Importing necessary libraries

In [1]:
```python
import pandas as pd
import numpy as np
import sklearn
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
from sklearn import metrics
from sklearn.metrics import *
from sklearn.model_selection import *
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
```

Uploading the data file

In [2]:
```python
from google.colab import files
uploaded  = files.upload()

import io
iris = pd.read_csv(io.BytesIO(uploaded['iris.csv']),names=["Sepal length", "Sepal widt
```

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```
Saving iris.csv to iris.csv
```

Describing the data

In [3]:
```python
# Number of rows and columns of the data
iris.shape
```

Out[3]:
```
(150, 5)
```

In [4]:
```python
# Printing the column names and data type of the columns
col_list = iris.columns
print(type(col_list))
print(col_list[:])
```

```
<class 'pandas.core.indexes.base.Index'>
Index(['Sepal length', 'Sepal width', 'Petal length', 'Petal width',
       'species'],
      dtype='object')
```

In [5]:
```python
# Printing each class count.
iris['species'].value_counts()
```

Out[5]:
```
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
Name: species, dtype: int64
```

In [6]:
```python
# select all the rows and col indices 0 to 3 (Selecting X value) and printing the shap
iris_data = iris.iloc[:,0:4]
iris_data.shape
```

Out[6]:
```
(150, 4)
```

In [7]:
```python
# Printing the head (top 2 data)
iris_data.head(2)
```

Out[7]:

	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

In [8]:
```python
# select all the rows and 4th column (Selecting the Y value) and printing the shape o
iris_lables = iris.iloc[:,4:]
iris_lables.shape
```

Out[8]:
```
(150, 1)
```

In [9]:
```python
# Printing the head (top 2 data)
iris_lables.head(2)
```

Out[9]:

	species
0	Iris-setosa
1	Iris-setosa

Data Standardization

In [10]:
```python
#Standardizing the data using sklearn pre-processing
iris_standard = StandardScaler().fit_transform(iris_data)  # this has transformed data
#each row in df is a list we will have n inner lists in a outer list,thats why length
#length of each inner list is 4.
print('length of iris_standard is ',len(iris_standard))
print('length of inner list is',len(iris_standard[0]))
print('sample elements are')
print((iris_standard[0:3]))
```

```
length of iris_standard is  150
length of inner list is 4
sample elements are
[[-0.90068117  1.03205722 -1.3412724  -1.31297673]
 [-1.14301691 -0.1249576  -1.3412724  -1.31297673]
 [-1.38535265  0.33784833 -1.39813811 -1.31297673]]
```

Splitting the data for training and testing

In [11]:
```python
#splitting dataset into train and test
iris_lables_np = iris_lables.values.reshape(1,150)
x_train, x_test, y_train, y_test = train_test_split(iris_standard, iris_lables_np[0],
print(x_test[0:2],y_test[0:2])
print(len(x_test),len(y_test))
print(len(x_train),len(y_train))
```

```
[[ 0.31099753 -0.58776353  0.53529583  0.00175297]
 [-0.17367395  1.72626612 -1.17067529 -1.18150376]] ['Iris-versicolor' 'Iris-setosa']
50 50
100 100
```

Model Training on Standardizied data

In [12]:
```python
#Training using kNN Classifier
neigh = KNeighborsClassifier(n_neighbors=5)
neigh.fit(x_train, y_train)
```

Out[12]:
```
KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
                     metric_params=None, n_jobs=None, n_neighbors=5, p=2,
                     weights='uniform')
```

Model Prediction

In [13]:
```python
#Predicting
predict_array = neigh.predict(x_test)
print("Accuracy Score =",metrics.accuracy_score(y_test, predict_array))

for i in range(len(predict_array)):
   if (predict_array[i] != y_test[i]):
       print('actual is {} but predicted is {}'.format(y_test[i],predict_array[i]))
       print('Wrong')
```

```
Accuracy Score = 0.98
actual is Iris-virginica but predicted is Iris-versicolor
Wrong
```

Model training and prediction on non-standardized data

In [14]:
```python
#prediction on non standardized data
x_train, x_test, y_train, y_test = train_test_split(iris_data, iris_lables_np[0], test
neigh2 = KNeighborsClassifier(n_neighbors=5)
neigh2.fit(x_train, y_train)
predict_array = neigh2.predict(x_test)
print(metrics.accuracy_score(y_test, predict_array))
```

```
0.98
```

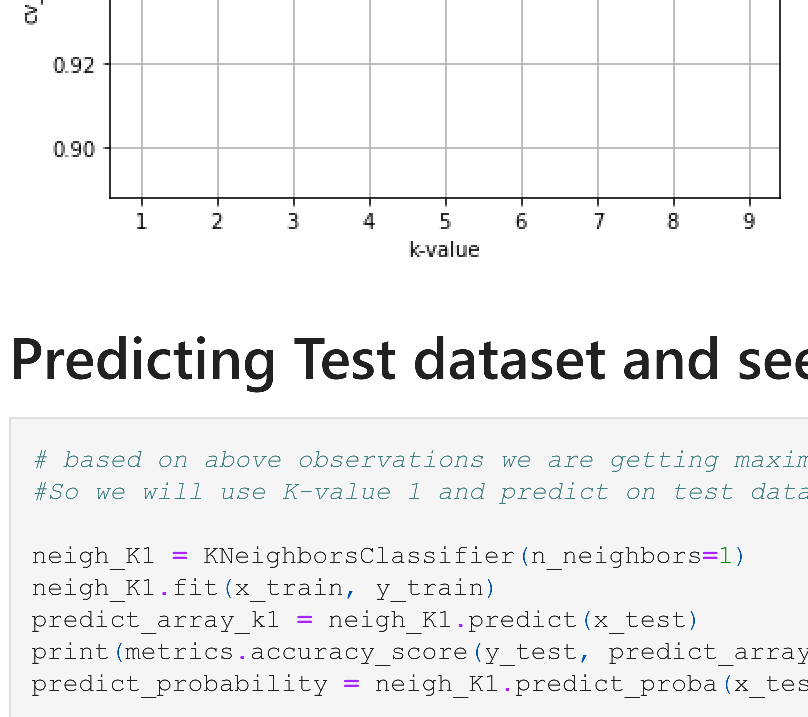
Cross validation using 10 folds and for different K values

In [15]:
```python
#cross validation using 10 folds,cv=10

k_list= [1,3,5,7,9]
cv_scores=[]

for i in k_list:
    cross_neigh = KNeighborsClassifier(n_neighbors=i)
    scores = cross_val_score(cross_neigh,x_train, y_train,cv=10)
    cv_scores.append(np.mean(scores))

print(len(cv_scores))
print(cv_scores)

cv_score_zip=zip(k_list,cv_scores)

for i in cv_score_zip:
    print(i)
```

```
5
[0.9400000000000001, 0.9400000000000001, 0.9400000000000001, 0.9400000000000001, 0.940
0000000000001]
(1, 0.9400000000000001)
(3, 0.9400000000000001)
(5, 0.9400000000000001)
(7, 0.9400000000000001)
(9, 0.9400000000000001)
```

Plotting K-value vs cv_score

In [16]:
```python
#plot for K-value and accuracy using 10 fold cv.
plt.figure('Iris_KNN')
plt.xlabel('k-value')
plt.ylabel('cv_score')
plt.grid()
plt.plot(k_list,cv_scores)
plt.show()
```



Predicting Test dataset and see Accuracy

In [17]:
```python
# based on above observations we are getting maximum accuracy when k=1,
#So we will use K-value 1 and predict on test dataset and see accuracy.

neigh_K1 = KNeighborsClassifier(n_neighbors=1)
neigh_K1.fit(x_train, y_train)
predict_array_k1 = neigh_K1.predict(x_test)
print(metrics.accuracy_score(y_test, predict_array_k1))
predict_probability = neigh_K1.predict_proba(x_test)

cross_predict = cross_val_predict(cross_neigh,x_test,y_test,cv=10)
print(metrics.accuracy_score(y_test, cross_predict))
```

```
0.98
0.96
```

Metrics Evaluation (Confusion Matrix, Classification Report)

In [18]:
```python
#confusion matrix and classification_report
#precision = TP/TP+FP
#Recall = TP/TP+FN

print(metrics.confusion_matrix(y_test, cross_predict))
print(metrics.classification_report(y_test, cross_predict))
```

```
[[19  0  0]
 [ 0 15  0]
 [ 0  2 14]]
                 precision    recall  f1-score   support

    Iris-setosa       1.00      1.00      1.00        19
Iris-versicolor       0.88      1.00      0.94        15
 Iris-virginica       1.00      0.88      0.93        16

       accuracy                           0.96        50
      macro avg       0.96      0.96      0.96        50
   weighted avg       0.96      0.96      0.96        50
```