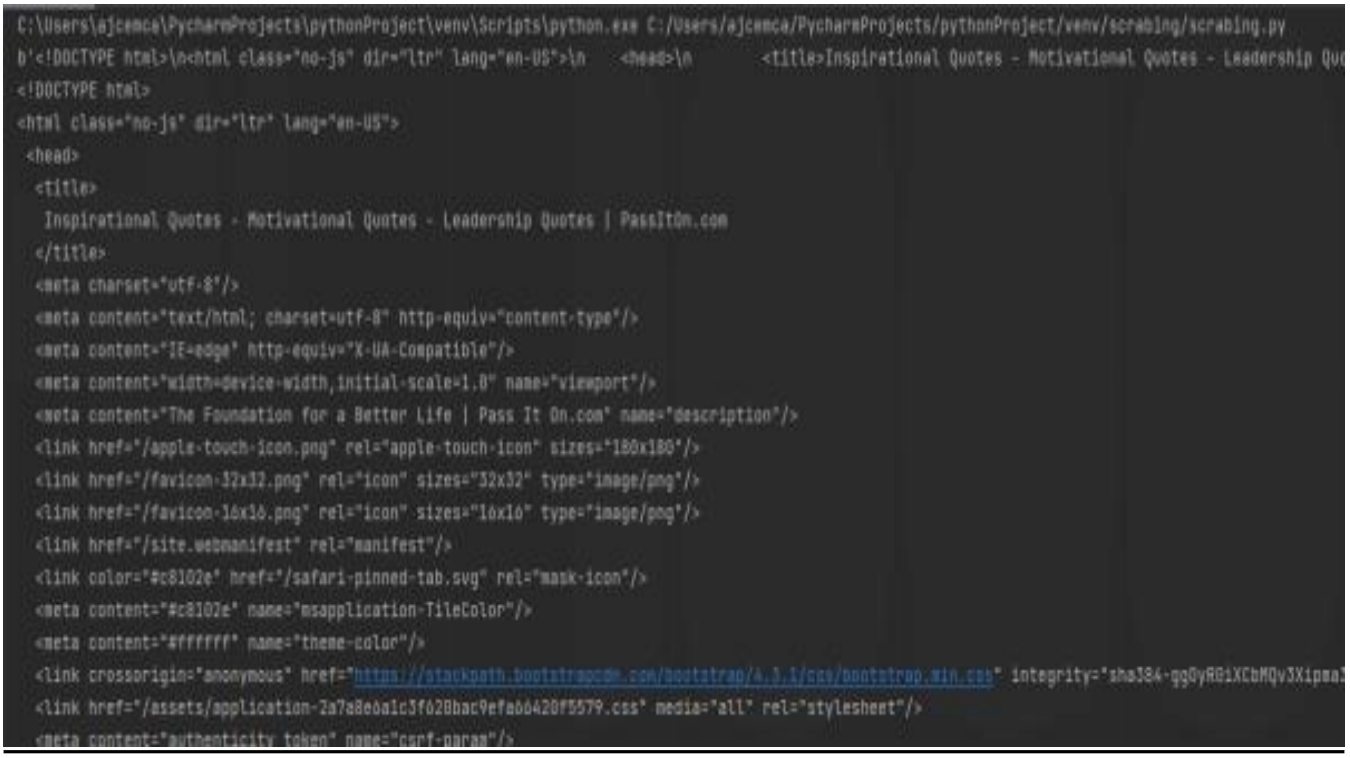
AIM : Program to implement scrap of any website.

PROGRAM CODE

```
import requests
from bs4 import BeautifulSoup
import csv
URL = "http://www.values.com/inspirational-quotes"
r = requests.get(URL)
print(r.content)
soup = BeautifulSoup(r.content, 'lxml')
print(soup.prettify())
quotes = []
table = soup.find('div', attrs={'id': 'all_quotes'})
for row in table.findAll('div',
                         attrs={'class': 'col-6 col-lg-3 text-center margin-30px-bottom sm-margin-30px-top'}):
    quote = {}
    quote['theme'] = row.h5.text
    quote['url'] = row.a['href']
    quote['img'] = row.img['src']
    quote['lines'] = row.img['alt'].split(" #")[0]
    quote['author'] = row.img['alt'].split(" #")[1]
    quotes.append(quote)
```

```
filename = 'inspirational_quotes.csv'
with open(filename, 'w', newline='') as f:
        w = csv.DictWriter(f, ['theme', 'url', 'img', 'lines', 'author'])
        w.writeheader()
        for quote in quotes:
      w.writerow(quote)
```

OUTPUT



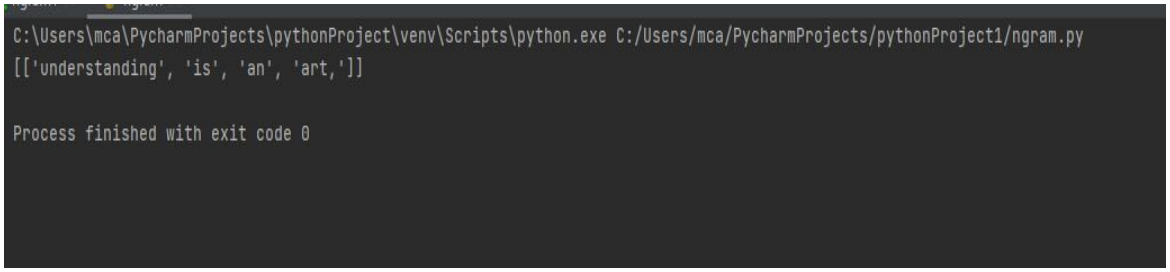
PROGRAM NO : 17 **Date :16/02/2022**

AIM : Program for Natural Language Processing which performs n-grams.

PROGRAM CODE

```
def generate_ngrams(text, WordsToCombine):
    words = text.split()
    output = []
    for i in range(len(words) - WordsToCombine + 1):
        output.append(words[i:i+1 + WordsToCombine])
        return output
x=generate_ngrams(text='understanding is an art, not everyone is an artist', WordsToCombine=3)
print(x)
```

OUTPUT



PROGRAM NO : 18 **Date :16/02/2022**

AIM : Program for Natural Language Processing which performs n-grams (Using in built functions).

PROGRAM CODE

```
import nltk

nltk.download('punkt')

from nltk.util import ngrams

sampleText='this is a very good book to study'

NGRAMS=ngrams(sequence=nltk.word_tokenize(sampleText),n=2)

for grams in NGRAMS:

        print(grams)
```

OUTPUT

PROGRAM NO : 19 **Date :16/02/2022**

AIM : Program for Natural Language Processing which performs speech tagging.

PROGRAM CODE

```
import nltk
from nltk.corpus import stopwords
from nltk.tokenize import word_tokenize, sent_tokenize
stop_words = set(stopwords.words('english'))
txt = "Sukanya, Rajib and Naba are my good friends. " \
      "Sukanya is getting married next year. " \
      "Marriage is a big step in one’s life." \
      "It is both exciting and frightening. " \
      "But friendship is a sacred bond between people." \
      "It is a special kind of love between us. " \
      "Many of you must have tried searching for a friend " \
      "but never found the right one."
tokenized = sent_tokenize(txt)
for i in tokenized:
    wordsList = nltk.word_tokenize(i)
    wordsList = [w for w in wordsList if not w in stop_words]
    tagged = nltk.pos_tag(wordsList)
    print(tagged)
```

OUTPUT


nlp
C:\Users\mca\PycharmProjects\pythonProject\venv\Scripts\python.exe C:/Users/mca/PycharmProjects/pythonProject1/nlp.py
[('Sukanya', 'NNP'), (',', ','), ('Rajib', 'NNP'), ('Naba', 'NNP'), ('good', 'JJ'), ('friends', 'NNS'), ('.', '.')]
[('Sukanya', 'NNP'), ('getting', 'VBG'), ('married', 'VBN'), ('next', 'JJ'), ('year', 'NN'), ('.', '.')]
[('Marriage', 'NN'), ('big', 'JJ'), ('step', 'NN'), ('one', 'CD'), ("''", 'NN'), ('life.It', 'NN'), ('exciting', 'VBG'), ('frightening', 'NN'), ('.', '.')]
[('But', 'CC'), ('friendship', 'NN'), ('sacred', 'VBD'), ('bond', 'NN'), ('people.It', 'NN'), ('special', 'JJ'), ('kind', 'NN'), ('love', 'VB'), ('us', 'PR
[('Many', 'JJ'), ('must', 'MD'), ('tried', 'VB'), ('searching', 'VBG'), ('friend', 'NN'), ('never', 'RB'), ('found', 'VBD'), ('right', 'JJ'), ('one', 'CD')
Process finished with exit code 0

PROGRAM NO : 20 **Date :23/02/2022**

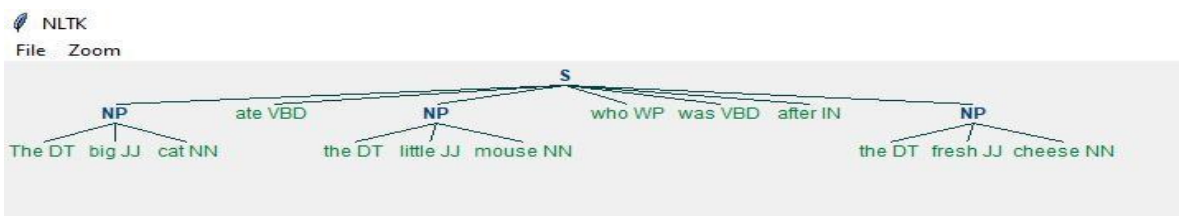
AIM : Python program which performs Natural language processing which perform Chunking.

PROGRAM CODE

```
import nltk

new="The big cat ate the little mouse who was after the fresh cheese"

new_tokens=nltk.word_tokenize(new)

print(new_tokens)

new_tag=nltk.pos_tag(new_tokens)

print(new_tag)

grammer=r"NP: {<DT>?<JJ>*<NN>}"

chunkParser=nltk.RegexpParser(grammer)

chunked=chunkParser.parse(new_tag)

print(chunked)

chunked.draw()
```

OUTPUT

```
C:\Users\mca\PycharmProjects\pythonProject\venv\Scripts\python.exe C:/Users/mca/PycharmProjects/pythonProject1/chunking.py
['The', 'big', 'cat', 'ate', 'the', 'little', 'mouse', 'who', 'was', 'after', 'the', 'fresh', 'cheese']
[('The', 'DT'), ('big', 'JJ'), ('cat', 'NN'), ('ate', 'VBD'), ('the', 'DT'), ('little', 'JJ'), ('mouse', 'NN'), ('who', 'WP'), ('was', 'VBD'), ('after', 'I
(S
  (NP The/DT big/JJ cat/NN)
  ate/VBD
  (NP the/DT little/JJ mouse/NN)
  who/WP
  was/VBD
  after/IN
  (NP the/DT fresh/JJ cheese/NN))
```



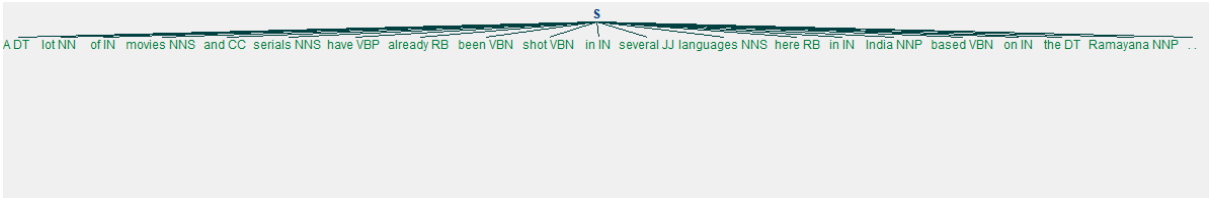
PROGRAM NO: 21 **DATE:23/02/2022**

AIM:PYTHON PROGRAM FOR NATURAL PROGRAM LANGUAGE PROCESSING WHICH PERFORMS CHUNKING

PROGRAM

```
import nltk

nltk.download('averaged_perceptron_tagger')

sample_text = """Rama killed Ravana to save sita from Lanka. The legend of the Ramayan is the most popular Indian epic. A lot of movies and serials have already been shot in several languages here in India based on the Ramayana."""


tokenized = nltk.sent_tokenize(sample_text)

for i in  tokenized:

    words = nltk.word_tokenize(i)

    tagged_words=nltk.pos_tag(words)

    chunkGram=r"""VB:{}"""

    chunkParse=nltk.RegexpParser(chunkGram)

    chunked=chunkParse.parse(tagged_words)

    print(chunked)

    chunked.draw()
```

OUTPUT



```
(S
  Rama/NNP
  killed/VBD
  Ravana/NNP
  to/TO
  save/VB
  sita/NN
  from/IN
  Lanka/NNP
  ./.)
(S
  The/DT
  legend/NN
  of/IN
  the/DT
  Ramayan/NNP
  is/VBZ
  the/DT
  most/RBS
  popular/JJ
  Indian/JJ
  epic/NN
  ./.)
(S
  A/DT
  lot/NN
  of/IN
  movies/NNS
  and/CC
  serials/NNS
  have/VBP
  already/RB
  been/VBN
  shot/VBN
  in/IN
  several/JJ
  languages/NNS
  here/RB
  in/IN
  India/NNP
  based/VBN
  on/IN
  the/DT
  Ramayana/NNP
  ./.)
```

RESULT: THE PROGRAM HAS BEEN EXECUTED AND OUTPUT VERIFIED