20MCA241 DATA SCIENCE LAB

Lab Report Submitted By

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Reg. No.: AJC20MCA-2028

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

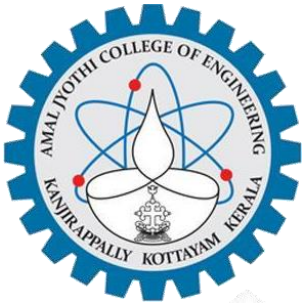
[Affiliated to APJ Abdul Kalam Technological University, Kerala. Approved by AICTE, Accredited by NAAC with 'A' grade. Koovappally, Kanjirappally, Kottayam, Kerala – 686518]

2021-2022

DEPARTMENT OF COMPUTER APPLICATIONS

AMAL JYOTHI COLLEGE OF ENGINEERING

KANJIRAPPALLY



CERTIFICATE

This is to certify that the Lab report, "**20MCA241 DATA SCIENCE LAB"** is the bonafide work of **ASHISH WILSON(Reg.No:AJC20MCA-2028)** 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

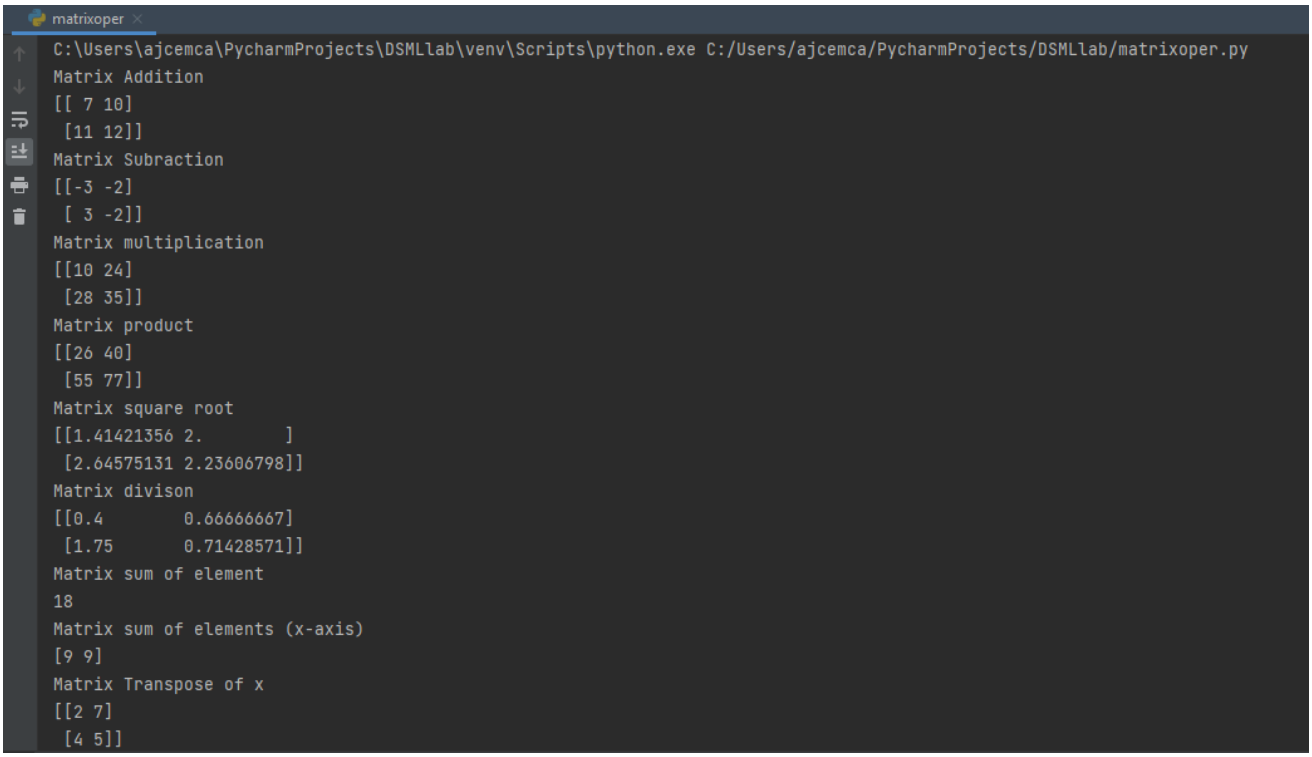
PROGRAM NO : 01 **Date:24/11/2021**

Aim: Perform all matrix operation using python.

Program Code:

```
import numpy
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]]

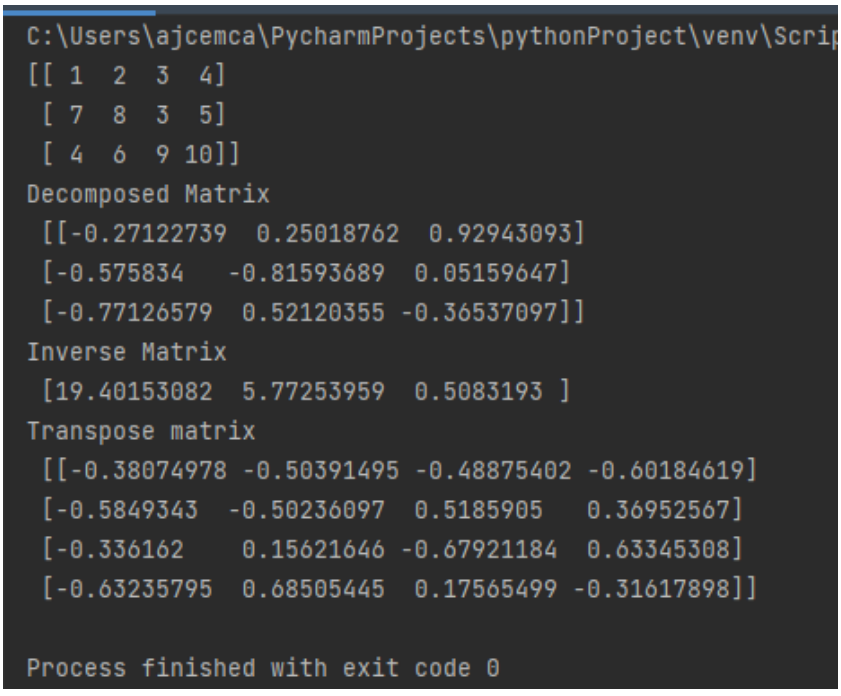
PROGRAM NO : 02 **Date:01/12/2021**

Aim : Program to perform SVD using python.

Program Code:

```
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:



PROGRAM NO : 03 **Date:1/12/2021**

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
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 NO : 04 **Date:01/12/2021**

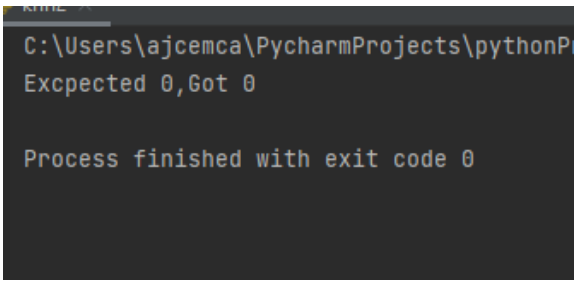
Aim: Program to implement k-NN classification using any random data set without using in built functions.

Program Code:

```
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:



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
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/ajc
[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 NO : 06 **Date:08/01/2022**

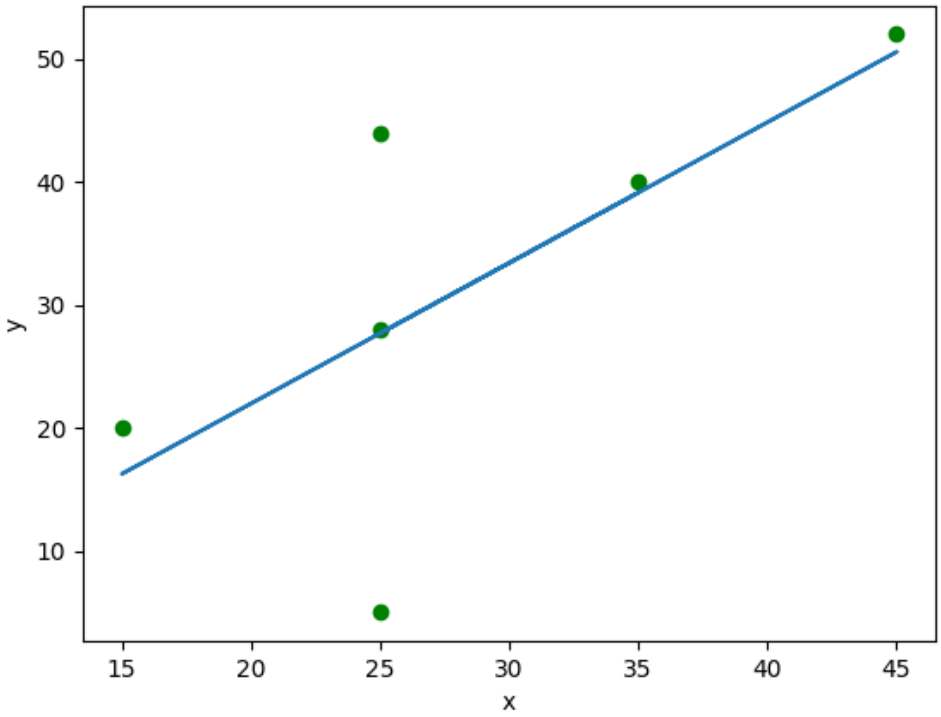
Aim: Program to implement linear regression techniques using any standard dataset available in the public domain and evaluate its performance.

Program(Code:

```
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 NO : 07 **Date:15/01/2022**

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

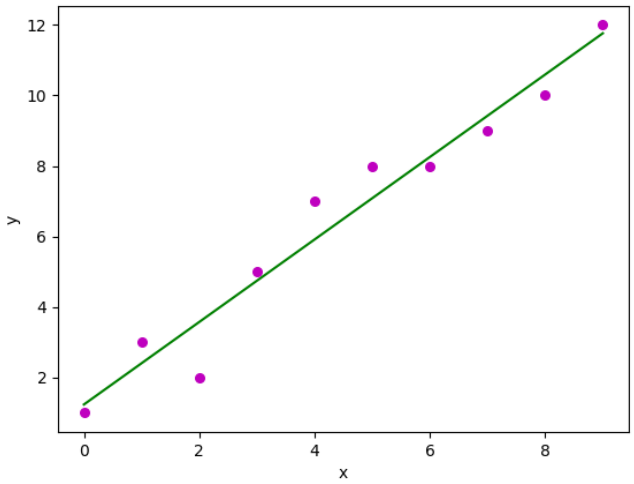
Program Code:

```
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
```



PROGRAM NO : 08 **Date:15/01/2022**

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

Program Code:

```
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]
```

PROGRAM NO : 09 **Date:15/01/2022**

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

Program Code:

```
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
```

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

Aim: Program to implement decision trees 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 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)

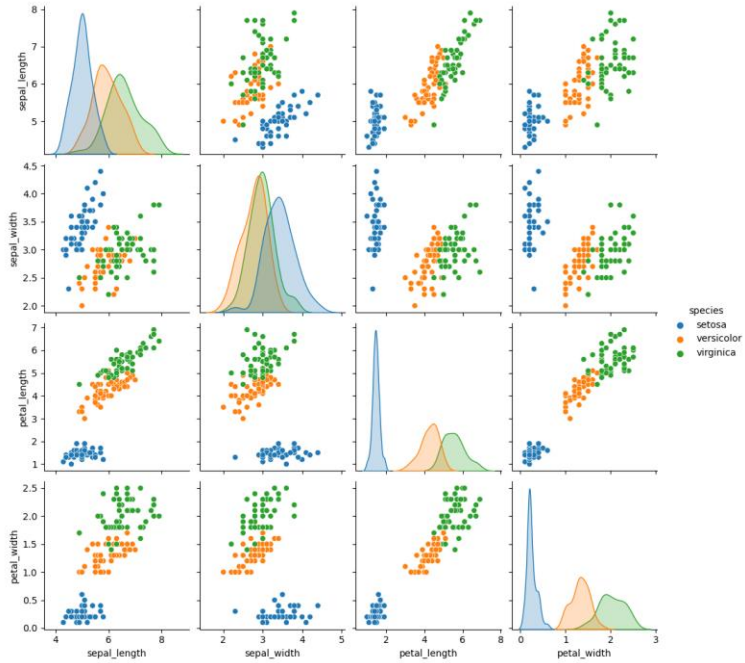
plt.savefig("three.png")

Output:

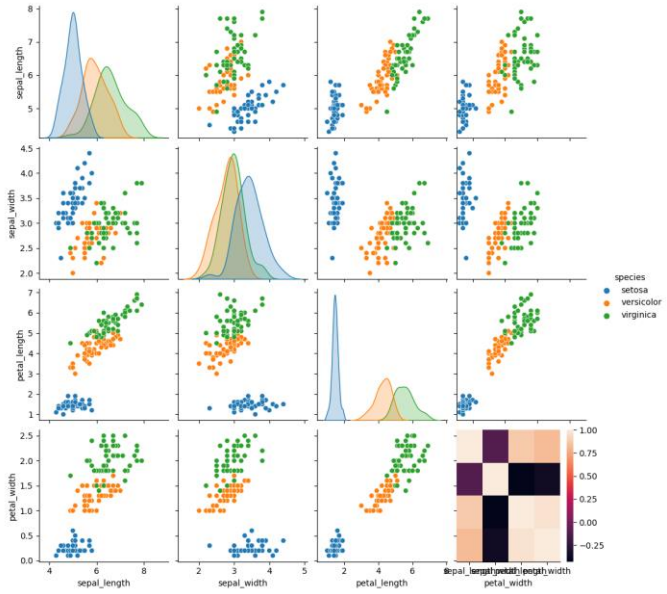
```
C:\Users\ashis\PycharmProjects\pythonProject1\venv\Scripts\python.exe C:/Users/ashis/PycharmProjects/pythonProject1/venv/d
   sepal_length  sepal_width  petal_length  petal_width species
0           5.1          3.5           1.4          0.2  setosa
1           4.9          3.0           1.4          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 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 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
```

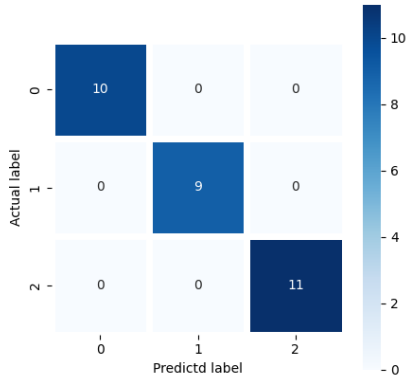
Pne.png



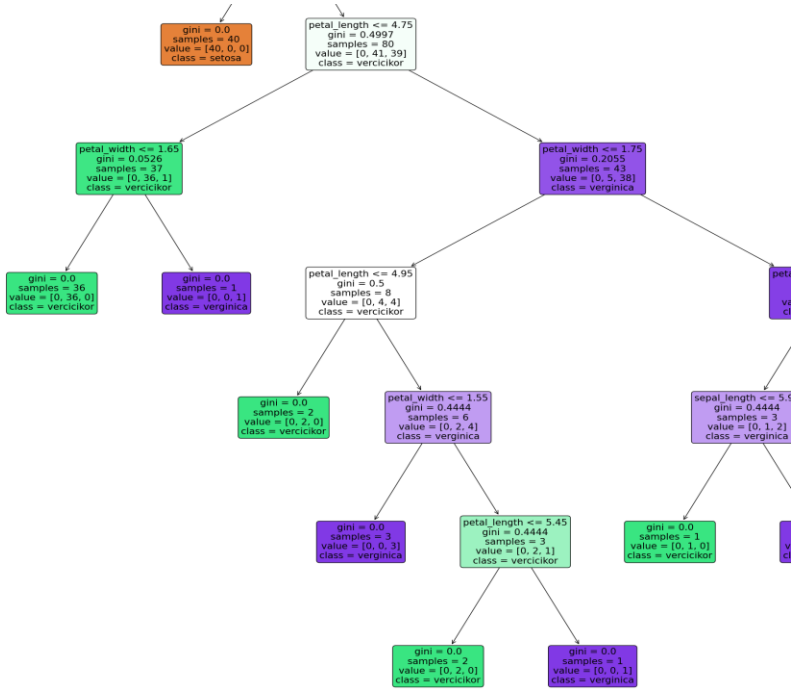
One.png



Two.png



Three.png



PROGRAM NO : 11 **Date:05/1/2022**

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(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]
```

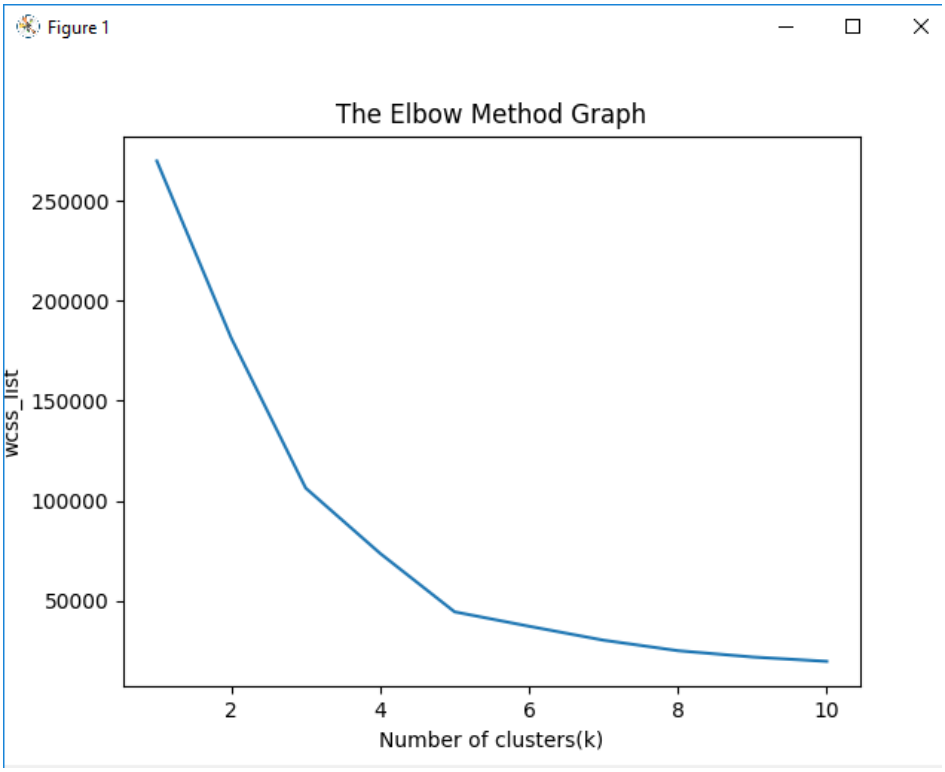
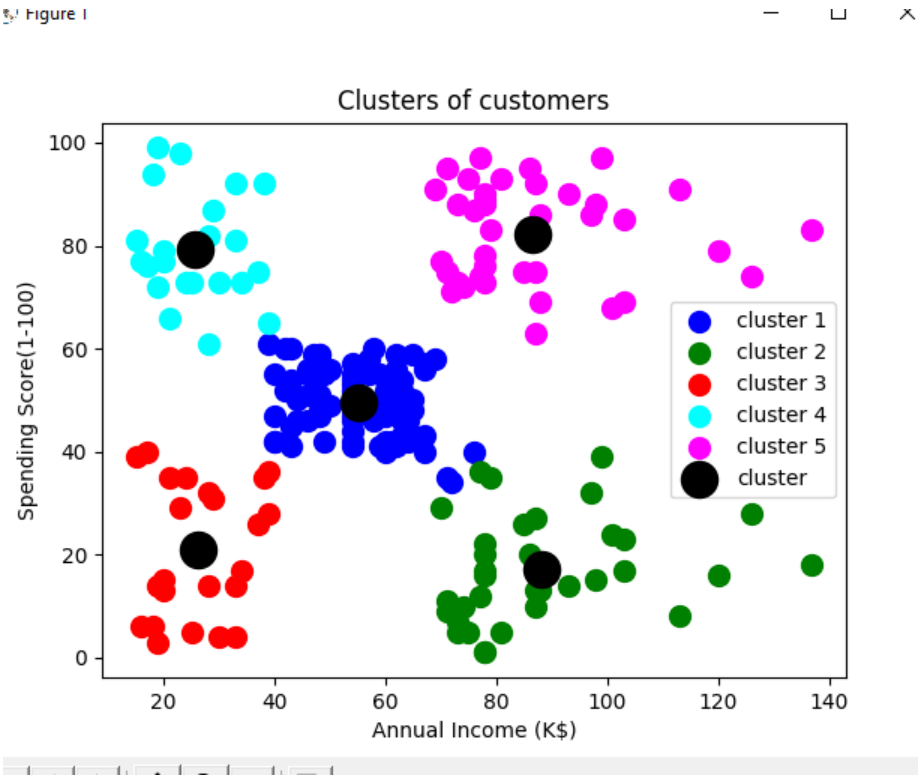


Figure 1
The Elbow Method Graph
250000
200000
150000
100000
50000
wcss_list
2
4
6
8
10
Number of clusters(k)


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

PROGRAM NO : 12 **Date:05/1/2022**

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

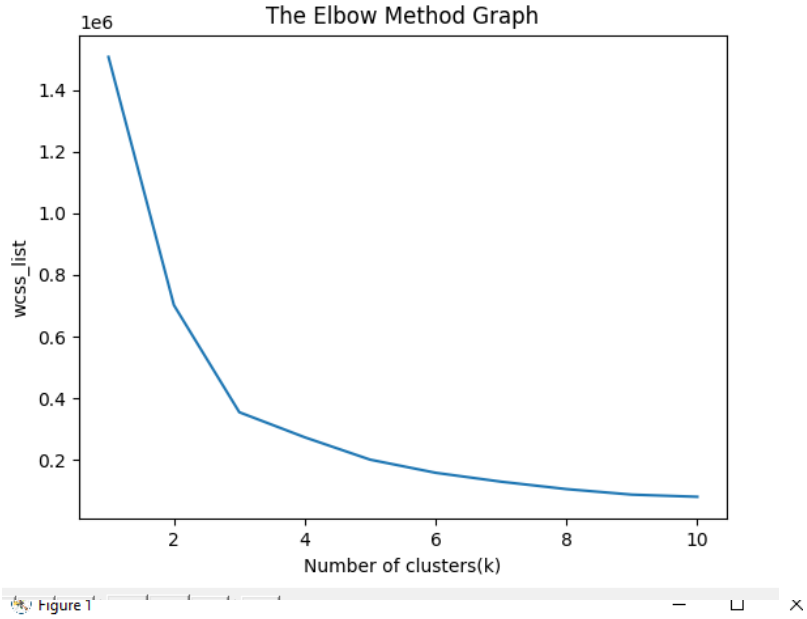
Program Code:

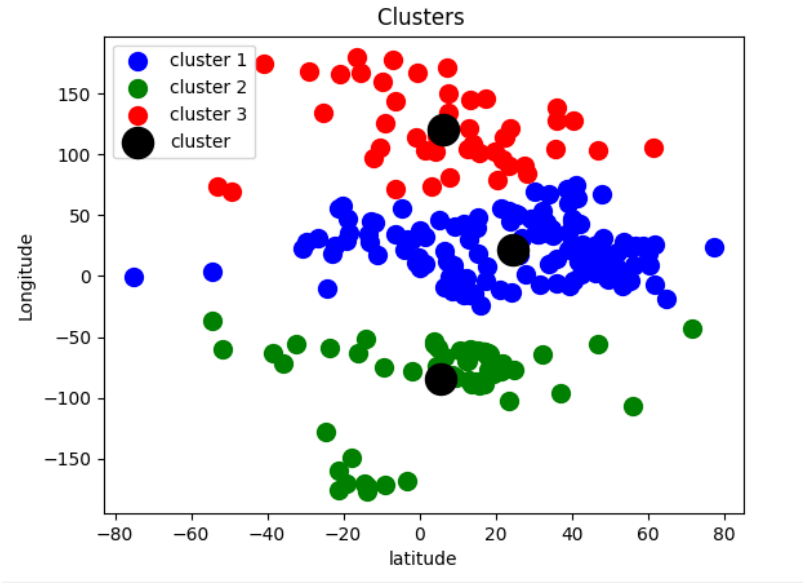
```
import numpy as nm
import matplotlib.pyplot as mtp
import pandas as pd
dataset = pd.read_csv('world_country_and_usa_states_latitude_and_longitude_values.csv')
x=dataset.iloc[:,[1,2]].values
print(x)
from sklearn.cluster import KMeans
wcss_list=[]
for i in range(1,11):
        kmeans=KMeans(n_clusters=i,init='k-means++',random_state=42)
        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(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='clu
ster')

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]
```


The Elbow Method Graph
1e6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
wcss_list
2
4
6
8
10
Number of clusters(k)
Figure 1


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

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

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

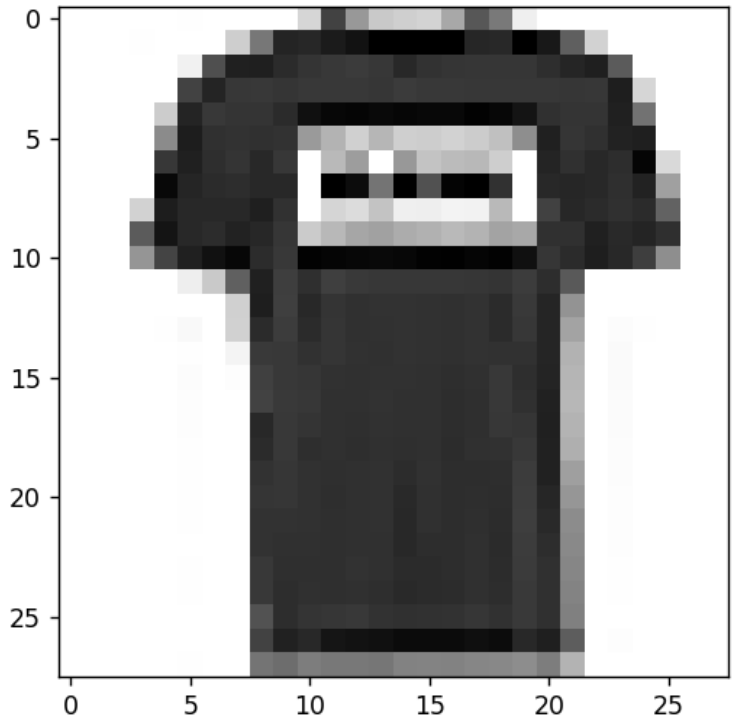
Program Code;

```
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)
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','Bag','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=['accurac
y'])
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))
```

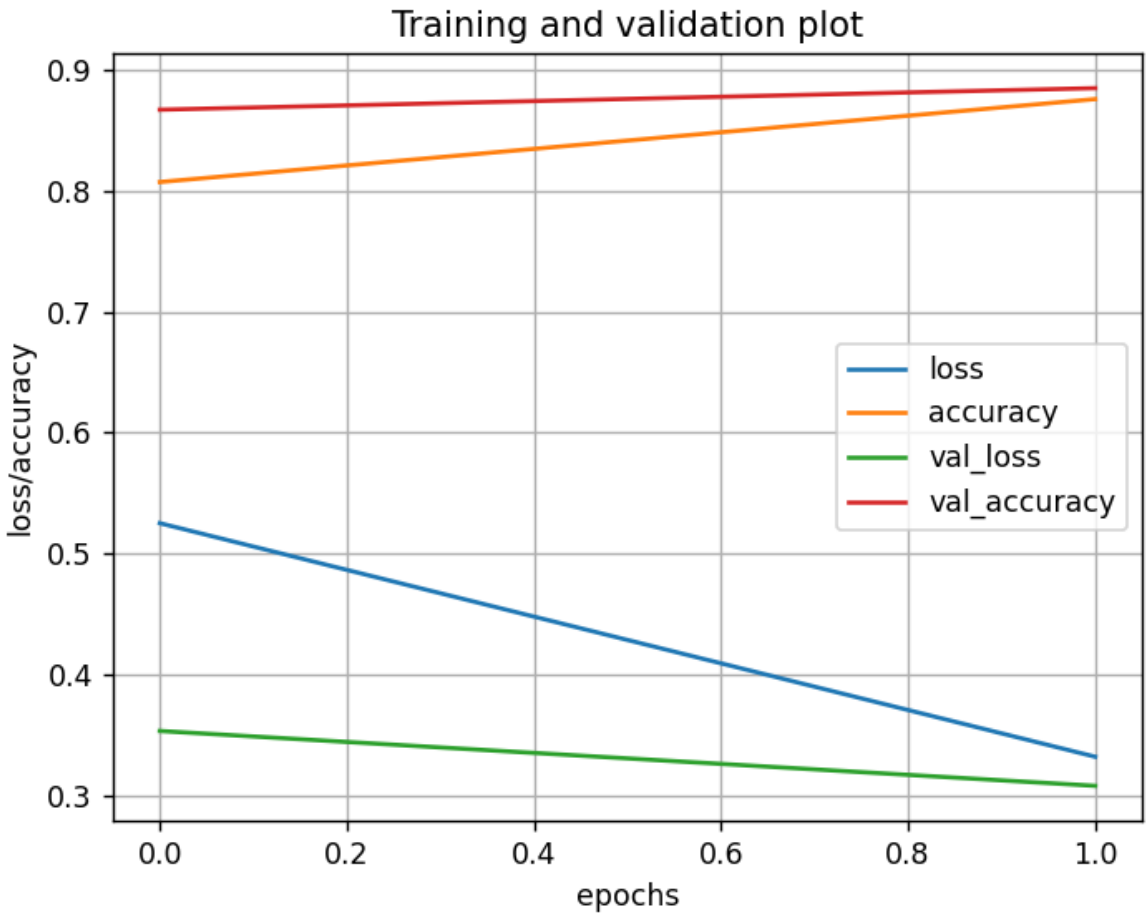
Output:




```
(60000, 28, 28) (10000, 28, 28)
2022-02-02 12:03:16.761271: W tensorflow/stream_executor/platform/default/dso_l
2022-02-02 12:03:16.763256: W tensorflow/core/common_runtime/gpu/gpu_device.cc:
Skipping registering GPU devices...
2022-02-02 12:03:16.773939: I tensorflow/core/platform/cpu_feature_guard.cc:151
To enable them in other operations, rebuild TensorFlow with the appropriate comp
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 28, 28, 32)        1600

 max_pooling2d (MaxPooling2D  (None, 14, 14, 32)       0
 )

 conv2d_1 (Conv2D)           (None, 14, 14, 64)        18496

 max_pooling2d_1 (MaxPooling  (None, 7, 7, 64)         0
 2D)

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

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

=================================================================
Total params: 38,560
Trainable params: 38,560
Non-trainable params: 0
```

```
Trainable params: 38,560
Non-trainable params: 0
_________________________________________________________________
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 28, 28, 32)        1600

 max_pooling2d (MaxPooling2D  (None, 14, 14, 32)       0
 )

 conv2d_1 (Conv2D)           (None, 14, 14, 64)        18496

 max_pooling2d_1 (MaxPooling  (None, 7, 7, 64)         0
 2D)

 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 [==============================] - 74s 43ms/step - loss: 0.5097 - accuracy: 0.8133 - val_loss: 0.3481 - val_accuracy: 0.8688
Epoch 2/2
1688/1688 [==============================] - 73s 43ms/step - loss: 0.3272 - accuracy: 0.8795 - val_loss: 0.3289 - val_accuracy: 0.8763
313/313 [==============================] - 4s 13ms/step - loss: 0.3441 - accuracy: 0.8721
 Test Loss :0.34412604570388794, Test Accuracy : 0.8720999956130981

Process finished with exit code 0
```


Training and validation plot
loss/accuracy
epochs
loss
accuracy
val_loss
val_accuracy
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.0
0.2
0.4
0.6
0.8
1.0

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
url = "https://www.rottentomatoes.com/top/bestofrt/"
headers = {
'User-Agent':'Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML, like
Gecko) Chrome/63.0.3239.132 Safari/537.36 OPR/50.0.2762.58 (Edition Yx 01)'
}
f = requests.get(url, headers = headers)
movies_lst = []
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_lst.append(urls)
print(movies_lst)
num += 1
movie_url = urls
```

```
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:

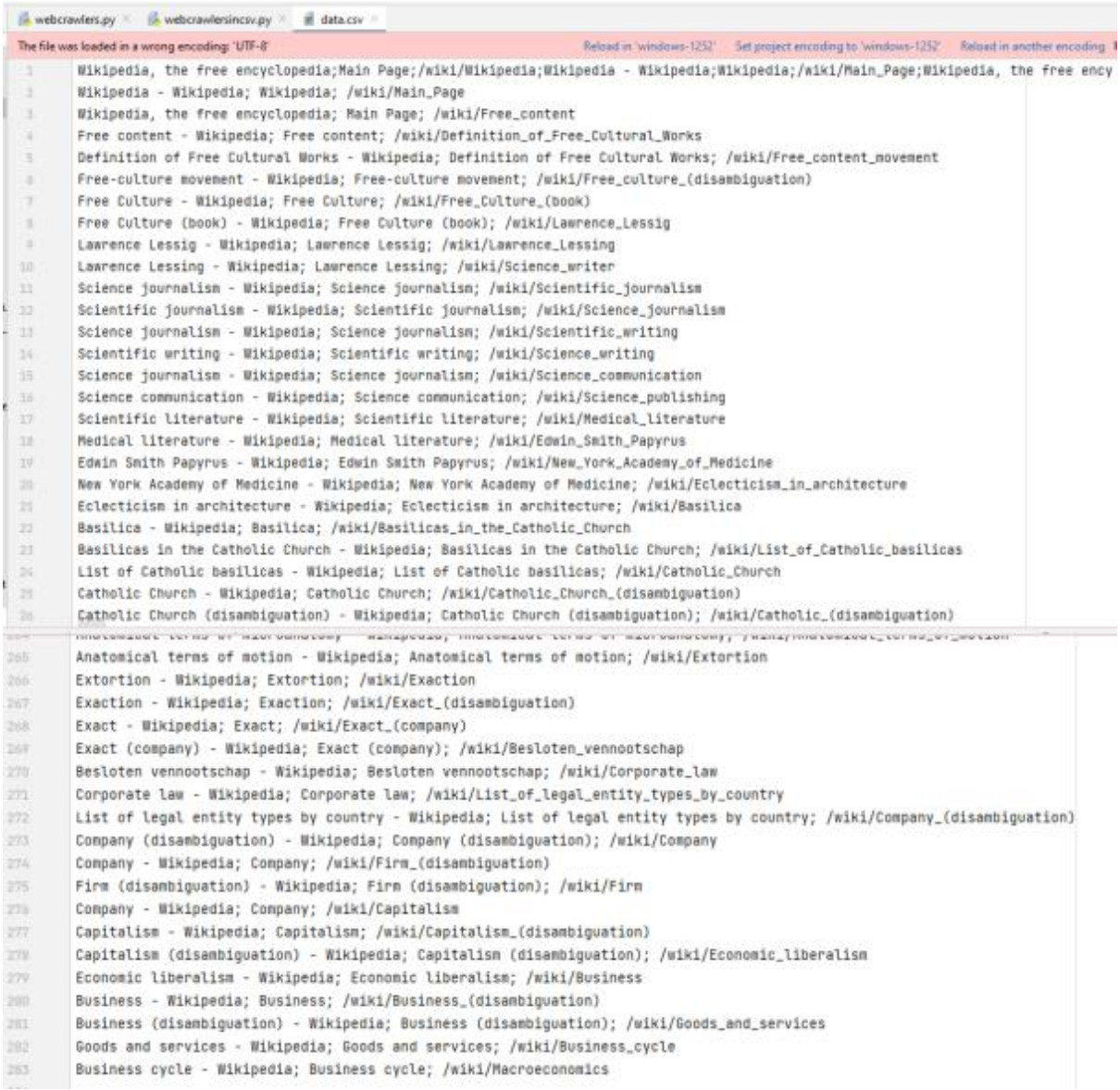
PROGRAM NO : 15 **Date:16/02/2022**

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}; {soup.h1.text}; {link["href"]}\n')
        crawler(new_link)
    except:
     continue
crawler(‘https://en.wikipedia.org’)
crawler()
```

Output:


webcrawlers.py
webcrawlersincsv.py
data.csv
The file was loaded in a wrong encoding: 'UTF-8'
Reload in 'windows-1252'
Set project encoding to 'windows-1252'
Reload in another encoding
Wikipedia, the free encyclopedia;Main Page;/wiki/Wikipedia;Wikipedia - Wikipedia;Wikipedia;/wiki/Main_Page;Wikipedia, the free ency
Wikipedia - Wikipedia; Wikipedia; /wiki/Main_Page
Wikipedia, the free encyclopedia; Main Page; /wiki/Free_content
Free content - Wikipedia; Free content; /wiki/Definition_of_Free_Cultural_Works
Definition of Free Cultural Works - Wikipedia; Definition of Free Cultural Works; /wiki/Free_content_movement
Free-culture movement - Wikipedia; Free-culture movement; /wiki/Free_culture_(disambiguation)
Free Culture - Wikipedia; Free Culture; /wiki/Free_Culture_(book)
Free Culture (book) - Wikipedia; Free Culture (book); /wiki/Lawrence_Lessig
Lawrence Lessig - Wikipedia; Lawrence Lessig; /wiki/Lawrence_Lessing
Lawrence Lessing - Wikipedia; Lawrence Lessing; /wiki/Science_writer
Science journalism - Wikipedia; Science journalism; /wiki/Scientific_journalism
Scientific journalism - Wikipedia; Scientific journalism; /wiki/Science_journalism
Science journalism - Wikipedia; Science journalism; /wiki/Scientific_writing
Scientific writing - Wikipedia; Scientific writing; /wiki/Science_writing
Science journalism - Wikipedia; Science journalism; /wiki/Science_communication
Science communication - Wikipedia; Science communication; /wiki/Science_publishing
Scientific literature - Wikipedia; Scientific literature; /wiki/Medical_literature
Medical literature - Wikipedia; Medical literature; /wiki/Edwin_Smith_Papyrus
Edwin Smith Papyrus - Wikipedia; Edwin Smith Papyrus; /wiki/New_York_Academy_of_Medicine
New York Academy of Medicine - Wikipedia; New York Academy of Medicine; /wiki/Eclecticism_in_architecture
Eclecticism in architecture - Wikipedia; Eclecticism in architecture; /wiki/Basilica
Basilica - Wikipedia; Basilica; /wiki/Basilicas_in_the_Catholic_Church
Basilicas in the Catholic Church - Wikipedia; Basilicas in the Catholic Church; /wiki/List_of_Catholic_basilicas
List of Catholic basilicas - Wikipedia; List of Catholic basilicas; /wiki/Catholic_Church
Catholic Church - Wikipedia; Catholic Church; /wiki/Catholic_Church_(disambiguation)
Catholic Church (disambiguation) - Wikipedia; Catholic Church (disambiguation); /wiki/Catholic_(disambiguation)
Anatomical terms of motion - Wikipedia; Anatomical terms of motion; /wiki/Extortion
Extortion - Wikipedia; Extortion; /wiki/Exaction
Exaction - Wikipedia; Exaction; /wiki/Exact_(disambiguation)
Exact - Wikipedia; Exact; /wiki/Exact_(company)
Exact (company) - Wikipedia; Exact (company); /wiki/Besloten_vennootschap
Besloten vennootschap - Wikipedia; Besloten vennootschap; /wiki/Corporate_law
Corporate law - Wikipedia; Corporate law; /wiki/List_of_legal_entity_types_by_country
List of legal entity types by country - Wikipedia; List of legal entity types by country; /wiki/Company_(disambiguation)
Company (disambiguation) - Wikipedia; Company (disambiguation); /wiki/Company
Company - Wikipedia; Company; /wiki/Firm_(disambiguation)
Firm (disambiguation) - Wikipedia; Firm (disambiguation); /wiki/Firm
Company - Wikipedia; Company; /wiki/Capitalism
Capitalism - Wikipedia; Capitalism; /wiki/Capitalism_(disambiguation)
Capitalism (disambiguation) - Wikipedia; Capitalism (disambiguation); /wiki/Economic_liberalism
Economic liberalism - Wikipedia; Economic liberalism; /wiki/Business
Business - Wikipedia; Business; /wiki/Business_(disambiguation)
Business (disambiguation) - Wikipedia; Business (disambiguation); /wiki/Goods_and_services
Goods and services - Wikipedia; Goods and services; /wiki/Business_cycle
Business cycle - Wikipedia; Business cycle; /wiki/Macroeconomics

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

Aim: Program to implement scrap of any website.

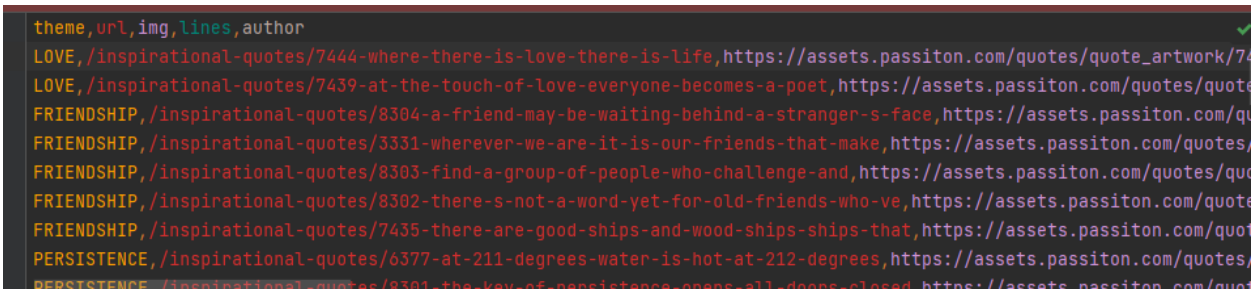
Program Code;

```
import csv
import requests
from bs4 import BeautifulSoup
url="http://www.values.com/inspirational-quotes"
r=requests.get(url)
print("Content:")
print(r.content)
print("Prettify:")
soup=BeautifulSoup(r.content,'lxml')
print(soup.prettify())
quotes=[]
table=soup.find('div',attrs={'id':'all_quotes'})
for row in table.find_all('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='insipration_quotation.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:

```
"C:\Users\ajcemca\Desktop\my pgms\venv\Scripts\python.exe" "C:/Users/ajcemca/Desktop/my pgms/transpose.py"
Content:
b'<!DOCTYPE html>\n<html class="no-js" dir="ltr" lang="en-US">\n    <head>\n        <title>Inspirational Quotes - Motivational Quotes - Leadership Quotes | Pas
Prettify:
<!DOCTYPE html>
<html class="no-js" dir="ltr" lang="en-US">
 <head>
  <title>
   Inspirational Quotes - Motivational Quotes - Leadership Quotes | PassItOn.com
  </title>
  <meta charset="utf-8"/>
  <meta content="text/html; charset=utf-8" http-equiv="content-type"/>
  <meta content="IE=edge" http-equiv="X-UA-Compatible"/>
  <meta content="width=device-width,initial-scale=1.0" name="viewport"/>
```



```
theme,url,img,lines,author
LOVE,/inspirational-quotes/7444-where-there-is-love-there-is-life,https://assets.passiton.com/quotes/quote_artwork/7
LOVE,/inspirational-quotes/7439-at-the-touch-of-love-everyone-becomes-a-poet,https://assets.passiton.com/quotes/quot
FRIENDSHIP,/inspirational-quotes/8304-a-friend-may-be-waiting-behind-a-stranger-s-face,https://assets.passiton.com/qu
FRIENDSHIP,/inspirational-quotes/3331-wherever-we-are-it-is-our-friends-that-make,https://assets.passiton.com/quotes/
FRIENDSHIP,/inspirational-quotes/8303-find-a-group-of-people-who-challenge-and,https://assets.passiton.com/quotes/quo
FRIENDSHIP,/inspirational-quotes/8302-there-s-not-a-word-yet-for-old-friends-who-ve,https://assets.passiton.com/quote
FRIENDSHIP,/inspirational-quotes/7435-there-are-good-ships-and-wood-ships-ships-that,https://assets.passiton.com/quot
PERSISTENCE,/inspirational-quotes/6377-at-211-degrees-water-is-hot-at-212-degrees,https://assets.passiton.com/quotes/
```

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 + WordsToCombine])
return output
x=generate_ngrams(text="this is a good book to study",WordsToCombine=3)
print(x)
```

Output:

```
"C:\Users\ajcemca\Desktop\my pgms\venv\Scripts\python.exe" "C:/Users/ajcemca/Desktop/my pgms/venv/ngrams.py"
[['this', 'is', 'a'], ['is', 'a', 'good'], ['a', 'good', 'book'], ['good', 'book', 'to'], ['book', 'to', 'study']]

Process finished with exit code 0
```

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
from nltk.util import ngrams
samplText="this is very good book to study"
Ngrams=ngrams(sequence=nltk.wordpunct_tokenize(samplText),n=2)
for grams in Ngrams:
    print(grams)
```

Output:

```
"C:\Users\ajcemca\Desktop\my pgms\ve
('this', 'is')
('is', 'very')
('very', 'good')
('good', 'book')
('book', 'to')
('to', 'study')

Process finished with exit code 0
```

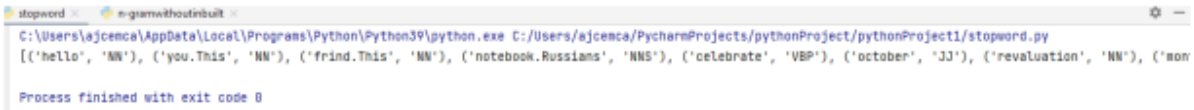
PROGRAM NO : 19 **Date:16/02/2022**

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 = "hello how are you."\
      "This is my frind." \
      "This is my notebook."\
      "Russians celebrate the october revaluation in the month of november."\
      "frienship is scared bond between people."\
     "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:



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

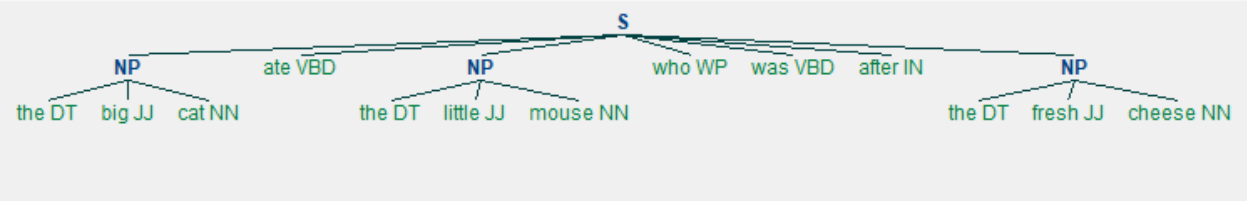
Aim: Program for Natural Language Processing which performs Chunking.

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\ajcemca\PycharmProjects\mypython\venv\Scripts\python.exe C:/Users/ajcemca/PycharmProjects/mypython/venv/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', 'IN'),
(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: Program for Natural Language Processing which performs Chunking.

Program Code :

```
import nltk
sample_text="""Rama killed Ravana to save sita from Lanka.The legend of Ramayan is thr most popular Indian epic.A lot of movies and serials have already been shot in several languages here in Indaia  based on 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:{<DT>*<NN>?<JJ>}"""
   chunkParser=nltk.RegexpParser(chunkgram)
   chunked=chunkParser.parse(tagged_words)
   print(chunked)
   chunked.draw()
```

Output:

```
C:\Users\ajcemca\PycharmProjects\mypython\ve
(S
  Rama/NNP
  killed/VBD
  Ravana/NNP
  to/TO
  save/VB
  sita/NN
  from/IN
  Lanka.The/NNP
  legend/NN
  of/IN
  Ramayan/NNP
  is/VBZ
  (VB thr/JJ)
  most/RBS
  (VB popular/JJ)
  (VB Indian/JJ)
  epic.A/NN
  lot/NN
  of/IN
  movies/NNS
  and/CC
  serials/NNS
  have/VBP
  already/RB
```