INDEX

Code:

```
# Practical 1 - Linear Regression Model
print("Practical no.1A : Linear Regression \nName: Rohit \t Roll no.:09")
print("-----------------------------------------------------")
import random
from sklearn.linear_model import LinearRegression

print("Read the train Data")
print("-----------------------------------------------------")
feature_set = []
target_set = []
no_of_rows = 200
limit = 2000
for i in range(0, no_of_rows):
    x = random.randint(0, limit)
    y = random.randint(0, limit)
    z = random.randint(0, limit)
    g = 10 * x + 2 * y + 3 * z
    print("x=", x, "\ty=", y, "\tz=", z, "\tg=",
    g) feature_set.append([x, y, z])
    target_set.append(g)
print("Here the training of model begins. ")
model = LinearRegression()
model.fit(feature_set, target_set)
print("Training of model ends here!")

print("Testing started here")
test_data = [[1, 1, 0]]
print("Test data:", test_data)
prediction = model.predict(test_data)

print("prediction:" + str(prediction) + '\t' + "Coefficient:"
+ str(model.coef_))
```

Output:

```
Practical no.1A : Linear Regression
Name: Rohit      Roll no.:09
-----------------------------------------------------
Read the train Data
-----------------------------------------------------
x= 1199     y= 1625     z= 718  g= 17394
x= 1942     y= 1275     z= 102  g= 22276
x= 1307     y= 417  z= 1243     g= 17633
x= 1294     y= 1087     z= 1492     g= 19590
x= 1085     y= 647  z= 1488     g= 16608
x= 476  y= 1948     z= 1836     g= 14164
x= 846  y= 1130     z= 12   g= 10756
x= 1720     y= 239  z= 191  g= 18251
x= 1967     y= 1351     z= 1766     g= 27670
x= 713  y= 1612     z= 1379     g= 14491
x= 326  y= 651  z= 971  g= 7475
x= 1402     y= 466  z= 237  g= 15663
x= 326  y= 1436     z= 973  g= 9051
x= 322  y= 62   z= 1479     g= 7781
x= 1047     y= 198  z= 510  g= 12396
x= 1309     y= 1547     z= 1028     g= 19268
Here the training of model begins.
Training of model ends here!
Testing started here
Test data: [[1, 1, 0]]
prediction:[12.]    Coefficient:[10.  2.  3.]
```

Training data → dataset_1b.csv

Sky	Temp	Humidity	Wind	Water	Forecast	EnjoySport
Sunny	Warm	Normal	Strong	Warm	Same	Yes
Sunny	Warm	High	Strong	Warm	Same	Yes
Rainy	Cold	High	Strong	Warm	Change	No
Sunny	Warm	High	Strong	Cool	Change	Yes

Code:

```
import csv

num_attributes = 6
dataset = []
print("Name: Rohit \tRoll No: 09")
print("Training data")

with open(r"data_find_s_1b.csv", "r") as csvfile:
    reader = csv.reader(csvfile)
    for row in reader:
        dataset.append(row)

# print(row)
# print(dataset)
print("\n The initial value of hypothesis:
") hypothesis = ['0'] * num_attributes
print(hypothesis)

for j in range(0, num_attributes):
    hypothesis[j] = dataset[1][j]
    print("\n Find S: Finding a Maximally Specific Hypothesis \n:")
    for i in range(1, len(dataset)):
        if dataset[i][num_attributes] == 'Yes':
            for j in range(0, num_attributes):
                if dataset[i][j] != hypothesis[j]:
                    hypothesis[j] = '?'
                else:
                    hypothesis[j] = dataset[i][j]
        print("For Training instance no:{0} the hypothesis is
".format(i), hypothesis)
```

```
    print("\n The Maximally Specific Hypothesis for a given
training examples: \n")
    print(hypothesis)
```

Output:

```
Training data

 The initial value of hypothesis:
['0', '0', '0', '0', '0', '0']

 Find S: Finding a Maximally Specific Hypothesis
:
For Training instance no:1 the hypothesis is  ['Sunny', '?', '?', '?', '?', '?']
For Training instance no:2 the hypothesis is  ['Sunny', '?', '?', '?', '?', '?']
For Training instance no:3 the hypothesis is  ['Sunny', '?', '?', '?', '?', '?']
For Training instance no:4 the hypothesis is  ['Sunny', '?', '?', '?', '?', '?']

 The Maximally Specific Hypothesis for a given training examples:

['Sunny', '?', '?', '?', '?', '?']

 Find S: Finding a Maximally Specific Hypothesis
:
```

PROBLEMS 1 OUTPUT DEBUG CONSOLE TERMINAL JUPYTER

```
For Training instance no:2 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', '?', '?']
For Training instance no:3 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', '?', '?']
For Training instance no:4 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', '?', '?']

 The Maximally Specific Hypothesis for a given training examples:

['Sunny', 'Warm', '?', 'Strong', '?', '?']

 Find S: Finding a Maximally Specific Hypothesis
:
For Training instance no:1 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', 'Warm', '?']
For Training instance no:2 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', 'Warm', '?']
For Training instance no:3 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', 'Warm', '?']
For Training instance no:4 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', '?', '?']

 The Maximally Specific Hypothesis for a given training examples:

['Sunny', 'Warm', '?', 'Strong', '?', '?']

 Find S: Finding a Maximally Specific Hypothesis
:
For Training instance no:1 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', '?', 'Same']
For Training instance no:2 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', '?', 'Same']
For Training instance no:3 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', '?', 'Same']
For Training instance no:4 the hypothesis is  ['Sunny', 'Warm', '?', 'Strong', '?', '?']

 The Maximally Specific Hypothesis for a given training examples:

['Sunny', 'Warm', '?', 'Strong', '?', '?']
PS C:\Users\Shalu\Documents\mscit\practical\Machine Learning> data_find_s_1b.csv
```

Perform Data Loading, Feature selection (Principal Component analysis) and Feature Scoring and Ranking.

Code:

```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.decomposition import PCA
from sklearn.preprocessing import StandardScaler

print("Name: Rohit \tRoll No: 09")

# Reading dataset using pandas
url = 'https://archive.ics.uci.edu/ml/machine-
learning-databases/iris/iris.data'
names = ["sepal-length", "sepal-width", "petal-length", "petal-
width", "class"]
dataset = pd.read_csv(url, names=names)

# Display dataset
print(dataset.head(10))
X = dataset.drop("class", 1)
Y = dataset["class"]

# Splitting the train and test datasets

x_train, x_test, y_train, y_test = train_test_split(X, Y,
test_size=0.2, random_state=0)

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

# Display Training and testing data

print(f"\nDataSet before PCA :\n\nTrain :\n{x_train}\n\nTest
:\n{x_test}")
# print(x_train)
# print(x_test)

# Creating PCA
```

```
pca = PCA()
x_train = pca.fit_transform(x_train)
x_test = pca.transform(x_test)

# Giving a principal feature to
model pca = PCA(n_components=2)
x_train = pca.fit_transform(x_train)
x_test = pca.transform(x_test)

print(f"\nDataSet After PCA :\n\nTrain :\n{x_train}\n\nTest
:\n{x_test}")
```

Output:

```
   sepal-length  sepal-width  petal-length  petal-width        class
0           5.1          3.5           1.4          0.2  Iris-setosa
1           4.9          3.0           1.4          0.2  Iris-setosa
2           4.7          3.2           1.3          0.2  Iris-setosa
3           4.6          3.1           1.5          0.2  Iris-setosa
4           5.0          3.6           1.4          0.2  Iris-setosa
5           5.4          3.9           1.7          0.4  Iris-setosa
6           4.6          3.4           1.4          0.3  Iris-setosa
7           5.0          3.4           1.5          0.2  Iris-setosa
8           4.4          2.9           1.4          0.2  Iris-setosa
9           4.9          3.1           1.5          0.1  Iris-setosa
c:\Users\Shalu\Documents\mscit\practical\Machine Learning\prac_2a.py:15: FutureWarning: In a future version of pandas all arguments of DataFrame.drop except for the argument 'labels' wil
  X = dataset.drop("class", 1)

DataSet before PCA :

Train :
[[ 0.61303014  0.10850105  0.94751783  0.73603967]
 [-0.56776627 -0.12400121  0.38491447  0.34808318]
 [-0.80392556  1.03851009 -1.30289562 -1.3330616 ]
 [ 0.25879121 -0.12400121  0.60995581  0.73603967]
 [ 0.61303014 -0.58900572  1.00377816  1.25331499]
 [-0.80392556 -0.82150798  0.04735245  0.21876435]
```

For a given set of training data examples stored in CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

Data set :data_2b.csv

sky	airtemp	humidity	wind	water	forcast	enjoysport
sunny	warm	normal	strong	warm	same	yes
sunny	warm	high	strong	warm	same	yes
rainy	cold	high	strong	warm	change	no
sunny	warm	high	strong	cool	change	yes

Code:

```
import numpy as np
import pandas as pd

print("Name: Rohit \tRoll No: 09")
data = pd.read_csv(r'C:\Users\Shalu\Documents\mscit\practical\Machine
Learning\data_find_s_1b.csv')
concepts = np.array(data.iloc[:, 0:-1])
print("\nInstances are:\n", concepts)
target = np.array(data.iloc[:, -1])
print("\nTarget Values are: ", target)

def learn(concepts, target):
    specific_h = concepts[0].copy()
    print("\nInitialization of specific_h and genearal_h")
    print("\nSpecific Boundary: ", specific_h)
    general_h = [["?" for i in range(len(specific_h))] for i
in range(len(specific_h))]
    print("\nGeneric Boundary: ", general_h)

    for i, h in enumerate(concepts):
        print("\nInstance", i + 1, "is ", h)
        if target[i] == "Yes":
            print("Instance is Positive ")
            for x in range(len(specific_h)):
                if h[x] != specific_h[x]:
```

```
                    specific_h[x] = '?'
                    general_h[x][x] = '?'

        if target[i] == "No":
            print("Instance is Negative ")
            for x in range(len(specific_h)):
                if h[x] != specific_h[x]:
                    general_h[x][x] = specific_h[x]
                else:
                    general_h[x][x] = '?'

        print("Specific Bundary after ", i + 1, "Instance is ",
specific_h)
        print("Generic Boundary after ", i + 1, "Instance is ",
general_h)
        print("\n")

    indices = [i for i, val in enumerate(general_h) if val == ['?',
'?', '?', '?', '?', '?']]
    for i in indices:
        general_h.remove(['?', '?', '?', '?', '?', '?'])
    return specific_h, general_h

s_final, g_final = learn(concepts, target)

print("Final Specific_h: ", s_final, sep="\n")
print("Final General_h: ", g_final, sep="\n")
```

Output:

```
Instances are:
 [['Sunny' 'Warm' 'Normal' 'Strong' 'Warm' 'Same']
 ['Sunny' 'Warm' 'High' 'Strong' 'Warm' 'Same']
 ['Rainy' 'Cold' 'High' 'Strong' 'Warm' 'Change']
 ['Sunny' 'Warm' 'High' 'Strong' 'Cool' 'Change']]

Target Values are:  ['Yes' 'Yes' 'No' 'Yes']

Initialization of specific_h and genearal_h

Specific Boundary:  ['Sunny' 'Warm' 'Normal' 'Strong' 'Warm' 'Same']

Instance is Negative
Specific Bundary after  3 Instance is  ['Sunny' 'Warm' '?' 'Strong' 'Warm' 'Same']
Generic Boundary after  3 Instance is  [['Sunny', '?', '?', '?', '?', '?'], ['?', 'Warm', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?
', 'Same']]


Instance 4 is  ['Sunny' 'Warm' 'High' 'Strong' 'Cool' 'Change']
Instance is Positive
Specific Bundary after  4 Instance is  ['Sunny' 'Warm' '?' 'Strong' '?' '?']
Generic Boundary after  4 Instance is  [['Sunny', '?', '?', '?', '?', '?'], ['?', 'Warm', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?', '?'], ['?', '?', '?', '?', '?
', '?']]


Final Specific_h:
['Sunny' 'Warm' '?' 'Strong' '?' '?']
Final General_h:
[['Sunny', '?', '?', '?', '?', '?'], ['?', 'Warm', '?', '?', '?', '?']]
PS C:\Users\Shalu\Documents\mscit\practical\Machine Learning> []
```

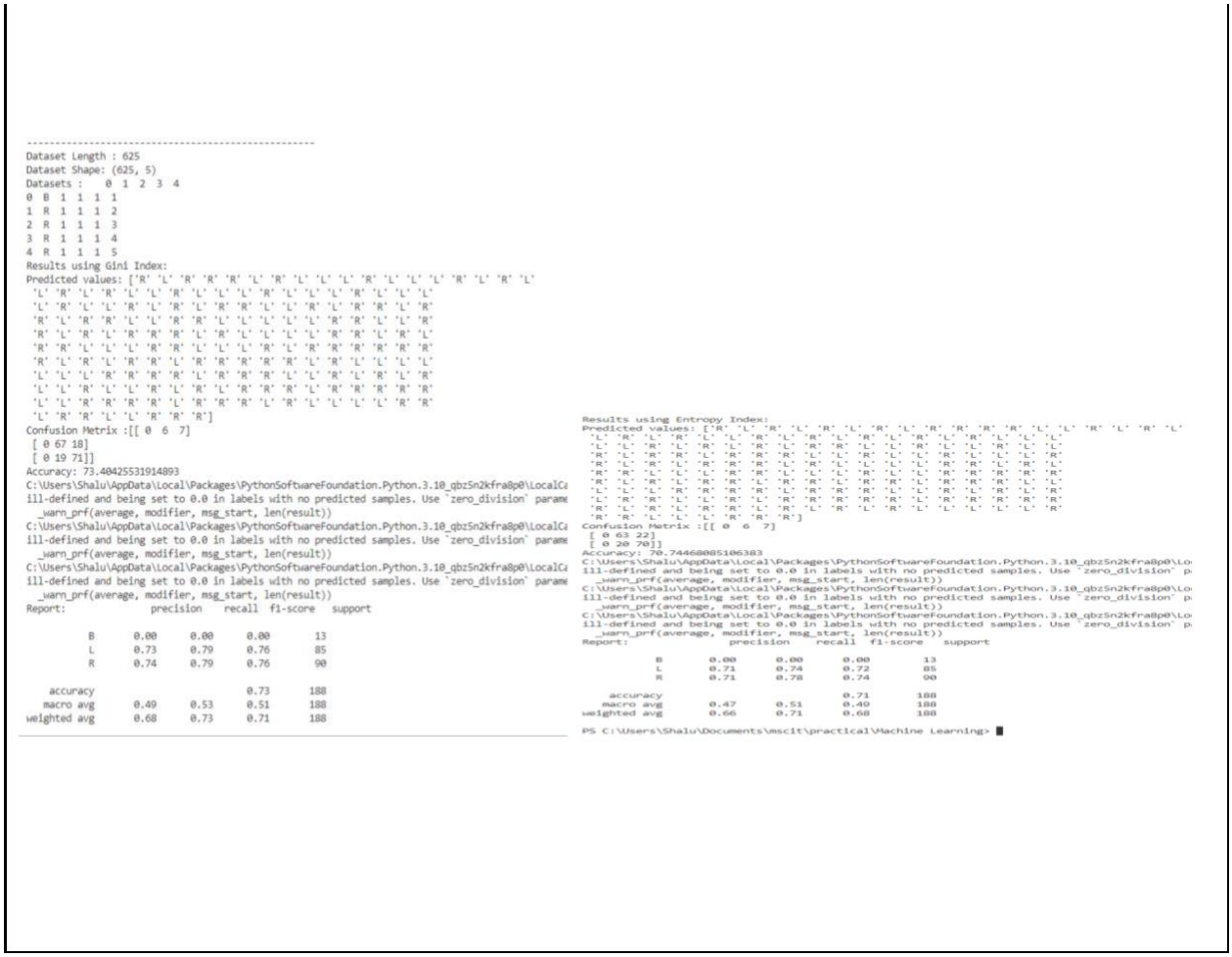
Write a program to implement Decision Tree and Random forest with Prediction, Test Score and Confusion Matrix.

Code:

```
#    Decision tree

import pandas as pd

from sklearn.model_selection import train_test_split

from sklearn.tree import DecisionTreeClassifier

from sklearn.metrics import confusion_matrix,
accuracy_score, classification_report


def read_datasets():

    print("------------------------------------------------------")

    datasets = pd.read_csv("https://archive.ics.uci.edu/ml/machine-
learning-databases/balance-scale/balance-scale.data",

                           sep=",", header=None)

    print(f"Dataset Length : {len(datasets)}")

    print(f"Dataset Shape: {datasets.shape}")

    print(f"Datasets : {datasets.head()}")

    return datasets

# Spliting Datasets into train and

test def splitdataset(datasets):

    X = datasets.values[:, 1:5]

    Y = datasets.values[:, 0]

    X_train, X_test, y_train, y_test = train_test_split(X,
Y, test_size=0.3, random_state=100)

    # print(f"x_train:{X_train}\n x_test: {X_test}\n
y_train: {y_train}\n y_test: {y_test}")

    return X_train, X_test, y_train, y_test

def train_using_gini(X_train, y_train):

    clf_gini = DecisionTreeClassifier(criterion='gini',
random_state=100, max_depth=3, min_samples_leaf=5)

    clf_gini.fit(X_train, y_train)

    return clf_gini
```

```
def train_using_entropy(X_train, y_train):

    clf_entropy = DecisionTreeClassifier(criterion='entropy',
random_state=100, max_depth=3, min_samples_leaf=5)

    clf_entropy.fit(X_train, y_train)

    return clf_entropy

def prediction(X_test, clf_object):

    y_pred = clf_object.predict(X_test)

    print(f"Predicted values: {y_pred}")

    return y_pred

def cal_accuracy(y_test, y_pred):

    print(f"Confusion Metrix :{confusion_matrix(y_test, y_pred)}")

    print(f"Accuracy: {accuracy_score(y_test, y_pred) * 100}")

    print(f"Report: {classification_report(y_test, y_pred)}")

def main():

    datasets = read_datasets()

    X_train, X_test, y_train, y_test = splitdataset(datasets)

    clf_gini = train_using_gini(X_train, y_train)

    clf_entropy = train_using_entropy(X_train, y_train)

    print("Results using Gini Index: ")

    y_pred_gini = prediction(X_test, clf_gini)

    cal_accuracy(y_test, y_pred_gini)

    print("Results using Entropy Index: ")

    y_pred_entropy = prediction(X_test, clf_entropy)

    cal_accuracy(y_test, y_pred_entropy

if __name__ == "__main__":

    main()
```

Output:


Dataset Length : 625
Dataset Shape: (625, 5)
Results using Gini Index:
Confusion Metrix :[[0 6 7]
[0 67 18]
[0 19 71]]
Accuracy: 73.40425531914893
Report: precision recall f1-score support
B 0.00 0.00 0.00 13
L 0.73 0.79 0.76 85
R 0.74 0.79 0.76 90
accuracy 0.73 188
macro avg 0.49 0.53 0.51 188
weighted avg 0.68 0.73 0.71 188
Results using Entropy Index:
Confusion Metrix :[[0 6 7]
[0 63 22]
[0 20 70]]
Accuracy: 70.74468085106383
Report: precision recall f1-score support
B 0.00 0.00 0.00 13
L 0.71 0.74 0.72 85
R 0.71 0.78 0.74 90
accuracy 0.71 188
macro avg 0.47 0.51 0.49 188
weighted avg 0.66 0.71 0.68 188
PS C:\Users\Shalu\Documents\mscit\practical\Machine Learning>

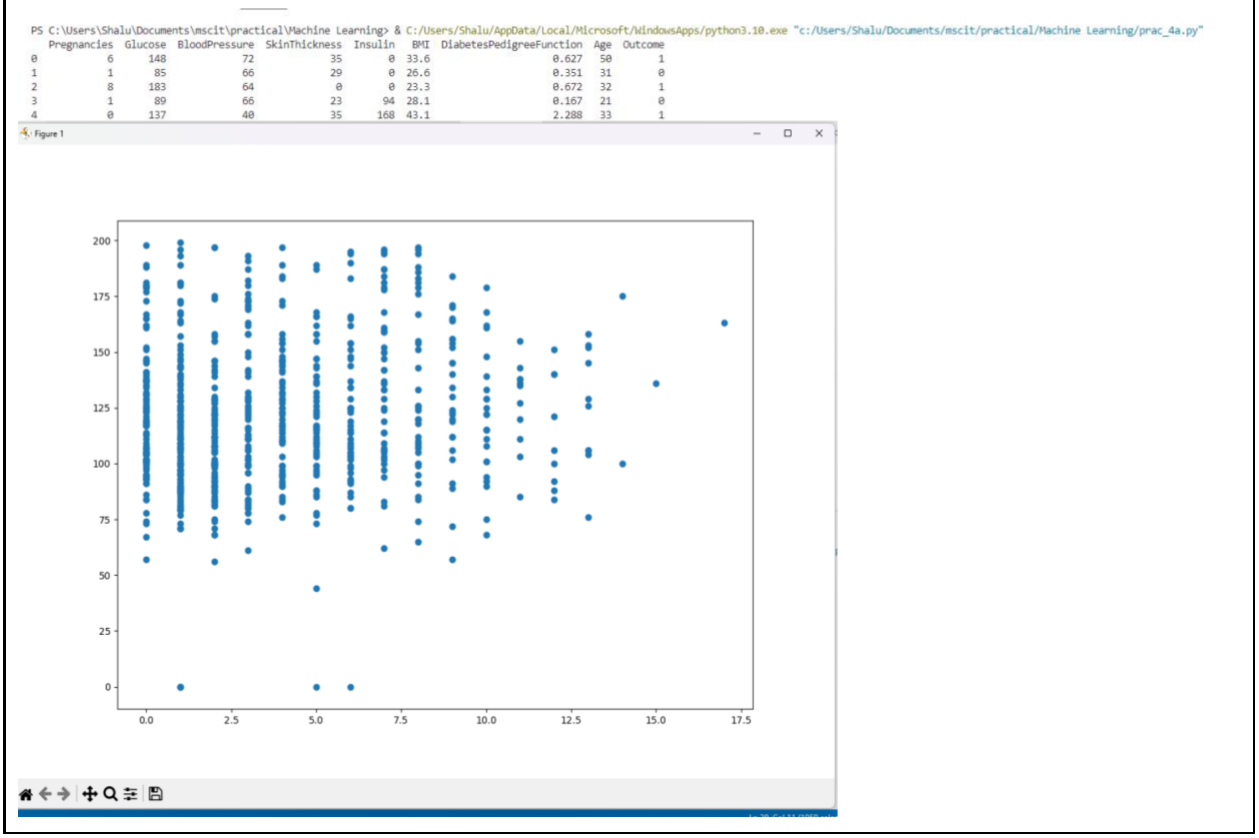
For a given set of training data examples stored in a .CSV file implement Least Square Regression algorithm. (Use Univariate dataset)

Code:

```
"""
Practical No - 4A.
 For a given set of training data examples stored in a .CSV
file implement Least Square Regression algorithm. (Use
Univariate dataset )
"""
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
# from sklearn.model_selection import train_test_split
# from sklearn.preprocessing import StandardScaler
# from sklearn.linear_model import Lea
# from sklearn.metrics import confusion_matrix,
accuracy_score plt.rcParams['figure.figsize']=(12.0,9.0)

dataset =
pd.read_csv("https://raw.githubusercontent.com/plotly/datasets/master/di
abetes.csv")
print(dataset.head())
print("Name: Rohit, Roll no: 09")
x = dataset.iloc[:,0]
y = dataset.iloc[:,1]
plt.scatter(x, y)
plt.show()

x_mean = np.mean(x)
y_mean = np.mean(y)
num = 0
den = 0

for i in range(len(x)):
    num += (x[i] -x_mean)*(y[i]-y_mean)
```

```
    den += (x[i] -x_mean)**2

m = num/den
c = y_mean -
m*x_mean print(m,c)
y_pred = m*x +c

plt.scatter(x,y)
plt.plot([min(x), max(x)], [min(y_pred), max(y_pred)], color="red")
plt.show()
```

Output:



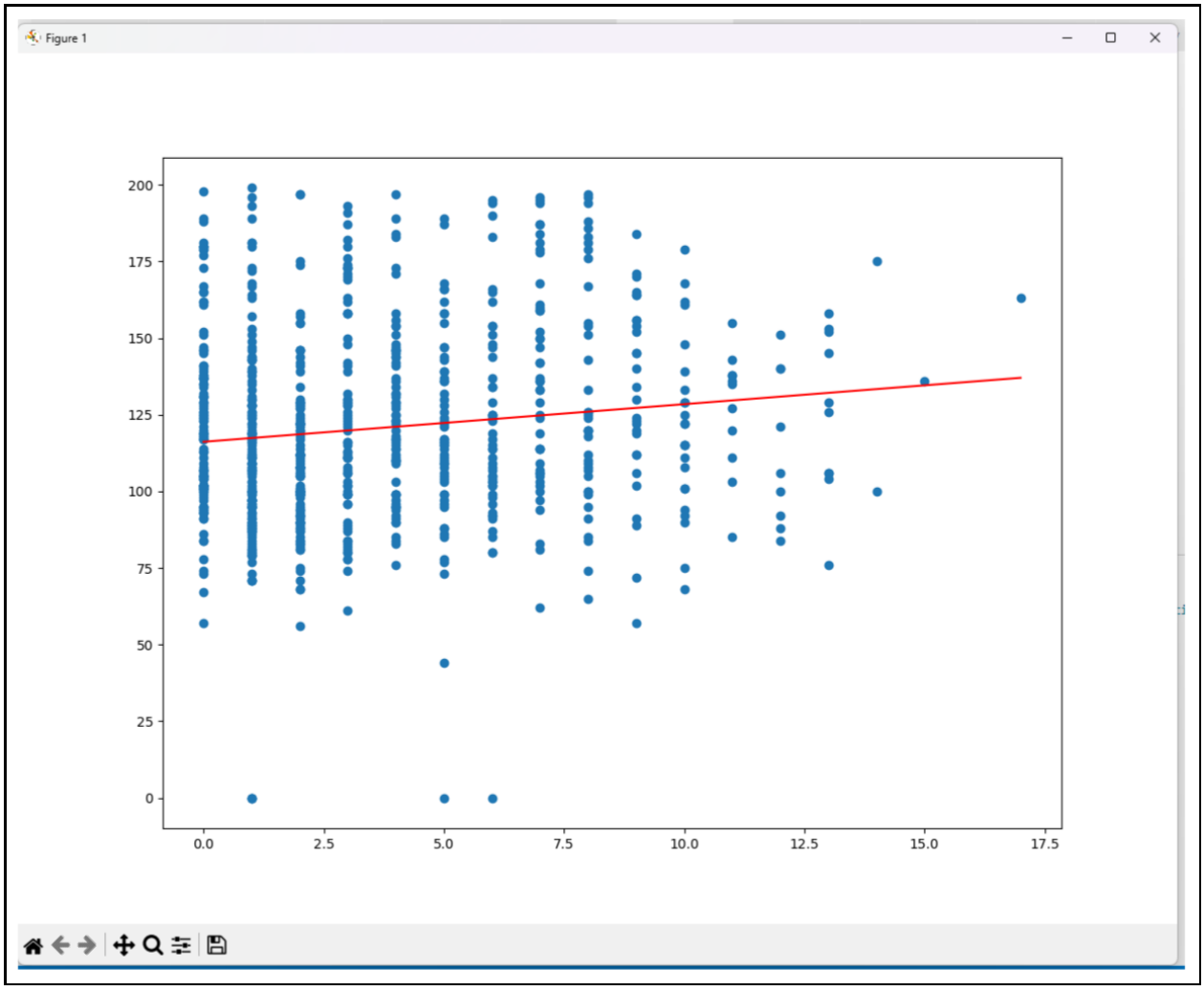


Figure 1
200
175
150
125
100
75
50
25
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5

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


print("Name: Rohit \tRoll No: 09")

dataset =
pd.read_csv("https://raw.githubusercontent.com/plotly/datasets/master/di
abetes.csv")
print(dataset.head())
x = dataset.iloc[:, [0, 1, 2, 3, 4, 5, 6, 7]].values
y = dataset.iloc[:, [-1]].values
print(x)
print(y)

x_train, x_test, y_train, y_test = train_test_split(x, y,
test_size=0.2, random_state=0)
sc = StandardScaler()
x_train = sc.fit_transform(x_train)
x_test = sc.transform(x_test)

print(x_train[0:15, :])

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

y_pred = classifier.predict(x_test)

cm = confusion_matrix(y_test, y_pred)
print("Confusion Matrix :\n ", cm)

print("Accuracy :", accuracy_score(y_test, y_pred))
```

Output:

```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  DiabetesPedigreeFunction  Age  Outcome
0            6      148             72             35        0  33.6                     0.627   50        1
1            1       85             66             29        0  26.6                     0.351   31        0
2            8      183             64              0        0  23.3                     0.672   32        1
3            1       89             66             23       94  28.1                     0.167   21        0
4            0      137             40             35      168  43.1                     2.288   33        1
[[  6.    148.     72.    ...  33.6     0.627  50.   ]
 [  1.     85.     66.    ...  26.6     0.351  31.   ]
 [  8.    183.     64.    ...  23.3     0.672  32.   ]
 ...
 [  5.    121.     72.    ...  26.2     0.245  30.   ]
 [  1.    126.     60.    ...  30.1     0.349  47.   ]
 [  1.     93.     70.    ...  30.4     0.315  23.   ]]
[[1]
 [0]
 [1]
 [0]
 [1]
 [0]]
[[-1.12606292 -0.05964563 -3.54371676 -1.28581572 -0.69965674  0.02444697
  -0.97758975 -0.79911377]
 [ 2.65209354 -1.41253563 -0.47230103 -1.28581572 -0.69965674  0.07502976
  -0.86044863  0.61680026]
 [-0.54400808 -0.3113461  -0.47230103 -1.28581572 -0.69965674 -0.75958622
  -0.37085882 -0.88240283]
 [-0.25418066  0.12912972 -0.57468156 -1.28581572 -0.69965674 -0.0767186
  -0.94755357 -0.79911377]]
C:\Users\Shalu\AppData\Local\Packages\PythonSoftwareFoundation.Python.3.10_qbz5n2kfra8p0\LocalCache\local-packages\Python310\site-packages\sklearn\utils\validation.py:1111: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
  y = column_or_1d(y, warn=True)
Confusion Matrix :
  [[98  9]
 [18 29]]
Accuracy : 0.8246753246753247
PS C:\Users\Shalu\Documents\mscit\practical\Machine Learning>
```

Code:

```
""" Write a program to implement k-Nearest Neighbour
algorithm to classify the iris data set.
 """
from sklearn.neighbors import KNeighborsClassifier
from sklearn.preprocessing import StandardScaler
from sklearn.pipeline import make_pipeline
from sklearn import datasets
from sklearn.model_selection import train_test_split,GridSearchCV

iris=datasets.load_iris()
X=iris.data
Y=iris.target
## Create train and test split X_train,X_test,Y_train,Y_test =
train_test_split(X,Y,test_size=0.3,random_state=42,stratify=Y )


#feature Scaling using StandardScalar
sc= StandardScaler()
sc.fit(X_train)
X_train_std= sc.transform(X_train)
X_test_std= sc.transform(X_test)

#Fit the model
knn=KNeighborsClassifier(n_neighbors=5,p=2,weights='uniform',algorithm='
auto')
knn.fit(X_train_std,Y_train)

#Evaluate the training and test score
print("Name: Rohit \t Roll no: 09")
print("Traing Accuracy score: %.3f " %knn.score(X_train_std,Y_train))
print("Test Accuracy score: %.3f" %knn.score(X_test_std,Y_test))

iris=datasets.load_iris()
X=iris.data
Y=iris.target
```

```
## Create train and test split X_train,X_test,Y_train,Y_test =
train_test_split(X,Y,test_size=0.3,random_state=42,stratify=Y )


#create a pipeline
pipeline=make_pipeline(StandardScaler(),KNeighborsClassifier())

#Create a parameter
param_grid=[{
    'kneighborsclassifier__n_neighbors':[2,3,4,5,6,7,8,9,10],
    'kneighborsclassifier__p':[1,2],
    'kneighborsclassifier__weights':['uniform','distance'],

'kneighborsclassifier__algorithm':['auto','ball_tree','kd_tree','brute' }]

#Create a grid search instance
gs=GridSearchCV(pipeline, param_grid=param_grid,
                scoring="accuracy",
                refit=True,
                cv=10,
                verbose=1,
                n_jobs=2)

gs.fit(X_train,Y_train)

#print best model parameter and score
print("Best Score: %.3f " %gs.best_score_ ,"
\nBest Parameters:",gs.best_params_)
```

Output:

```
Traing Accuracy score: 0.981
Test Accuracy score: 0.911
Fitting 10 folds for each of 144 candidates, totalling 1440 fits
Best Score: 0.972
Best Parameters: {'kneighborsclassifier__algorithm': 'auto', 'kneighborsclassifier__n_neighbors': 5, 'kneighborsclassifier__p': 1, 'kneighborsclassifier__weights': 'uniform'}
PS C:\Users\Shalu\Documents\mscit\practical\Machine Learning>
```

Code:

```
# Q. 6A. Implement the different Distance methods (Euclidean,
Manhattan Distance, Minkowski Distance)

# with Prediction, Test Score and Confusion Matrix.

from math import sqrt

from sklearn.metrics import confusion_matrix, classification_report


print("Practical no.3 : Decision tree \nName: Rohit \t Roll no.:09")

print("----------------------------------------------------")

def euclidian_distance(a, b):

    return sqrt(sum((e1 - e2) ** 2 for e1, e2 in zip(a, b)))

def manhattan_distance(a, b):

    return sum(abs(e1 - e2) for e1, e2 in zip(a, b))

def minkowski_distance(a, b, p):

    return sum(abs(e1 - e2) ** p for e1, e2 in zip(a, b)) ** (1 /
p) actual = [1, 0, 0, 1, 0, 0, 1, 0, 0, 1]

predicted = [1, 0, 0, 1, 0, 0, 0, 1, 0, 0] dist1 =

euclidian_distance(actual, predicted) dist2 =

manhattan_distance(actual, predicted) dist3 =

minkowski_distance(actual, predicted, 1)

print(f"Euclidian_dist: {dist1}\nManhattan_dist: {dist2}\nMinkowski_dist
with value 1: {dist3}")

dist4 = minkowski_distance(actual, predicted, 2)

print(f"Minkowski_dist with value 2: {dist4}\n")


matrix = confusion_matrix(actual, predicted, labels=[1, 0])
```

```
print("Confusion_matrix: \n", matrix)

tp, fn, fp, tn = confusion_matrix(actual, predicted, labels=[1,
0]).reshape(-1)

print("Outcome values: \n", tp, fn, fp, tn)

matrix = classification_report(actual, predicted, labels=[1, 0])

print("Classification_report: \n", matrix)
```

Output:

```
--------------------------------------------------
Euclidian_dist: 1.7320508075688772
Manhattan_dist: 3
Minkowski_dist with value 1: 3.0
Minkowski_dist with value 2: 1.7320508075688772

Confusion_matrix:
 [[2 2]
 [1 5]]
Outcome values:
 2 2 1 5
Classification_report:
              precision    recall  f1-score   support

           1       0.67      0.50      0.57         4
           0       0.71      0.83      0.77         6

    accuracy                           0.70        10
   macro avg       0.69      0.67      0.67        10
weighted avg       0.70      0.70      0.69        10

PS C:\Users\Shalu\Documents\mscit\practical\Machine Learning>
```

Code:

```
# Common imports

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import StandardScaler from
sklearn.model_selection import train_test_split from
sklearn.neighbors import KNeighborsClassifier from
sklearn.metrics import classification_report from
sklearn.metrics import confusion_matrix

# Import the data set
raw_data = pd.read_csv(
    'https://raw.githubusercontent.com/imhardikj/A-Model-a-
Day/master/K-Nearest%20Neighbors/Classified%20Data.csv',
    index_col=0)

# Standardize the data set
scaler = StandardScaler()
scaler.fit(raw_data.drop('TARGET CLASS', axis=1))
scaled_features = scaler.transform(raw_data.drop('TARGET
CLASS', axis=1))
scaled_data = pd.DataFrame(scaled_features,
columns=raw_data.drop('TARGET CLASS', axis=1).columns)

# Split the data set into training data and test data

x = scaled_data
y = raw_data['TARGET CLASS']
x_training_data, x_test_data, y_training_data, y_test_data
= train_test_split(x, y, test_size=0.3)
```

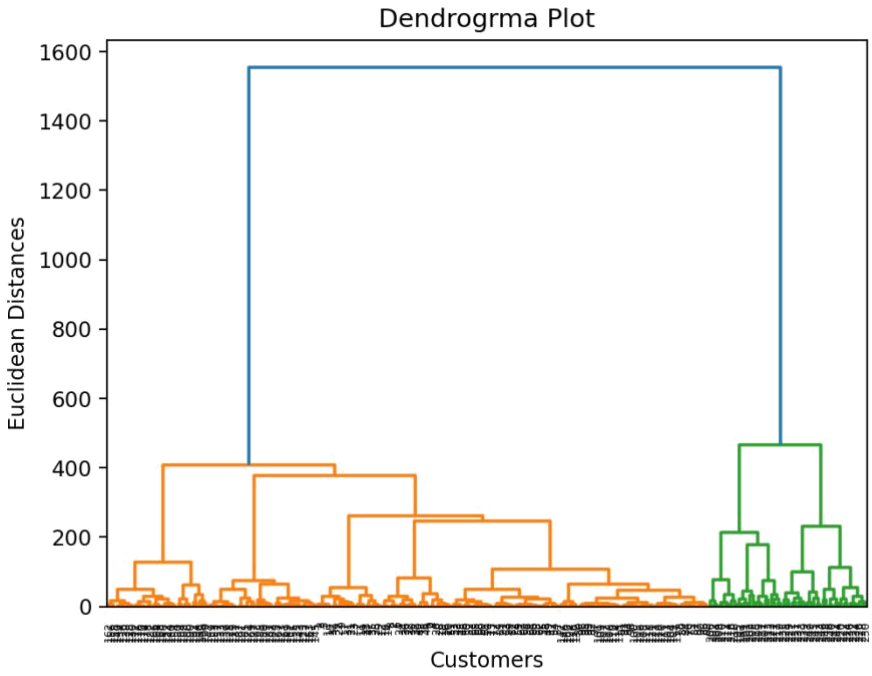
```
# Train the model and make predictions
model = KNeighborsClassifier(n_neighbors=1)
model.fit(x_training_data, y_training_data)
predictions = model.predict(x_test_data)

# Performance measurement
print(classification_report(y_test_data, predictions))
print(confusion_matrix(y_test_data, predictions))

# Selecting an optimal K value
error_rates = []

# for i in np.arange(1, 101):
new_model = KNeighborsClassifier(n_neighbors=1)
new_model.fit(x_training_data, y_training_data)
new_predictions = new_model.predict(x_test_data)
error_rates.append(np.mean(new_predictions != y_test_data))
plt.figure(figsize=(16, 12))
plt.plot(error_rates)
plt.show()
```

Output:

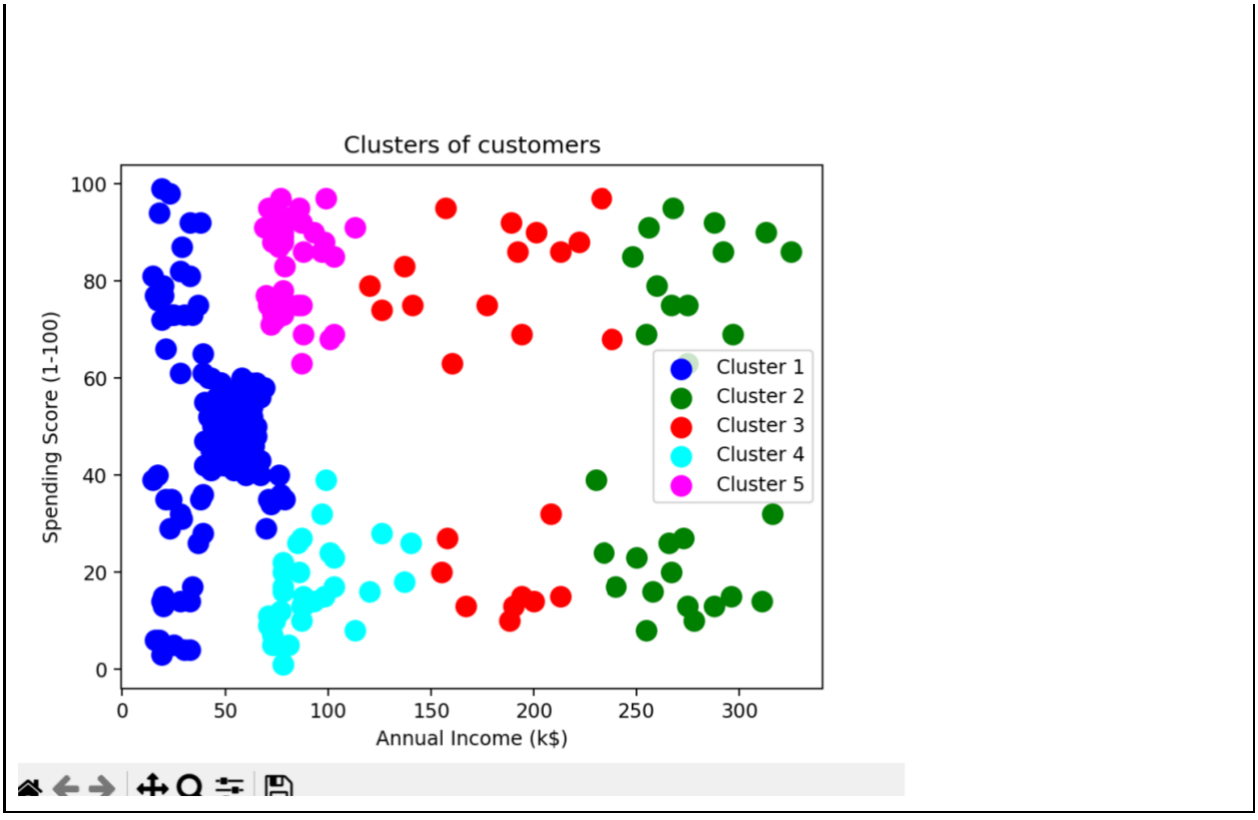
```
              precision    recall  f1-score   support

           0       0.92      0.91      0.92       143
           1       0.92      0.93      0.92       157

    accuracy                           0.92       300
   macro avg       0.92      0.92      0.92       300
weighted avg       0.92      0.92      0.92       300

[[130  13]
 [ 11 146]]
```

Code:

```
'''
Implement the classification model using clustering for the
following techniques with hierarchical clustering with Prediction,
Test Score and Confusion Matrix
'''

# Importing the libraries
import numpy as nm
import matplotlib.pyplot as
mtp import pandas as pd

# Importing the dataset
dataset = pd.read_csv('7_Mall_Customers.csv')
x = dataset.iloc[:, [3, 4]].values

# Finding the optimal number of clusters using the
dendrogram import scipy.cluster.hierarchy as shc

dendro = shc.dendrogram(shc.linkage(x, method="ward"))
mtp.title("Dendrogrma Plot")
mtp.ylabel("Euclidean Distances")
mtp.xlabel("Customers")
mtp.show()

# training the hierarchical model on dataset
from sklearn.cluster import AgglomerativeClustering

hc = AgglomerativeClustering(n_clusters=5,
affinity='euclidean', linkage='ward')
y_pred = hc.fit_predict(x)

# visulaizing the clusters
mtp.scatter(x[y_pred == 0, 0], x[y_pred == 0, 1], s=100,
c='blue', label='Cluster 1')
mtp.scatter(x[y_pred == 1, 0], x[y_pred == 1, 1], s=100,
c='green', label='Cluster 2')
mtp.scatter(x[y_pred == 2, 0], x[y_pred == 2, 1], s=100,
c='red', label='Cluster 3')
mtp.scatter(x[y_pred == 3, 0], x[y_pred == 3, 1], s=100,
c='cyan', label='Cluster 4')
mtp.scatter(x[y_pred == 4, 0], x[y_pred == 4, 1], s=100,
c='magenta', label='Cluster 5')
mtp.title('Clusters of customers')
mtp.xlabel('Annual Income (k$)')
mtp.ylabel('Spending Score (1-100)')
mtp.legend()
mtp.show()
```


Dendrogrma Plot
Euclidean Distances
1600
1400
1200
1000
800
600
400
200
0
Customers

Output:


Clusters of customers
Spending Score (1-100)
100
80
60
40
20
0
0
50
100
150
200
250
300
Annual Income (k$)
Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5

Code:

```
"""
A. Write a program to construct a Bayesian network considering
medical data.
Use this model to demonstrate the diagnosis of heart patients
using standard Heart Disease Data Set.
"""

import numpy as np
import pandas as pd
import csv
from pgmpy.estimators import MaximumLikelihoodEstimator
from pgmpy.models import BayesianNetwork
from pgmpy.inference import VariableElimination

heartDisease = pd.read_csv('8a_heart_data.csv')
heartDisease = heartDisease.replace('?',np.nan)

print('Sample instances from the dataset are given below')
print(heartDisease.head())

print('\n Attributes and datatypes')
print(heartDisease.dtypes)

model=
BayesianNetwork([('age','heartdisease'),('gender','heartdisease'),('exan
g','heartdisease'),('cp','heartdisease'),('heartdisease','restecg'),('he
artdisease','chol')])
print('\nLearning CPD using Maximum likelihood estimators')
model.fit(heartDisease,estimator=MaximumLikelihoodEstimator)

print('\n Inferencing with Bayesian Network:')
HeartDiseasetest_infer = VariableElimination(model)

print('\n 1. Probability of HeartDisease given evidence= restecg')
q1=HeartDiseasetest_infer.query(variables=['heartdisease'],evidence={'re
stecg':1})
print(q1)

print('\n 2. Probability of HeartDisease given evidence= cp ')
q2=HeartDiseasetest_infer.query(variables=['heartdisease'],evidence={'cp
':2})
print(q2)
```

Output:

```
Sample instances from the dataset are given below
   age  gender  cp  trestbps  chol  ...  oldpeak  slope  ca  thal  heartdisease
0   63       1   1       145   233  ...      2.3      3   0     6             0
1   67       1   4       160   286  ...      1.5      2   3     3             2
2   67       1   4       120   229  ...      2.6      2   2     7             1
3   37       1   3       130   250  ...      3.5      3   0     3             0
4   41       0   2       130   204  ...      1.4      1   0     3             0

[5 rows x 14 columns]

 Attributes and datatypes
age              int64
gender           int64
cp               int64
trestbps         int64
chol             int64
fbs              int64
restecg          int64
thalach          int64
exang            int64
oldpeak        float64
slope            int64
ca              object
thal            object
heartdisease     int64
dtype: object

 Inferencing with Bayesian Network:

 1. Probability of HeartDisease given evidence= restecg
+-----------------+---------------------+
| heartdisease    |   phi(heartdisease) |
+=================+=====================+
| heartdisease(0) |              0.1012 |
+-----------------+---------------------+
| heartdisease(1) |              0.0000 |
+-----------------+---------------------+
| heartdisease(2) |              0.2392 |
+-----------------+---------------------+
| heartdisease(3) |              0.2015 |
+-----------------+---------------------+
| heartdisease(4) |              0.4581 |
+-----------------+---------------------+

 2. Probability of HeartDisease given evidence= cp
+-----------------+---------------------+
| heartdisease    |   phi(heartdisease) |
+=================+=====================+
| heartdisease(0) |              0.3610 |
+-----------------+---------------------+
| heartdisease(1) |              0.2159 |
+-----------------+---------------------+
| heartdisease(2) |              0.1373 |
+-----------------+---------------------+
| heartdisease(3) |              0.1537 |
+-----------------+---------------------+
| heartdisease(4) |              0.1321 |
+-----------------+---------------------+
```

Code:

```
""" NON Parametric model

 Implement the non-parametric Locally Weighted Regression algorithm in
order to fit data points.
 Select appropriate data set for your experiment and draw graphs.
"""

import matplotlib.pyplot as plt
import pandas as pd
import numpy as np

def kernel(point, xmat, k):
    m, n = np.shape(xmat)
    weights = np.mat(np.eye((m)))
    for j in range(m):
        diff = point - X[j]
        weights[j, j] = np.exp(diff * diff.T / (-2.0 * k ** 2))
    return weights

def localWeight(point, xmat, ymat, k):
    wei = kernel(point, xmat, k)
    W = (X.T * (wei * X)).I * (X.T * (wei * ymat.T))
    return W

def localWeightRegression(xmat, ymat, k):
    m, n = np.shape(xmat)
    ypred = np.zeros(m)
    for i in range(m):
        ypred[i] = xmat[i] * localWeight(xmat[i], xmat, ymat, k)
    return ypred

# load data points
data = pd.read_csv('8b_resturant_data.csv')
bill = np.array(data.total_bill)
tip = np.array(data.tip)

# preparing and add 1 in
bill mbill = np.mat(bill)
mtip = np.mat(tip)

m = np.shape(mbill)[1]
one = np.mat(np.ones(m))
X = np.hstack((one.T, mbill.T))

# set k here
ypred = localWeightRegression(X, mtip, 0.5)
SortIndex = X[:, 1].argsort(0)
xsort = X[SortIndex][:, 0]

fig = plt.figure()
ax = fig.add_subplot(1, 1, 1)
ax.scatter(bill, tip, color='green')
```

```
ax.plot(xsort[:, 1], ypred[SortIndex], color='red', linewidth=5)
plt.xlabel('Total bill')
plt.ylabel('Tip')
plt.show()
```

Output: