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

#importing the libraries

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.neighbors import KNeighborsClassifier
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
```

#read the dataset

```
iris=pd.read_csv("iris_csv.csv")
iris.tail()
```

| | sepallength | sepalwidth | petallength | petalwidth | class |
|---|---|---|---|---|---|
| 145 | 6.7 | 3.0 | 5.2 | 2.3 | Iris-virginica |
| 146 | 6.3 | 2.5 | 5.0 | 1.9 | Iris-virginica |
| 147 | 6.5 | 3.0 | 5.2 | 2.0 | Iris-virginica |
| 148 | 6.2 | 3.4 | 5.4 | 2.3 | Iris-virginica |
| 149 | 5.9 | 3.0 | 5.1 | 1.8 | Iris -virginica |

```
iris['class'].value_counts()
```

```
Iris-setosa       50
Iris-versicolor   50
Iris-virginica    50
Name: class, dtype: int64
```

```
iris.columns
```

```
Index(['sepallength', 'sepalwidth', 'petallength', 'petalwidth', 'class'],
dtype='object')
```

**iris.values**

```
array([[5.1, 3.5, 1.4, 0.2, 'Iris-setosa'],
       [4.9, 3.0, 1.4, 0.2, 'Iris-setosa'],
       [4.7, 3.2, 1.3, 0.2, 'Iris-setosa'],
       [4.6, 3.1, 1.5, 0.2, 'Iris-setosa'],
       [5.0, 3.6, 1.4, 0.2, 'Iris-setosa'],
       [5.4, 3.9, 1.7, 0.4, 'Iris-setosa'],
       [4.6, 3.4, 1.4, 0.3, 'Iris-setosa'],
       [5.0, 3.4, 1.5, 0.2, 'Iris-setosa'],
       [4.4, 2.9, 1.4, 0.2, 'Iris-setosa'],
       [4.9, 3.1, 1.5, 0.1, 'Iris-setosa'],
       [5.4, 3.7, 1.5, 0.2, 'Iris-setosa'],
       [4.8, 3.4, 1.6, 0.2, 'Iris-setosa'],
       [4.8, 3.0, 1.4, 0.1, 'Iris-setosa'],
       [4.3, 3.0, 1.1, 0.1, 'Iris-setosa'],
       [5.8, 4.0, 1.2, 0.2, 'Iris-setosa'],
       [5.7, 4.4, 1.5, 0.4, 'Iris-setosa'],
       [5.4, 3.9, 1.3, 0.4, 'Iris-setosa'],
       [5.1, 3.5, 1.4, 0.3, 'Iris-setosa'],
       [5.7, 3.8, 1.7, 0.3, 'Iris-setosa'],
       [5.1, 3.8, 1.5, 0.3, 'Iris-setosa'],
       [5.4, 3.4, 1.7, 0.2, 'Iris-setosa'],
       [5.1, 3.7, 1.5, 0.4, 'Iris-setosa'],
       [4.6, 3.6, 1.0, 0.2, 'Iris-setosa'],
       [5.1, 3.3, 1.7, 0.5, 'Iris-setosa'],
       [4.8, 3.4, 1.9, 0.2, 'Iris-setosa'],
       [5.0, 3.0, 1.6, 0.2, 'Iris-setosa'],
       [5.0, 3.4, 1.6, 0.4, 'Iris-setosa'],
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       [5.2, 3.4, 1.4, 0.2, 'Iris-setosa'],
       [4.7, 3.2, 1.6, 0.2, 'Iris-setosa'],
       [4.8, 3.1, 1.6, 0.2, 'Iris-setosa'],
       [5.4, 3.4, 1.5, 0.4, 'Iris-setosa'],
       [5.2, 4.1, 1.5, 0.1, 'Iris-setosa'],
       [5.5, 4.2, 1.4, 0.2, 'Iris-setosa'],
       [4.9, 3.1, 1.5, 0.1, 'Iris-setosa'],
```

[5.0, 3.2, 1.2, 0.2, 'Iris-setosa'],
[5.5, 3.5, 1.3, 0.2, 'Iris-setosa'],
[4.9, 3.1, 1.5, 0.1, 'Iris-setosa'],
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[6.5, 2.8, 4.6, 1.5, 'Iris-versicolor'],
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[6.1, 2.8, 4.7, 1.2, 'Iris-versicolor'],
[6.4, 2.9, 4.3, 1.3, 'Iris-versicolor'],

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[5.8, 2.6, 4.0, 1.2, 'Iris-versicolor'],
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[5.6, 2.7, 4.2, 1.3, 'Iris-versicolor'],
[5.7, 3.0, 4.2, 1.2, 'Iris-versicolor'],
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[7.6, 3.0, 6.6, 2.1, 'Iris-virginica'],
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[6.8, 3.0, 5.5, 2.1, 'Iris-virginica'],
[5.7, 2.5, 5.0, 2.0, 'Iris-virginica'],
[5.8, 2.8, 5.1, 2.4, 'Iris-virginica'],

```
[6.4, 3.2, 5.3, 2.3, 'Iris-virginica'],
[6.5, 3.0, 5.5, 1.8, 'Iris-virginica'],
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[7.7, 2.6, 6.9, 2.3, 'Iris-virginica'],
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[6.9, 3.2, 5.7, 2.3, 'Iris-virginica'],
[5.6, 2.8, 4.9, 2.0, 'Iris-virginica'],
[7.7, 2.8, 6.7, 2.0, 'Iris-virginica'],
[6.3, 2.7, 4.9, 1.8, 'Iris-virginica'],
[6.7, 3.3, 5.7, 2.1, 'Iris-virginica'],
[7.2, 3.2, 6.0, 1.8, 'Iris-virginica'],
[6.2, 2.8, 4.8, 1.8, 'Iris-virginica'],
[6.1, 3.0, 4.9, 1.8, 'Iris-virginica'],
[6.4, 2.8, 5.6, 2.1, 'Iris-virginica'],
[7.2, 3.0, 5.8, 1.6, 'Iris-virginica'],
[7.4, 2.8, 6.1, 1.9, 'Iris-virginica'],
[7.9, 3.8, 6.4, 2.0, 'Iris-virginica'],
[6.4, 2.8, 5.6, 2.2, 'Iris-virginica'],
[6.3, 2.8, 5.1, 1.5, 'Iris-virginica'],
[6.1, 2.6, 5.6, 1.4, 'Iris-virginica'],
[7.7, 3.0, 6.1, 2.3, 'Iris-virginica'],
[6.3, 3.4, 5.6, 2.4, 'Iris-virginica'],
[6.4, 3.1, 5.5, 1.8, 'Iris-virginica'],
[6.0, 3.0, 4.8, 1.8, 'Iris-virginica'],
[6.9, 3.1, 5.4, 2.1, 'Iris-virginica'],
[6.7, 3.1, 5.6, 2.4, 'Iris-virginica'],
[6.9, 3.1, 5.1, 2.3, 'Iris-virginica'],
[5.8, 2.7, 5.1, 1.9, 'Iris-virginica'],
[6.8, 3.2, 5.9, 2.3, 'Iris-virginica'],
[6.7, 3.3, 5.7, 2.5, 'Iris-virginica'],
[6.7, 3.0, 5.2, 2.3, 'Iris-virginica'],
[6.3, 2.5, 5.0, 1.9, 'Iris-virginica'],
[6.5, 3.0, 5.2, 2.0, 'Iris-virginica'],
[6.2, 3.4, 5.4, 2.3, 'Iris-virginica'],
[5.9, 3.0, 5.1, 1.8, 'Iris-virginica']], dtype=object)
```

**iris.describe(include='all')**

| | sepallength | sepalwidth | petallength | petalwidth | class |
|---|---|---|---|---|---|
| count | 150.000000 | 150.000000 | 150.000000 | 150.000000 | 150 |
| unique | NaN | NaN | NaN | NaN | 3 |
| top | NaN | NaN | NaN | NaN | Iris-setosa |
| freq | NaN | NaN | NaN | NaN | 50 |
| mean | 5.843333 | 3.054000 | 3.758667 | 1.198667 | NaN |
| std | 0.828066 | 0.433594 | 1.764420 | 0.763161 | NaN |
| min | 4.300000 | 2.000000 | 1.000000 | 0.100000 | NaN |
| 25% | 5.100000 | 2.800000 | 1.600000 | 0.300000 | NaN |
| 50% | 5.800000 | 3.000000 | 4.350000 | 1.300000 | NaN |
| 75% | 6.400000 | 3.300000 | 5.100000 | 1.800000 | NaN |
| max | 7.900000 | 4.400000 | 6.900000 | 2.500000 | NaN |

**x=iris.iloc[:,:4]**
**x.head()**

| | sepallength | sepalwidth | petallength | petalwidth |
|---|---|---|---|---|
| 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 |

**y=iris.iloc[:,-1]**
**y.head()**

```
0    Iris-setosa
1    Iris-setosa
2    Iris-setosa
3    Iris-setosa
4    Iris-setosa
Name: class, dtype: object
```

#Data Normalization

**x=preprocessing.StandardScaler().fit_transform(x)**
**x[0:4]**

```
array([[-0.90068117,  1.03205722, -1.3412724 , -1.31297673],
       [-1.14301691, -0.1249576 , -1.3412724 , -1.31297673],
       [-1.38535265,  0.33784833, -1.39813811, -1.31297673],
       [-1.50652052,  0.10644536, -1.2844067 , -1.31297673]])
```

#train test slit

**from sklearn.model_selection import train_test_split**
**x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.3,random_state=1)**
**y_test.shape**

(45,)

#training and predicting

**knnmodel=KNeighborsClassifier(n_neighbors=3)**

**knnmodel.fit(x_train,y_train)**

KNeighborsClassifier(n_neighbors=3)

**KNeighborsClassifier(algorithm='auto',leaf_size=30,metric='minkowski',**
**metric_params=None,n_jobs=None,n_neighbors=3,p=2,**
**weights='uniform')**

KNeighborsClassifier(n_neighbors=3)

**y_predict1=knnmodel.predict(x_test)**

# Accuracy

**from sklearn.metrics import accuracy_score**

**acc=accuracy_score(y_test,y_predict1)**
**Acc**

0.9777777777777777

#confusion matrix

**from sklearn.metrics import confusion_matrix**
**cm=confusion_matrix(y_test.values,y_predict1)**
**Cm**

```
array([[14,  0,  0],
       [ 0, 18,  0],
       [ 0,  1, 12]], dtype=int64)
```

**cm1=pd.DataFrame(data=cm,index=['setosa','versicolor','verginica'],columns=['setosa','versicolor','verginica'])**
**cm1**

| | setosa | versicolor | verginica |
|---|---|---|---|
| setosa | 14 | 0 | 0 |
| versicolor | 0 | 18 | 0 |
| verginica | 0 | 1 | 12 |

#output visualization

**prediction_output=pd.DataFrame(data=[y_test.values,y_predict1],index=['y_test','y_predict1'])**

**prediction_output.transpose()**

| | y_test | y_predict1 |
|---|---|---|
| 0 | Iris-setosa | Iris-setosa |
| 1 | Iris-versicolor | Iris-versicolor |
| 2 | Iris-versicolor | Iris-versicolor |
| 3 | Iris-setosa | Iris-setosa |

| | | |
|---|---|---|
| 4 | Iris-virginica | Iris-virginica |
| 5 | Iris-versicolor | Iris-versicolor |
| 6 | Iris-virginica | Iris-virginica |
| 7 | Iris-setosa | Iris-setosa |
| 8 | Iris-setosa | Iris-setosa |
| 9 | Iris-virginica | Iris-virginica |
| 10 | Iris-versicolor | Iris-versicolor |
| 11 | Iris-setosa | Iris-setosa |
| 12 | Iris-virginica | Iris-virginica |
| 13 | Iris-versicolor | Iris-versicolor |
| 14 | Iris-versicolor | Iris-versicolor |
| 15 | Iris-setosa | Iris-setosa |
| 16 | Iris-versicolor | Iris-versicolor |
| 17 | Iris-versicolor | Iris-versicolor |
| 18 | Iris-setosa | Iris-setosa |
| 19 | Iris-setosa | Iris-setosa |
| 20 | Iris-versicolor | Iris-versicolor |
| 21 | Iris-versicolor | Iris-versicolor |
| 22 | Iris-versicolor | Iris-versicolor |
| 23 | Iris-setosa | Iris-setosa |
| 24 | Iris-virginica | Iris-virginica |
| 25 | Iris-versicolor | Iris-versicolor |
| 26 | Iris-setosa | Iris-setosa |
| 27 | Iris-setosa | Iris-setosa |
| 28 | Iris-versicolor | Iris-versicolor |
| 29 | Iris-virginica | Iris-virginica |
| 30 | Iris-versicolor | Iris-versicolor |
| 31 | Iris-virginica | Iris-virginica |
| 32 | Iris-versicolor | Iris-versicolor |
| 33 | Iris-virginica | Iris-virginica |
| 34 | Iris-virginica | Iris-virginica |
| 35 | Iris-setosa | Iris-setosa |
| 36 | Iris-versicolor | Iris-versicolor |
| 37 | Iris-setosa | Iris-setosa |
| 38 | Iris-versicolor | Iris-versicolor |
| 39 | Iris-virginica | Iris-virginica |
| 40 | Iris-virginica | Iris-virginica |
| 41 | Iris-setosa | Iris-setosa |
| 42 | Iris-virginica | Iris-versicolor |
| 43 | Iris-virginica | Iris-virginica |

44 Iris-versicolor Iris-versicolor

**prediction_output.iloc[0,:].value_counts()**

Iris-versicolor 18
Iris-setosa 14
Iris-virginica 13
Name: y_test, dtype: int64