# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

**“JnanaSangama”, Belgaum -590014, Karnataka.**



## LAB REPORT

### on

Machine Learning (23CS6PCMAL)

#### Submitted by

**PRERANA MEDA KRISHNA (1BM22CS209)**

#### in partial fulfillment for the award of the degree of

**BACHELOR OF ENGINEERING**

***in***

## COMPUTER SCIENCE AND ENGINEERING



**B.M.S. COLLEGE OF ENGINEERING**

**(Autonomous Institution under VTU)**

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**B.M.S. College of Engineering,**

**Bull Temple Road, Bangalore 560019**

(Affiliated To Visvesvaraya Technological University, Belgaum)

**Department of Computer Science and Engineering**



##### CERTIFICATE

This is to certify that the Lab work entitled “Machine Learning (23CS6PCMAL)” carried out by **Prerana Meda Krishna (1BM22CS209),** who is a bonafide student of **B.M.S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum. The Lab report has been approved as it satisfies the academic requirements in respect of an Machine Learning (23CS6PCMAL) work prescribed for the said degree.

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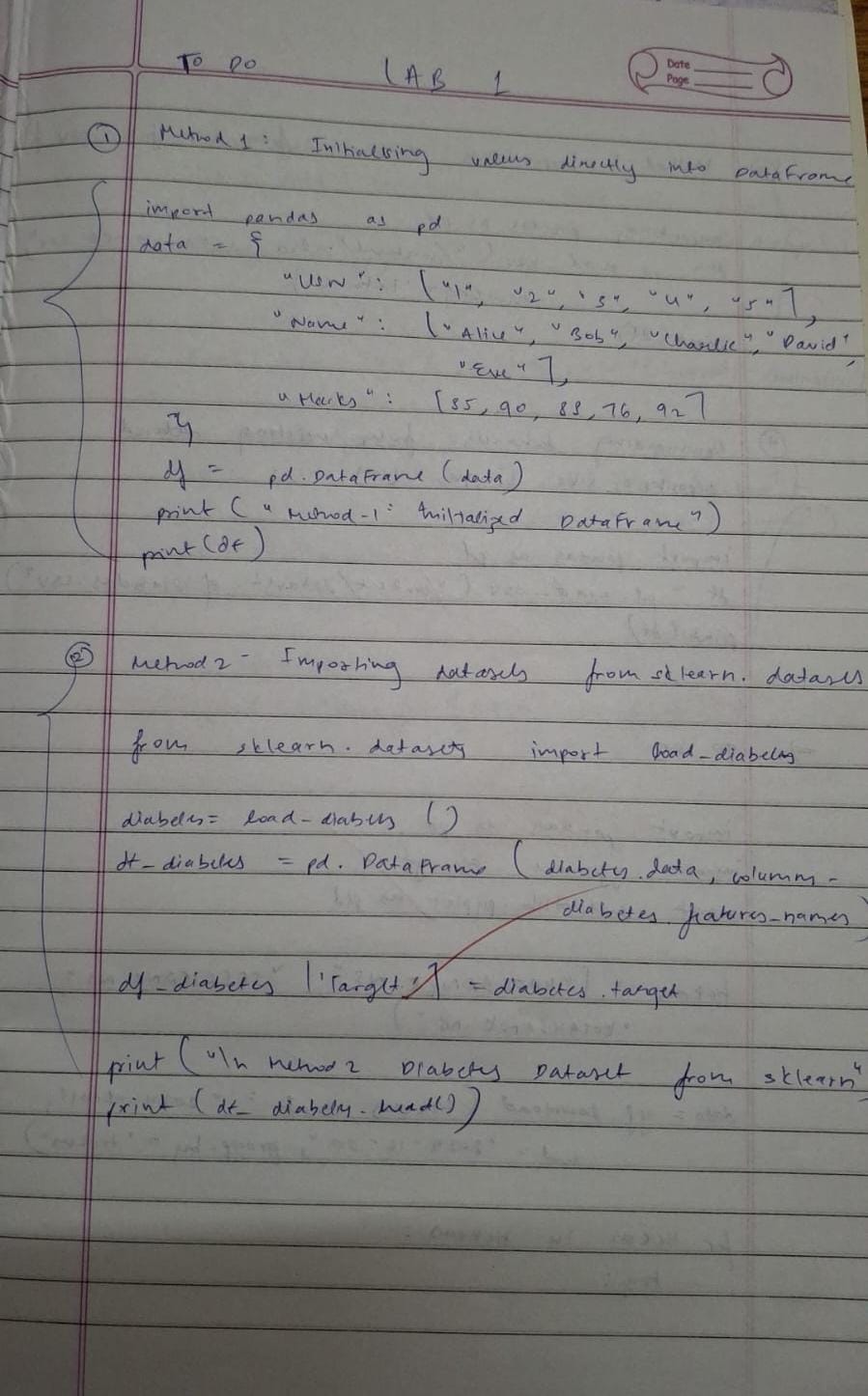
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**Github Link:** <https://github.com/Preranamk/ML_pmk>

**Program 1**

Write a python program to import and export data using Pandas library functions.

**Screenshot:**



A piece of lined paper with writing on it

AI-generated content may be incorrect.

A piece of lined paper with writing on it

AI-generated content may be incorrect.

**Code:**

import pandas as pd

data = {

'Name': ['Alice', 'Bob', 'Charlie', 'David'],

'Age': [25, 30, 35, 40],

'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']

}

df = pd.DataFrame(data)

print("Sample data:")

print(df.head())

from sklearn.datasets import load\_iris

iris = load\_iris()

df = pd.DataFrame(iris.data, columns=iris.feature\_names)

df['target'] = iris.target

print("Sample data:")

print(df.head())

from sklearn.datasets import load\_iris

iris = load\_iris()

df = pd.DataFrame(iris.data, columns=iris.feature\_names)

df['target'] = iris.target

print("Sample data:")

print(df.head())

file\_path = 'mobiles-dataset-2025.csv'

df = pd.read\_csv(file\_path, encoding='latin-1') # or 'cp1252' or other suitable encoding

print("Sample data:")

print(df.head())

import pandas as pd

data = {

'USN': ['IS001','IS002','IS003','IS004','IS005'],

'Name': ['Alice', 'Bob', 'Charlie', 'David','Eve'],

'Marks': [25, 30, 35, 40,45]

}

df = pd.DataFrame(data)

print("Sample data:")

print(df.head())

file\_path = 'sample\_sales\_data.csv'

df = pd.read\_csv(file\_path)

print("Sample data:")

print(df.head())

print("\n")

df = pd.read\_csv("/content/dataset-of-diabetes .csv",encoding='latin-1')

print("Sample data:")

print(df.head())

print("\n")

df =pd.read\_csv('sample\_sales\_data.csv')

print("Sample data:")

print(df.head())

df.to\_csv('output.csv',index=False)

print("Data saved to output.csv")

sales\_df =pd.read\_csv('sample\_sales\_data.csv')

print("Sample data:")

print(sales\_df.head())

sales\_by\_region =sales\_df.groupby('Region')['Sales'].sum()

print("\nTotal sales by region:")

print(sales\_by\_region)

best\_selling\_products =sales\_df.groupby('Product')['Quantity'].sum().sort\_values(ascending=False)

print("\nBest-selling products by quantity:")

print(best\_selling\_products)

sales\_by\_region.to\_csv('sales\_by\_region.csv')

best\_selling\_products.to\_csv('best\_selling\_products.csv')

print("Data saved to sales\_by\_region.csv and best\_selling\_products.csv")

import yfinance as yf

import matplotlib.pyplot as plt

tickers = ["RELIANCE.NS", "TCS.NS", "INFY.NS"]

data = yf.download(tickers, start="2022-10-01", end="2023-10-01",

group\_by='ticker')

print("First 5 rows of the dataset:")

print(data.head())

print("\nShape of the dataset:")

print(data.shape)

print("\nColumn names:")

print(data.columns)

print("\n")

reliance\_data = data['RELIANCE.NS']

print("\nSummary statistics for Reliance Industries:")

print(reliance\_data.describe())

reliance\_data['Daily Return'] = reliance\_data['Close'].pct\_change()

print("\n")

plt.figure(figsize=(12, 6))

plt.subplot(2, 1, 1)

reliance\_data['Close'].plot(title="Reliance Industries - Closing Price")

plt.subplot(2, 1, 2)

reliance\_data['Daily Return'].plot(title="Reliance Industries - Daily Returns", color='orange')

plt.tight\_layout()

plt.show()

reliance\_data.to\_csv('reliance\_stock\_data.csv')

tickers = ["HDFCBANK.NS", "ICICI.NS", "KOTAKBANK.NS"]

data = yf.download(tickers, start="2024-01-01", end="2024-12-30",

group\_by='ticker')

print("First 5 rows of the dataset:")

print(data.head())

print("\nShape of the dataset:")

print(data.shape)

print("\nColumn names:")

print(data.columns)

print("\n")

reliance\_data = data['HDFCBANK.NS']

print("\nSummary statistics for Reliance Industries:")

print(reliance\_data.describe())

reliance\_data['Daily Return'] = reliance\_data['Close'].pct\_change()

print("\n")

plt.figure(figsize=(12, 6))

plt.subplot(2, 1, 1)

reliance\_data['Close'].plot(title="HDFC Industries - Closing Price")

plt.subplot(2, 1, 2)

reliance\_data['Daily Return'].plot(title="HDFCIndustries - Daily Returns", color='red')

plt.tight\_layout()

plt.show()

reliance\_data.to\_csv('hdfc\_stock\_data.csv')

print("\nhdfc stock data saved to 'hdfc\_stock\_data.csv'.")

**Program 2**

Demonstrate various data pre-processing techniques for a given dataset.

**Screenshot:**

A notebook with writing on it

AI-generated content may be incorrect.

A piece of paper with writing on it

AI-generated content may be incorrect.

A notebook with writing on it

AI-generated content may be incorrect.

**Code:**

import pandas as pd

import numpy as np

from sklearn.model\_selection import train\_test\_split

from sklearn.preprocessing import MinMaxScaler, StandardScaler

from sklearn.impute import SimpleImputer

try:

diabetes\_df = pd.read\_csv('diabetes.csv')

adult\_df = pd.read\_csv('adult.csv')

except FileNotFoundError:

print("Error: Please upload 'diabetes.csv' and 'adult.csv' to your Google Colab environment.")

exit()

diabetes\_df.head(10)

adult\_df.head(10)

diabetes\_df.shape

adult\_df.shape

*#Handling Missing Values*

diabetes\_numeric\_cols = diabetes\_df.select\_dtypes(include=[np.number]).columns

diabetes\_categorical\_cols = diabetes\_df.select\_dtypes(exclude=[np.number]).columns

adult\_numeric\_cols = adult\_df.select\_dtypes(include=[np.number]).columns

adult\_categorical\_cols = adult\_df.select\_dtypes(exclude=[np.number]).columns

diabetes\_numeric\_imputer = SimpleImputer(strategy='mean')

adult\_numeric\_imputer = SimpleImputer(strategy='mean')

diabetes\_df[diabetes\_numeric\_cols] = diabetes\_numeric\_imputer.fit\_transform(diabetes\_df[diabetes\_numeric\_cols])

adult\_df[adult\_numeric\_cols] = adult\_numeric\_imputer.fit\_transform(adult\_df[adult\_numeric\_cols])

diabetes\_categorical\_imputer = SimpleImputer(strategy='most\_frequent')

adult\_categorical\_imputer = SimpleImputer(strategy='most\_frequent')

diabetes\_df[diabetes\_categorical\_cols] = diabetes\_categorical\_imputer.fit\_transform(diabetes\_df[diabetes\_categorical\_cols])

adult\_df[adult\_categorical\_cols] = adult\_categorical\_imputer.fit\_transform(adult\_df[adult\_categorical\_cols])

print("Missing values in Diabetes dataset after imputation:")

print(diabetes\_df.isnull().sum())

print("Missing values in Adult Income dataset after imputation:")

print(adult\_df.isnull().sum())

adult\_df.replace("?", np.nan, inplace=True)

print("Missing values in Adult Income dataset after replacing '?':")

print(adult\_df.isnull().sum())

from sklearn.impute import SimpleImputer

*# Identify numeric and categorical columns*

adult\_numeric\_cols = adult\_df.select\_dtypes(include=[np.number]).columns

adult\_categorical\_cols = adult\_df.select\_dtypes(exclude=[np.number]).columns

*# Handle missing values in numeric columns using mean imputation*

adult\_numeric\_imputer = SimpleImputer(strategy='mean')

adult\_df[adult\_numeric\_cols] = adult\_numeric\_imputer.fit\_transform(adult\_df[adult\_numeric\_cols])

*# Handle missing values in categorical columns using most frequent imputation*

adult\_categorical\_imputer = SimpleImputer(strategy='most\_frequent')

adult\_df[adult\_categorical\_cols] = adult\_categorical\_imputer.fit\_transform(adult\_df[adult\_categorical\_cols])

print("Missing values in Adult Income dataset after imputation:")

print(adult\_df.isnull().sum())

from sklearn.preprocessing import LabelEncoder

label\_encoder = LabelEncoder()

*# Encode categorical columns in Diabetes dataset*

for col in diabetes\_categorical\_cols:

diabetes\_df[col] = label\_encoder.fit\_transform(diabetes\_df[col])

*# Encode categorical columns in Adult Income dataset*

for col in adult\_categorical\_cols:

adult\_df[col] = label\_encoder.fit\_transform(adult\_df[col])

print("Encoded columns in Diabetes dataset:")

print(diabetes\_df.head())

print("Encoded columns in Adult Income dataset:")

print(adult\_df.head())

*#Handling outliers*

def remove\_outliers(df):

Q1 = df.quantile(0.25)

Q3 = df.quantile(0.75)

IQR = Q3 - Q1

df\_no\_outliers = df[~((df < (Q1 - 1.5 \* IQR)) | (df > (Q3 + 1.5 \* IQR))).any(axis=1)]

return df\_no\_outliers

diabetes\_df\_no\_outliers = remove\_outliers(diabetes\_df)

adult\_df\_no\_outliers = remove\_outliers(adult\_df)

print("Diabetes dataset shape after removing outliers:", diabetes\_df\_no\_outliers.shape)

print("Adult Income dataset shape after removing outliers:", adult\_df\_no\_outliers.shape)

*#Min-max scaling*

from sklearn.preprocessing import MinMaxScaler

min\_max\_scaler = MinMaxScaler()

diabetes\_scaled\_minmax = pd.DataFrame(min\_max\_scaler.fit\_transform(diabetes\_df\_no\_outliers), columns=diabetes\_df\_no\_outliers.columns)

adult\_scaled\_minmax = pd.DataFrame(min\_max\_scaler.fit\_transform(adult\_df\_no\_outliers), columns=adult\_df\_no\_outliers.columns)

print("Diabetes dataset after Min-Max scaling:")

print(diabetes\_scaled\_minmax.head())

print("Adult Income dataset after Min-Max scaling:")

print(adult\_scaled\_minmax.head())

*# Initialize Standard Scaler*

from sklearn.preprocessing import StandardScaler

standard\_scaler = StandardScaler()

diabetes\_scaled\_standard = pd.DataFrame(standard\_scaler.fit\_transform(diabetes\_df\_no\_outliers), columns=diabetes\_df\_no\_outliers.columns)

adult\_scaled\_standard = pd.DataFrame(standard\_scaler.fit\_transform(adult\_df\_no\_outliers), columns=adult\_df\_no\_outliers.columns)

print("Diabetes dataset after Standard scaling:")

print(diabetes\_scaled\_standard.head())

print("Adult Income dataset after Standard scaling:")

print(adult\_scaled\_standard.head())

**Program 3**

Implement Linear and Multi-Linear Regression algorithm using appropriate dataset.

**Screenshot:**

A piece of paper with writing on it

AI-generated content may be incorrect.

**Code:**

import pandas as pd

import numpy as np

from sklearn import linear\_model

import matplotlib.pyplot as plt

df = pd.read\_csv('housing\_area\_price.csv')

plt.xlabel('area')

plt.ylabel('price')

plt.scatter(df.area,df.price,color='red',marker='+')

new\_df = df.drop('price',axis='columns')

new\_df

price = df.price

reg = linear\_model.LinearRegression()

reg.fit(new\_df,price)

*#(1) Predict price of a home with area = 3300 sqr ft*

reg.predict([[3300]])

reg.coef\_

reg.intercept\_

3300\*135.78767123 + 180616.43835616432

*#(2) Predict price of a home with area = 5000 sqr ft*

reg.predict([[5000]])

df = pd.read\_csv('homeprices\_Multiple\_LR.csv')

df.bedrooms.median()

df.bedrooms = df.bedrooms.fillna(df.bedrooms.median())

reg = linear\_model.LinearRegression()

reg.fit(df.drop('price',axis='columns'),df.price)

reg.coef\_

reg.intercept\_

*#Find price of home with 3000 sqr ft area, 3 bedrooms, 40 year old*

reg.predict([[3000, 3, 40]])

112.06244194\*3000 + 23388.88007794\*3 + -3231.71790863\*40 + 221323.00186540384

df = pd.read\_csv('canada\_per\_capita\_income.csv')

print(df.head())

X = df[['year']]

y = df['per capita income (US$)']

reg = LinearRegression()

reg.fit(X, y)

predicted\_income\_2020 = reg.predict([[2020]])

print(f"Predicted per capita income for Canada in 2020: {predicted\_income\_2020[0]:.2f}")

plt.scatter(X, y, color='blue')

plt.plot(X, reg.predict(X), color='red')

plt.xlabel('Year')

plt.ylabel('Per Capita Income')

plt.title('Per Capita Income in Canada Over the Years')

plt.show()

df = pd.read\_csv('salary.csv')

print(df.head())

print("Missing values in the dataset:")

print(df.isnull().sum())

df['YearsExperience'] = df['YearsExperience'].fillna(df['YearsExperience'].median())

print("\nMissing values after filling:")

print(df.isnull().sum())

X = df[['YearsExperience']]

y = df['Salary']

reg = LinearRegression()

reg.fit(X, y)

predicted\_salary\_12\_years = reg.predict([[12]])

print(f"\nPredicted salary for an employee with 12 years of experience: ${predicted\_salary\_12\_years[0]:,.2f}")

plt.scatter(X, y, color='blue')

plt.plot(X, reg.predict(X), color='red')

plt.xlabel('Years of Experience')

plt.ylabel('Salary')

plt.title('Salary vs. Years of Experience')

plt.show()

def convert\_to\_numeric(value):

word\_to\_num = {

'zero': 0, 'one': 1, 'two': 2, 'three': 3, 'four': 4, 'five': 5,

'six': 6, 'seven': 7, 'eight': 8, 'nine': 9, 'ten': 10,

'eleven': 11, 'twelve': 12, 'thirteen': 13, 'fourteen': 14,

'fifteen': 15

}

return word\_to\_num.get(value.lower(), value) if isinstance(value, str) else value

df\_hiring = pd.read\_csv('hiring.csv')

print(df.head())

df\_hiring['experience'] = df\_hiring['experience'].apply(convert\_to\_numeric)

df\_hiring['experience'].fillna(0, inplace=True)

df\_hiring['test\_score(out of 10)'].fillna(df\_hiring['test\_score(out of 10)'].median(), inplace=True)

df\_hiring['interview\_score(out of 10)'].fillna(df\_hiring['interview\_score(out of 10)'].median(), inplace=True)

X\_hiring = df\_hiring[['experience', 'test\_score(out of 10)', 'interview\_score(out of 10)']]

y\_hiring = df\_hiring['salary($)']

reg\_hiring = LinearRegression()

reg\_hiring.fit(X\_hiring, y\_hiring)

candidates = np.array([[2, 9, 6], [12, 10, 10]])

predicted\_salaries = reg\_hiring.predict(candidates)

for i, candidate in enumerate(candidates):

print(f"\nPredicted salary for candidate with {candidate[0]} yrs experience, {candidate[1]} test score, {candidate[2]} interview score: {predicted\_salaries[i]:.2f} USD")

plt.scatter(y\_hiring, reg\_hiring.predict(X\_hiring), color='blue', label='Predicted vs Actual')

plt.xlabel("Actual Salary")

plt.ylabel("Predicted Salary")

plt.title("Actual vs Predicted Salary")

plt.legend()

plt.show()

df\_companies = pd.read\_csv('1000\_Companies.csv')

print(df.head())

label\_encoder = LabelEncoder()

df\_companies['State'] = label\_encoder.fit\_transform(df\_companies['State'])

X\_companies = df\_companies[['R&D Spend', 'Administration', 'Marketing Spend', 'State']]

y\_companies = df\_companies['Profit']

df\_companies.fillna(df\_companies.median(), inplace=True)

reg\_companies = LinearRegression()

reg\_companies.fit(X\_companies, y\_companies)

input\_data = np.array([[91694.48, 515841.3, 11931.24, label\_encoder.transform(['Florida'])[0]]])

predicted\_profit = reg\_companies.predict(input\_data)

print(f"Predicted profit: {predicted\_profit[0]:.2f} USD")

plt.scatter(y\_companies, reg\_companies.predict(X\_companies), color='blue', label='Predicted vs Actual')

plt.xlabel("Actual Profit")

plt.ylabel("Predicted Profit")

plt.title("Actual vs Predicted Profit")

plt.legend()

plt.show()

**Program 4**

Build Logistic Regression Model for a given dataset.

**Screenshot:**

A notebook with writing on it

AI-generated content may be incorrect.

A piece of paper with writing on it

AI-generated content may be incorrect.

**Code:**

import pandas as pd

import seaborn as sns

import matplotlib.pyplot as plt

df = pd.read\_csv("HR\_comma\_sep.csv")

print(df.info())

numericCols = df.select\_dtypes(include=['float64', 'int64']).columns

plt.figure(figsize=(10, 8))

sns.heatmap(df[numericCols].corr(), annot=True, cmap='coolwarm', fmt='.2f')

plt.title("Correlation Matrix (Numeric Features)")

plt.show()

plt.figure(figsize=(8, 6))

sns.countplot(x='salary', hue='left', data=df)

plt.title("Impact of Salary on Employee Retention")

plt.xlabel("Salary Level")

plt.ylabel("Employee Count")

plt.show()

import pandas as pd

df = pd.read\_csv("zoo-data.csv")

print(df.info())

print(df.head())

print(df.isnull().sum())

df.drop(columns=['animal\_name'], inplace=True)

X = df.drop(columns=['class\_type'])

y = df['class\_type']

from sklearn.model\_selection import train\_test\_split

from sklearn.preprocessing import StandardScaler

from sklearn.linear\_model import LogisticRegression

X\_train, X\_test, y\_train, y\_test = train\_test\_split(

X, y, test\_size=0.2, random\_state=42, stratify=y)

scaler = StandardScaler()

X\_train = scaler.fit\_transform(X\_train)

X\_test = scaler.transform(X\_test)

logreg = LogisticRegression(max\_iter=200, multi\_class='multinomial', solver='lbfgs')

logreg.fit(X\_train, y\_train)

from sklearn.metrics import accuracy\_score

y\_pred = logreg.predict(X\_test)

accuracy = accuracy\_score(y\_test, y\_pred)

print(f"Model Accuracy: {accuracy:.2f}")

from sklearn.metrics import confusion\_matrix, ConfusionMatrixDisplay

import matplotlib.pyplot as plt

cm = confusion\_matrix(y\_test, y\_pred)

disp = ConfusionMatrixDisplay(confusion\_matrix=cm, display\_labels=logreg.classes\_)

disp.plot(cmap=plt.cm.Blues)

plt.title("Confusion Matrix for Zoo Animal Classification")

plt.show()

y\_pred = logreg.predict(X\_test)

pred\_classes = [class\_mapping[pred] for pred in y\_pred]

print("Predicted Classes:", pred\_classes)

import seaborn as sns

import matplotlib.pyplot as plt

sns.countplot(x='class\_type', data=df)

plt.title("Class Distribution of Animals in Zoo Dataset")

plt.xlabel("Class Type")

plt.ylabel("Count")

plt.show()

from sklearn.metrics import confusion\_matrix, ConfusionMatrixDisplay

cm = confusion\_matrix(y\_test, y\_pred)

class\_labels = [class\_mapping[num] for num in logreg.classes\_]

disp = ConfusionMatrixDisplay(confusion\_matrix=cm, display\_labels=class\_labels)

disp.plot(cmap=plt.cm.Blues)

plt.title("Confusion Matrix with Class Names")

plt.show()

**Program 5**

Use an appropriate data set for building the decision tree (ID3) and apply this knowledge to classify a new sample.

**Screenshot:**

A piece of paper with writing on it

AI-generated content may be incorrect.

A notebook with writing on it

AI-generated content may be incorrect.

A piece of paper with writing on it

AI-generated content may be incorrect.

**Code:**

import pandas as pd

import numpy as np

import seaborn as sns

import matplotlib.pyplot as plt

from sklearn.model\_selection import train\_test\_split

from sklearn.tree import DecisionTreeClassifier

from sklearn.metrics import accuracy\_score, confusion\_matrix, precision\_score, recall\_score, f1\_score

from sklearn.preprocessing import LabelEncoder

def train\_and\_evaluate\_iris():

iris\_df = pd.read\_csv("iris.csv")

X = iris\_df.drop(columns=["species"])

y = iris\_df["species"]

y\_le = LabelEncoder()

y = y\_le.fit\_transform(y)

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, test\_size=0.2, random\_state=42)

model = DecisionTreeClassifier(random\_state=42)

model.fit(X\_train, y\_train)

y\_pred = model.predict(X\_test)

*# Evaluating the model*

acc = accuracy\_score(y\_test, y\_pred)

prec = precision\_score(y\_test, y\_pred, average='weighted')

rec = recall\_score(y\_test, y\_pred, average='weighted')

f1 = f1\_score(y\_test, y\_pred, average='weighted')

cm = confusion\_matrix(y\_test, y\_pred)

print("IRIS Dataset Classification:")

print(f"Accuracy Score: {acc:.4f}")

print(f"Precision Score: {prec:.4f}")

print(f"Recall Score: {rec:.4f}")

print(f"F1 Score: {f1:.4f}")

plt.figure(figsize=(6, 4))

sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=y\_le.classes\_, yticklabels=y\_le.classes\_)

plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.title("Confusion Matrix: iris.csv")

plt.show()

train\_and\_evaluate\_iris()

def train\_and\_evaluate\_drug():

drug\_df = pd.read\_csv("drug.csv")

categorical\_features = ["Sex", "BP", "Cholesterol"]

label\_encoders = {}

for col in categorical\_features:

le = LabelEncoder()

drug\_df[col] = le.fit\_transform(drug\_df[col])

label\_encoders[col] = le

X = drug\_df.drop(columns=["Drug"])

y = drug\_df["Drug"]

y\_le = LabelEncoder()

y = y\_le.fit\_transform(y)

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, test\_size=0.2, random\_state=42)

model = DecisionTreeClassifier(random\_state=42)

model.fit(X\_train, y\_train)

y\_pred = model.predict(X\_test)

acc = accuracy\_score(y\_test, y\_pred)

prec = precision\_score(y\_test, y\_pred, average='weighted')

rec = recall\_score(y\_test, y\_pred, average='weighted')

f1 = f1\_score(y\_test, y\_pred, average='weighted')

cm = confusion\_matrix(y\_test, y\_pred)

print("Drug Dataset Classification:")

print(f"Accuracy Score: {acc:.4f}")

print(f"Precision Score: {prec:.4f}")

print(f"Recall Score: {rec:.4f}")

print(f"F1 Score: {f1:.4f}")

plt.figure(figsize=(6, 4))

sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=y\_le.classes\_, yticklabels=y\_le.classes\_)

plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.title("Confusion Matrix: drug.csv")

plt.show()

train\_and\_evaluate\_drug()

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

from sklearn.model\_selection import train\_test\_split

from sklearn.tree import DecisionTreeRegressor, plot\_tree

from sklearn.preprocessing import StandardScaler

from sklearn.metrics import mean\_absolute\_error, mean\_squared\_error

petrol\_df = pd.read\_csv("petrol\_consumption.csv")

X = petrol\_df.drop(columns=["Petrol\_Consumption"])

y = petrol\_df["Petrol\_Consumption"]

scaler = StandardScaler()

X\_scaled = scaler.fit\_transform(X)

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X\_scaled, y, test\_size=0.2, random\_state=42)

model = DecisionTreeRegressor(max\_depth=5, random\_state=42)

model.fit(X\_train, y\_train)

y\_pred = model.predict(X\_test)

print("Petrol Consumption Regression:")

print("Mean Absolute Error (MAE):", mean\_absolute\_error(y\_test, y\_pred))

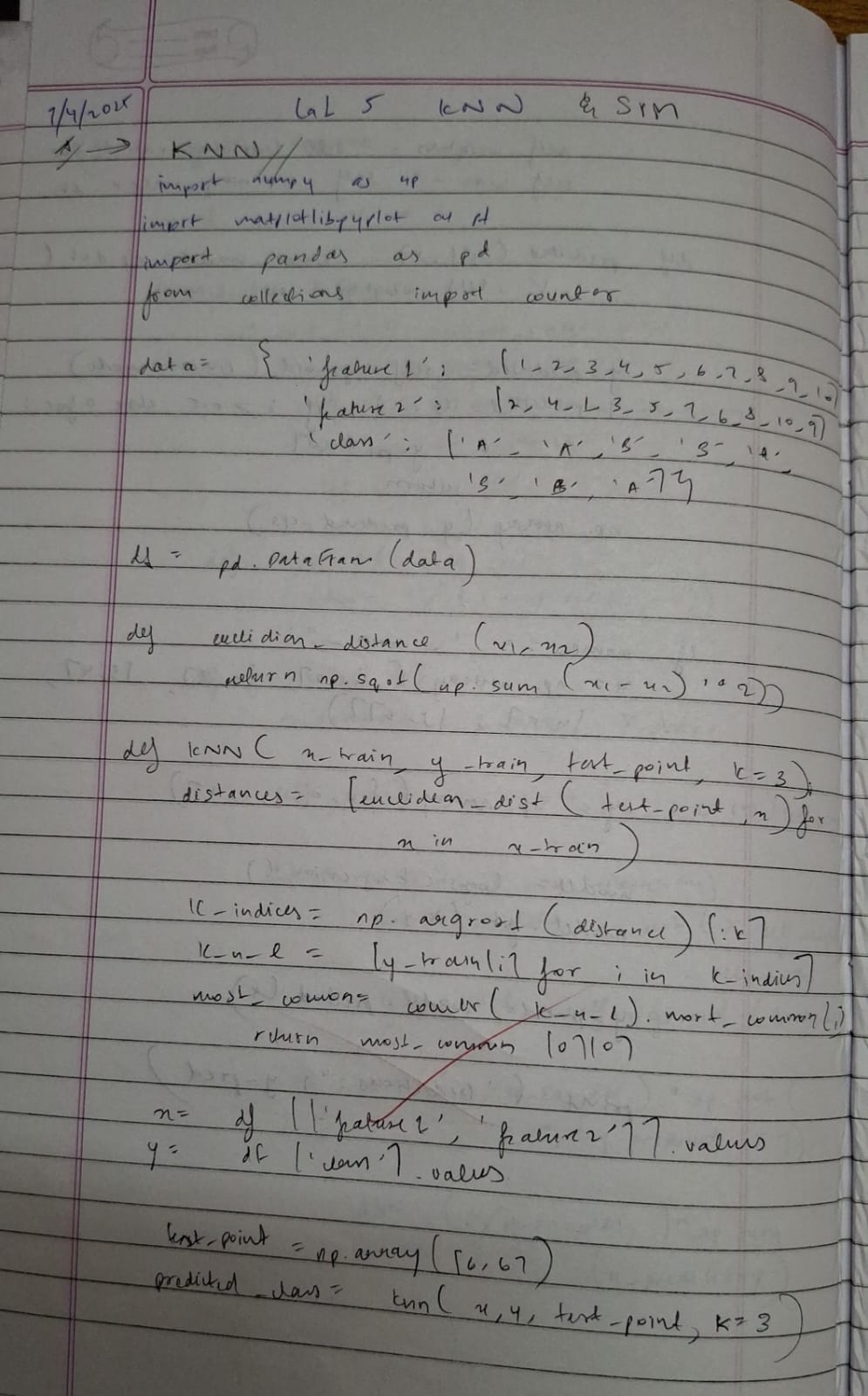
print("Mean Squared Error (MSE):", mean\_squared\_error(y\_test, y\_pred))

print("Root Mean Squared Error (RMSE):", np.sqrt(mean\_squared\_error(y\_test, y\_pred)))

**Program 6**

Build KNN Classification model for a given dataset.

**Screenshot:**



A piece of paper with writing on it

AI-generated content may be incorrect.

**Code:**

import pandas as pd

from sklearn.model\_selection import train\_test\_split

from sklearn.preprocessing import LabelEncoder

from sklearn.preprocessing import StandardScaler

from sklearn.neighbors import KNeighborsClassifier

from sklearn.metrics import classification\_report, confusion\_matrix, accuracy\_score

import seaborn as sns

import matplotlib.pyplot as plt

iris\_df = pd.read\_csv('iris.csv')

le = LabelEncoder()

iris\_df['species'] = le.fit\_transform(iris\_df['species'])

X = iris\_df.drop('species', axis=1)

y = iris\_df['species']

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, test\_size=0.2, random\_state=42)

error\_rates = []

accuracies = []

k\_values = range(1, 10)

for k in k\_values:

knn = KNeighborsClassifier(n\_neighbors=k)

knn.fit(X\_train, y\_train)

y\_pred\_k = knn.predict(X\_test)

error = 1 - accuracy\_score(y\_test, y\_pred\_k)

error\_rates.append(error)

accuracies.append(accuracy\_score(y\_test, y\_pred\_k))

plt.figure(figsize=(12, 5))

plt.subplot(1, 2, 1)

plt.plot(k\_values, accuracies, marker='o', color='blue')

plt.title("Accuracy vs K")

plt.xlabel("K Value")

plt.ylabel("Accuracy")

plt.subplot(1, 2, 2)

plt.plot(k\_values, error\_rates, marker='o', color='red')

plt.title("Error Rate vs K")

plt.xlabel("K Value")

plt.ylabel("Error Rate")

plt.tight\_layout()

plt.show()

best\_k = k\_values[accuracies.index(max(accuracies))]

print(f"Best K: {best\_k} with Accuracy: {max(accuracies):.2f}")

knn = KNeighborsClassifier(n\_neighbors=best\_k)

knn.fit(X\_train, y\_train)

y\_pred = knn.predict(X\_test)

*# Evaluation*

print("\n=== Final Evaluation on IRIS Dataset ===")

print("Accuracy Score:", accuracy\_score(y\_test, y\_pred))

print("\nClassification Report:")

print(classification\_report(y\_test, y\_pred, labels=[0, 1, 2], target\_names=le.classes\_))

*# Confusion Matrix*

cm = confusion\_matrix(y\_test, y\_pred)

sns.heatmap(cm, annot=True, fmt='d', cmap='Blues',

xticklabels=le.classes\_, yticklabels=le.classes\_)

plt.title("Confusion Matrix - IRIS")

plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.show()

df = pd.read\_csv('diabetes.csv')

X = df.drop('Outcome', axis=1)

y = df['Outcome']

scaler = StandardScaler()

X\_scaled = scaler.fit\_transform(X)

X\_train, X\_test, y\_train, y\_test = train\_test\_split(

X\_scaled, y, test\_size=0.2, random\_state=42, stratify=y

)

accuracy\_scores = []

k\_range = range(1, 21)

for k in k\_range:

knn = KNeighborsClassifier(n\_neighbors=k)

knn.fit(X\_train, y\_train)

y\_pred\_k = knn.predict(X\_test)

acc = accuracy\_score(y\_test, y\_pred\_k)

accuracy\_scores.append(acc)

plt.figure(figsize=(8, 5))

plt.plot(k\_range, accuracy\_scores, marker='o', color='purple')

plt.title("Accuracy vs K (Diabetes Dataset)")

plt.xlabel("K Value")

plt.ylabel("Accuracy")

plt.xticks(k\_range)

plt.grid()

plt.show()

best\_k = k\_range[accuracy\_scores.index(max(accuracy\_scores))]

print(f"Best K: {best\_k} with Accuracy: {max(accuracy\_scores):.2f}")

knn = KNeighborsClassifier(n\_neighbors=best\_k)

knn.fit(X\_train, y\_train)

y\_pred = knn.predict(X\_test)

print("=== Final Evaluation (Diabetes Dataset) ===")

print("Accuracy Score:", accuracy\_score(y\_test, y\_pred))

print("\nClassification Report:")

print(classification\_report(y\_test, y\_pred))

cm = confusion\_matrix(y\_test, y\_pred)

sns.heatmap(cm, annot=True, fmt='d', cmap='Purples', xticklabels=['No Diabetes', 'Diabetes'], yticklabels=['No Diabetes', 'Diabetes'])

plt.title("Confusion Matrix - Diabetes")

plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.show()

heart\_df = pd.read\_csv('heart.csv')

X = heart\_df.drop('target', axis=1)

y = heart\_df['target']

scaler = StandardScaler()

X\_scaled = scaler.fit\_transform(X)

X\_train, X\_test, y\_train, y\_test = train\_test\_split(

X\_scaled, y, test\_size=0.2, random\_state=42, stratify=y

)

accuracy\_scores = []

k\_range = range(1, 21)

for k in k\_range:

knn = KNeighborsClassifier(n\_neighbors=k)

knn.fit(X\_train, y\_train)

y\_pred\_k = knn.predict(X\_test)

acc = accuracy\_score(y\_test, y\_pred\_k)

accuracy\_scores.append(acc)

plt.figure(figsize=(8, 5))

plt.plot(k\_range, accuracy\_scores, marker='o', color='red')

plt.title("Accuracy vs K (Heart Dataset)")

plt.xlabel("K Value")

plt.ylabel("Accuracy")

plt.xticks(k\_range)

plt.grid()

plt.show()

best\_k = k\_range[accuracy\_scores.index(max(accuracy\_scores))]

print(f"Best K: {best\_k} with Accuracy: {max(accuracy\_scores):.2f}")

knn = KNeighborsClassifier(n\_neighbors=best\_k)

knn.fit(X\_train, y\_train)

y\_pred = knn.predict(X\_test)

print("=== Final Evaluation (Heart Dataset) ===")

print("\nAccuracy Score:", accuracy\_score(y\_test, y\_pred))

print("\nClassification Report:")

print(classification\_report(y\_test, y\_pred, target\_names=['No Disease', 'Disease']))

cm = confusion\_matrix(y\_test, y\_pred)

sns.heatmap(cm, annot=True, fmt='d', cmap='Reds', xticklabels=['No Disease', 'Disease'], yticklabels=['No Disease', 'Disease'])

plt.title("Confusion Matrix - Heart Disease")

plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.show()

**Program 7**

Build Support vector machine model for a given dataset.

**Screenshot:**

A piece of paper with writing on it

AI-generated content may be incorrect.

A notebook with writing on it

AI-generated content may be incorrect.

A paper with writing on it

AI-generated content may be incorrect.

**Code:**

import pandas as pd

import numpy as np

from sklearn.model\_selection import train\_test\_split

from sklearn.preprocessing import LabelEncoder, StandardScaler

from sklearn.svm import SVC

from sklearn.metrics import accuracy\_score, confusion\_matrix, roc\_auc\_score, roc\_curve

from sklearn.preprocessing import label\_binarize

import matplotlib.pyplot as plt

import seaborn as sns

iris = pd.read\_csv("iris.csv")

label\_encoder = LabelEncoder()

iris['species'] = label\_encoder.fit\_transform(iris['species'])

class\_names\_iris = label\_encoder.classes\_

X\_iris = iris.drop('species', axis=1)

y\_iris = iris['species']

X\_train\_iris, X\_test\_iris, y\_train\_iris, y\_test\_iris = train\_test\_split(X\_iris, y\_iris, test\_size=0.2, random\_state=42)

scaler = StandardScaler()

X\_train\_iris = scaler.fit\_transform(X\_train\_iris)

X\_test\_iris = scaler.transform(X\_test\_iris)

svm\_linear = SVC(kernel='linear')

svm\_linear.fit(X\_train\_iris, y\_train\_iris)

y\_pred\_linear = svm\_linear.predict(X\_test\_iris)

acc\_linear = accuracy\_score(y\_test\_iris, y\_pred\_linear)

cm\_linear = confusion\_matrix(y\_test\_iris, y\_pred\_linear)

plt.figure(figsize=(6,4))

sns.heatmap(cm\_linear, annot=True, fmt='d', cmap='Blues', xticklabels=class\_names\_iris, yticklabels=class\_names\_iris)

plt.title(f'IRIS SVM Linear Kernel\nAccuracy: {acc\_linear:.2f}')

plt.xlabel("Predicted Label")

plt.ylabel("True Label")

plt.tight\_layout()

plt.show()

svm\_rbf = SVC(kernel='rbf')

svm\_rbf.fit(X\_train\_iris, y\_train\_iris)

y\_pred\_rbf = svm\_rbf.predict(X\_test\_iris)

acc\_rbf = accuracy\_score(y\_test\_iris, y\_pred\_rbf)

cm\_rbf = confusion\_matrix(y\_test\_iris, y\_pred\_rbf)

plt.figure(figsize=(6,4))

sns.heatmap(cm\_rbf, annot=True, fmt='d', cmap='Greens', xticklabels=class\_names\_iris, yticklabels=class\_names\_iris)

plt.title(f'IRIS SVM RBF Kernel\nAccuracy: {acc\_rbf:.2f}')

plt.xlabel("Predicted Label")

plt.ylabel("True Label")

plt.tight\_layout()

plt.show()

letters = pd.read\_csv("letter-recognition.csv")

X\_letters = letters.drop('letter', axis=1)

y\_letters = letters['letter']

label\_encoder\_letters = LabelEncoder()

y\_letters\_encoded = label\_encoder\_letters.fit\_transform(y\_letters)

class\_names\_letters = label\_encoder\_letters.classes\_

X\_train\_letters, X\_test\_letters, y\_train\_letters, y\_test\_letters = train\_test\_split(

X\_letters, y\_letters\_encoded, test\_size=0.2, random\_state=42)

scaler\_letters = StandardScaler()

X\_train\_letters = scaler\_letters.fit\_transform(X\_train\_letters)

X\_test\_letters = scaler\_letters.transform(X\_test\_letters)

svm\_letters = SVC(kernel='rbf', probability=True)

svm\_letters.fit(X\_train\_letters, y\_train\_letters)

y\_pred\_letters = svm\_letters.predict(X\_test\_letters)

acc\_letters = accuracy\_score(y\_test\_letters, y\_pred\_letters)

cm\_letters = confusion\_matrix(y\_test\_letters, y\_pred\_letters)

plt.figure(figsize=(14, 12))

sns.heatmap(cm\_letters, annot=True, fmt='d', cmap='Purples',

xticklabels=class\_names\_letters,

yticklabels=class\_names\_letters,

annot\_kws={"size": 8},

cbar=True)

plt.title(f'Letter Recognition - SVM RBF Kernel\nAccuracy: {acc\_letters\*100:.2f}%', fontsize=16)

plt.xlabel("Predicted Label", fontsize=14)

plt.ylabel("True Label", fontsize=14)

plt.xticks(rotation=45)

plt.yticks(rotation=0)

plt.tight\_layout()

plt.show()

y\_test\_binarized = label\_binarize(y\_test\_letters, classes=np.arange(len(class\_names\_letters)))

y\_score = svm\_letters.predict\_proba(X\_test\_letters)

auc\_score = roc\_auc\_score(y\_test\_binarized, y\_score, average='macro')

fpr = dict()

tpr = dict()

for i in range(len(class\_names\_letters)):

fpr[i], tpr[i], \_ = roc\_curve(y\_test\_binarized[:, i], y\_score[:, i])

plt.figure(figsize=(8, 6))

for i in range(0, len(class\_names\_letters), 4): # Plot every 4th class

plt.plot(fpr[i], tpr[i], lw=1.5, label=f'Class {class\_names\_letters[i]}')

plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')

plt.xlabel("False Positive Rate")

plt.ylabel("True Positive Rate")

plt.title(f"Multi-Class ROC Curve (Macro AUC = {auc\_score:.6f})")

plt.legend(loc="lower right", fontsize='small')

plt.grid()

plt.tight\_layout()

plt.show()

print(f"Exact AUC Score = {auc\_score}")

**Program 8**

Implement Random forest ensemble method on a given dataset.

**Screenshot:**

A notebook with writing on it

AI-generated content may be incorrect.

**Code:**

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

from sklearn.ensemble import RandomForestClassifier

from sklearn.model\_selection import train\_test\_split

from sklearn.metrics import accuracy\_score

from sklearn.preprocessing import LabelEncoder

from sklearn.metrics import confusion\_matrix

iris\_df = pd.read\_csv("iris.csv")

X = iris\_df.drop('species', axis=1)

y = iris\_df['species']

le = LabelEncoder()

y\_encoded = le.fit\_transform(y)

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y\_encoded, test\_size=0.3, random\_state=42)

rf\_model = RandomForestClassifier(n\_estimators=10, random\_state=42)

rf\_model.fit(X\_train, y\_train)

y\_pred = rf\_model.predict(X\_test)

print("Random Forest Accuracy with 10 trees:", accuracy\_score(y\_test, y\_pred))

scores = []

n\_range = range(1, 101)

best\_model = None

best\_preds = None

for n in n\_range:

model = RandomForestClassifier(n\_estimators=n, random\_state=42)

model.fit(X\_train, y\_train)

preds = model.predict(X\_test)

acc = accuracy\_score(y\_test, preds)

scores.append(acc)

if acc == max(scores):

best\_model = model

best\_preds = preds

best\_score = max(scores)

best\_n = n\_range[scores.index(best\_score)]

print(f"Best Random Forest Accuracy: {best\_score:.4f} with {best\_n} trees")

plt.figure(figsize=(10, 5))

plt.plot(n\_range, scores, marker='o', linestyle='-', color='blue')

plt.title('Random Forest Accuracy vs Number of Trees (Iris Dataset)')

plt.xlabel('Number of Trees')

plt.ylabel('Accuracy')

plt.grid(True)

plt.show()

cm = confusion\_matrix(y\_test, best\_preds)

plt.figure(figsize=(6, 5))

sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=le.classes\_, yticklabels=le.classes\_)

plt.title(f"Confusion Matrix for Best Random Forest Model ({best\_n} Trees)")

plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.show()

**Program 9**

Implement Boosting ensemble method on a given dataset.

**Screenshot:**

A piece of paper with writing on it

AI-generated content may be incorrect.

**Code:**

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

from sklearn.ensemble import AdaBoostClassifier

from sklearn.model\_selection import train\_test\_split

from sklearn.metrics import accuracy\_score

from sklearn.preprocessing import LabelEncoder

from sklearn.metrics import confusion\_matrix

income\_df = pd.read\_csv("income.csv")

X\_income = income\_df.drop('income\_level', axis=1)

y\_income = income\_df['income\_level']

X\_train\_i, X\_test\_i, y\_train\_i, y\_test\_i = train\_test\_split(X\_income, y\_income, test\_size=0.3, random\_state=42)

ada\_model = AdaBoostClassifier(n\_estimators=10, random\_state=42)

ada\_model.fit(X\_train\_i, y\_train\_i)

y\_pred\_i = ada\_model.predict(X\_test\_i)

print("AdaBoost Accuracy with 10 estimators:", accuracy\_score(y\_test\_i, y\_pred\_i))

scores\_ada = []

n\_range\_ada = range(1, 51)

best\_model\_ada = None

best\_preds\_ada = None

for n in n\_range\_ada:

model = AdaBoostClassifier(n\_estimators=n, random\_state=42)

model.fit(X\_train\_i, y\_train\_i)

preds = model.predict(X\_test\_i)

acc = accuracy\_score(y\_test\_i, preds)

scores\_ada.append(acc)

if acc == max(scores\_ada):

best\_model\_ada = model

best\_preds\_ada = preds

best\_score\_ada = max(scores\_ada)

best\_n\_ada = n\_range\_ada[scores\_ada.index(best\_score\_ada)]

print(f"Best AdaBoost Accuracy: {best\_score\_ada:.4f} with {best\_n\_ada} estimators")

plt.figure(figsize=(10, 5))

plt.plot(n\_range\_ada, scores\_ada, marker='o', linestyle='-', color='orange')

plt.title('AdaBoost Accuracy vs Number of Estimators (Income Dataset)')

plt.xlabel('Number of Estimators')

plt.ylabel('Accuracy')

plt.grid(True)

plt.show()

cm\_ada = confusion\_matrix(y\_test\_i, best\_preds\_ada)

plt.figure(figsize=(6, 5))

sns.heatmap(cm\_ada, annot=True, fmt='d', cmap='Oranges', xticklabels=[0, 1], yticklabels=[0, 1])

plt.title(f"Confusion Matrix for Best AdaBoost Model ({best\_n\_ada} Estimators)")

plt.xlabel("Predicted")

plt.ylabel("Actual")

plt.show()

**Program 10**

Build k-Means algorithm to cluster a set of data stored in a .CSV file.

**Screenshot:**

A notebook with writing on it

AI-generated content may be incorrect.

A close up of a paper

AI-generated content may be incorrect.

**Code:**

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

from sklearn.model\_selection import train\_test\_split

from scipy import stats

import seaborn as sns

from sklearn.model\_selection import train\_test\_split

from sklearn.metrics import accuracy\_score

from sklearn.metrics import classification\_report, confusion\_matrix, accuracy\_score

from sklearn.cluster import KMeans

from sklearn.preprocessing import StandardScaler

df1=pd.read\_csv("iris.csv")

df1.head()

df = df1.drop(['sepal\_length','sepal\_width','species'],axis=1)

scaler = StandardScaler()

scaled\_df = scaler.fit\_transform(df)

wcss = []

for i in range(1, 11):

kmeans = KMeans(n\_clusters=i, init='k-means++', max\_iter=300, n\_init=10, random\_state=0)

kmeans.fit(scaled\_df)

wcss.append(kmeans.inertia\_)

plt.plot(range(1, 11), wcss)

plt.title('Elbow Method')

plt.xlabel('Number of clusters')

plt.ylabel('WCSS')

plt.show()

kmeans = KMeans(n\_clusters=3, init='k-means++', max\_iter=300, n\_init=10, random\_state=0)

pred\_y = kmeans.fit\_predict(scaled\_df)

df['cluster'] = pred\_y

plt.scatter(df['petal\_length'], df['petal\_width'], c=df['cluster'])

plt.title('Clusters of Iris Flowers')

plt.xlabel('Petal Length')

plt.ylabel('Petal Width')

plt.show()

**Program 11**

Implement Dimensionality reduction using Principal Component Analysis (PCA) method.

**Screenshot:**

A piece of paper with writing on it

AI-generated content may be incorrect.

A close-up of a paper

AI-generated content may be incorrect.

**Code:**

from google.colab import files

heart=files.upload()

import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

from sklearn.model\_selection import train\_test\_split

from scipy import stats

import seaborn as sns

from sklearn.preprocessing import LabelEncoder, OneHotEncoder

from sklearn.model\_selection import train\_test\_split

from sklearn.metrics import accuracy\_score

from sklearn.metrics import classification\_report, confusion\_matrix, accuracy\_score

from sklearn.preprocessing import StandardScaler

from sklearn.svm import SVC

from sklearn.linear\_model import LogisticRegression

from sklearn.ensemble import RandomForestClassifier

from sklearn.decomposition import PCA

df1=pd.read\_csv("heart.csv")

df1.head()

text\_cols = df1.select\_dtypes(include=['object']).columns

label\_encoder = LabelEncoder()

for col in text\_cols:

df1[col] = label\_encoder.fit\_transform(df1[col])

print(df1.head())

X = df1.drop('HeartDisease', axis=1)

y = df1['HeartDisease']

X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, test\_size=0.2, random\_state=42)

scaler = StandardScaler()

X\_train = scaler.fit\_transform(X\_train)

X\_test = scaler.transform(X\_test)

*# Support Vector Machine*

svm\_model = SVC(kernel='linear', random\_state=42)

svm\_model.fit(X\_train, y\_train)

svm\_predictions = svm\_model.predict(X\_test)

svm\_accuracy = accuracy\_score(y\_test, svm\_predictions)

print(f"SVM Accuracy: {svm\_accuracy}")

*# Logistic Regression*

lr\_model = LogisticRegression(random\_state=42)

lr\_model.fit(X\_train, y\_train)

lr\_predictions = lr\_model.predict(X\_test)

lr\_accuracy = accuracy\_score(y\_test, lr\_predictions)

print(f"Logistic Regression Accuracy: {lr\_accuracy}")

*# Random Forest*

rf\_model = RandomForestClassifier(random\_state=42)

rf\_model.fit(X\_train, y\_train)

rf\_predictions = rf\_model.predict(X\_test)

rf\_accuracy = accuracy\_score(y\_test, rf\_predictions)

print(f"Random Forest Accuracy: {rf\_accuracy}")

models = {

"SVM": svm\_accuracy,

"Logistic Regression": lr\_accuracy,

"Random Forest": rf\_accuracy}

best\_model = max(models, key=models.get)

print(f"\nBest Model: {best\_model} with accuracy {models[best\_model]}")

pca = PCA(n\_components=0.95)

X\_train\_pca = pca.fit\_transform(X\_train)

X\_test\_pca = pca.transform(X\_test)

svm\_model\_pca = SVC(kernel='linear', random\_state=42)

svm\_model\_pca.fit(X\_train\_pca, y\_train)

svm\_predictions\_pca = svm\_model\_pca.predict(X\_test\_pca)

svm\_accuracy\_pca = accuracy\_score(y\_test, svm\_predictions\_pca)

print(f"SVM Accuracy (with PCA): {svm\_accuracy\_pca}")

lr\_model\_pca = LogisticRegression(random\_state=42)

lr\_model\_pca.fit(X\_train\_pca, y\_train)

lr\_predictions\_pca = lr\_model\_pca.predict(X\_test\_pca)

lr\_accuracy\_pca = accuracy\_score(y\_test, lr\_predictions\_pca)

print(f"Logistic Regression Accuracy (with PCA): {lr\_accuracy\_pca}")

rf\_model\_pca = RandomForestClassifier(random\_state=42)

rf\_model\_pca.fit(X\_train\_pca, y\_train)

rf\_predictions\_pca = rf\_model\_pca.predict(X\_test\_pca)

rf\_accuracy\_pca = accuracy\_score(y\_test, rf\_predictions\_pca)

print(f"Random Forest Accuracy (with PCA): {rf\_accuracy\_pca}")

models\_pca = {

"SVM": svm\_accuracy\_pca,

"Logistic Regression": lr\_accuracy\_pca,

"Random Forest": rf\_accuracy\_pca}

best\_model\_pca = max(models\_pca, key=models\_pca.get)

print(f"\nBest Model (with PCA): {best\_model\_pca} with accuracy {models\_pca[best\_model\_pca]}")