

**VISVESVARAYA TECHNOLOGICAL  
UNIVERSITY**  
“JnanaSangama”, Belgaum -590014, Karnataka.



**LAB REPORT  
on**

**Machine Learning (23CS6PCMAL)**

*Submitted by*

**Bhuvana M(1BM22CS071)**

*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 **Bhuvana M(1BM22CS071)**, 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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**Github Link:**

<https://github.com/Bhu06/ML-LAB>

## Program 1

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

### Screenshots

**Note 1: Obesity Prediction Dataset**  
Understanding lifestyle factors that contribute to obesity can help with early intervention, health recommendations, and machine learning applications in healthcare.

**Attributes:**

- 1) Gender      No. of columns: 14
- 2) Age            No. of rows: 211
- 3) Height
- 4) Weight
- 5) Family history with overweight
- 6) FAFC - Frequent high-calorie food consumption
- 7) FFC - Vegetable consumption
- 8) NCF - No. of meals/day
- 9) CAFC - Frequency of consuming food blue meals
- 10) Smoker
- 11) H2O - daily water intake
- 12) SCC - If person monitors their calorie intake
- 13) PAF - Physical activity
- 14) CALC - Alcohol consumption

**Note 2: Road Accident Survival Dataset**  
Analyzing the impact of Age, Speed, and safety measures on accident survival.

**Attributes:**

- 1) Age            No. of Rows: 96
- 2) Gender        No. of columns: 6

**Note 3: Customer Personality Analysis**  
Helps business to better understand its customers and make it easier for them to specify products catering to the specific needs. ~~for example,~~

**Attributes:**

- 1) ID
- 2) Rec. Birth      No. of rows: 224
- 3) Education
- 4) Marital Status
- 5) Income
- 6) KidHome
- 7) JobHome
- 8) JobCustomer
- 9) Income
- 10) Completion
- 11) WorkExperience
- 12) WorkExperience      No. of rows: 9538
- 13) WorkExperience      No. of columns: 17

### Code:

```
import pandas as pd
```

```
# Create a DataFrame directly from a dictionary
```

```
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())
```

```
→ Sample data:
      Name  Age      City
0    Alice  25  New York
1     Bob  30  Los Angeles
2  Charlie  35   Chicago
3   David  40   Houston
```

```
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())
```

```
→ Sample data:
      sepal length (cm)  sepal width (cm)  petal length (cm)  petal width (cm) \
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

      target
0        0
1        0
2        0
3        0
4        0
```

```
# Load data from a CSV file (replace 'data.csv' with your file path)
file_path = '/content/industry.csv'

# Ensure the file exists in the same directory
df = pd.read_csv(file_path)
print("Sample data:")
print(df.head())
print("\n")
```

```
→ Sample data:
      Industry
0  Accounting/Finance
1  Advertising/Public Relations
2  Aerospace/Aviation
3  Arts/Entertainment/Publishing
4        Automotive
```

```
import pandas as pd
# Reading data from a CSV file
data = {
  'Name': ['Alice', 'Bob', 'Charlie', 'David', 'Evangline'],
  'USN': ['1BM22CS025', '1BM22CS030', '1BM22CS035', '1BM22CS040', '1BM22CS045'],
  'Marks': [25, 30, 35, 40, 45]
```

```

}

df = pd.DataFrame(data)

print("Sample data:")

print(df.head())

```

Sample data:				
	Name	USN	Marks	
0	Alice	1BM22CS025	25	
1	Bob	1BM22CS030	30	
2	Charlie	1BM22CS035	35	
3	David	1BM22CS040	40	
4	Evangeline	1BM22CS045	45	

```

from sklearn.datasets import load_diabetes

dia = load_diabetes()

df = pd.DataFrame(dia.data, columns=dia.feature_names)

df['target'] = dia.target

print("Sample data:")

print(df.head())

```

Sample data:						
	age	sex	bmi	bp	s1	s2
0	0.038076	0.050680	0.061696	0.021872	-0.044223	-0.034821
1	-0.001882	-0.044642	-0.051474	-0.026328	-0.008449	-0.019163
2	0.085299	0.050680	0.044451	-0.005670	-0.045599	-0.034194
3	-0.089063	-0.044642	-0.011595	-0.036656	0.012191	0.024991
4	0.005383	-0.044642	-0.036385	0.021872	0.003935	0.015596
	s3					\
0	-0.002592	0.019987	-0.017646	151.0		
1	-0.039493	-0.068332	-0.092204	75.0		
2	-0.002592	0.002861	-0.025930	141.0		
3	0.034309	0.022688	-0.009362	206.0		
4	-0.002592	-0.031988	-0.046641	135.0		
	s4	s5	s6	target		

```

# Load data from a CSV file (replace 'data.csv' with your file path)

file_path = '/content/sample_data/california_housing_train.csv' # Ensure the file exists in the same
directory

df = pd.read_csv(file_path)

print("Sample data:")

print(df.head())

print("\n")

```

Sample data:						
	longitude	latitude	housing_median_age	total_rooms	total_bedrooms	\
0	-114.31	34.19	15.0	5612.0	1283.0	
1	-114.47	34.40	19.0	7650.0	1901.0	
2	-114.56	33.69	17.0	720.0	174.0	
3	-114.57	33.64	14.0	1501.0	337.0	
4	-114.57	33.57	20.0	1454.0	326.0	
	population	households	median_income	median_house_value		
0	1015.0	472.0	1.4936	66900.0		
1	1129.0	463.0	1.8200	80100.0		
2	333.0	117.0	1.6509	85700.0		
3	515.0	226.0	3.1917	73400.0		
4	624.0	262.0	1.9250	65500.0		

```
# Load data from a CSV file (replace 'data.csv' with your file path)
# downloading and loading

file_path = '/content/Dataset of Diabetes .csv' # Ensure the file exists in the same directory
df = pd.read_csv(file_path)

print("Sample data:")
print(df.head())
print("\n")
```

Sample data:													
	ID	No_Pation	Gender	AGE	Urea	Cr	HbA1c	Chol	TG	HDL	LDL	VLDL	\
0	502	17975	F	50	4.7	46	4.9	4.2	0.9	2.4	1.4	0.5	
1	735	34221	M	26	4.5	62	4.9	3.7	1.4	1.1	2.1	0.6	
2	420	47975	F	50	4.7	46	4.9	4.2	0.9	2.4	1.4	0.5	
3	680	87656	F	50	4.7	46	4.9	4.2	0.9	2.4	1.4	0.5	
4	504	34223	M	33	7.1	46	4.9	4.9	1.0	0.8	2.0	0.4	
BMI CLASS													
0	24.0	N											
1	23.0	N											
2	24.0	N											
3	24.0	N											
4	21.0	N											

```
import pandas as pd

# Reading data from a CSV file

df=pd.read_csv('/content/sample_data/california_housing_test.csv')

# Displaying the first few rowsof the DataFrame

print(df.head())

# Writing the DataFrame to a CSV file

df.to_csv('output.csv',index=False)

print("Data saved tooutput.csv")
```

Data saved tooutput.csv						
	longitude	latitude	housing_median_age	total_rooms	total_bedrooms	\
0	-122.05	37.37	27.0	3885.0	661.0	
1	-118.30	34.26	43.0	1510.0	310.0	
2	-117.81	33.78	27.0	3589.0	507.0	
3	-118.36	33.82	28.0	67.0	15.0	
4	-119.67	36.33	19.0	1241.0	244.0	
population households median_income median_house_value						
0	1537.0	606.0	6.6085	344700.0		
1	809.0	277.0	3.5990	176500.0		
2	1484.0	495.0	5.7934	270500.0		
3	49.0	11.0	6.1359	330000.0		
4	856.0	237.0	2.9375	81700.0		

```
# Reading sales data from a CSV file

california_df=pd.read_csv('/content/sample_data/california_housing_test.csv')

# Displaying the first fewrows of the dataset

print("First few rows of the california_housing_test data:")

print(california_df.head())
```

```

→ First few rows of the california_housing_test data:
   longitude latitude housing_median_age total_rooms total_bedrooms \
0    -122.05     37.37          27.0      3885.0        661.0
1    -118.30     34.26          43.0      1510.0        310.0
2    -117.81     33.78          27.0      3589.0        507.0
3    -118.36     33.82          28.0       67.0         15.0
4    -119.67     36.33          19.0      1241.0        244.0

   population households median_income median_house_value
0      1537.0      606.0      6.6085      344700.0
1       809.0      277.0      3.5990      176500.0
2     1484.0      495.0      5.7934      270500.0
3       49.0       11.0      6.1359      330000.0
4      850.0      237.0      2.9375      81700.0

```

# Grouping by Region and calculating total sales

```

california =california_df.groupby('total_rooms')['total_bedrooms'].sum()
print("\nTotal housing by region:")
print(california)

```

```

→ Total housing by region:
total_rooms
6.0           2.0
16.0          4.0
18.0          3.0
19.0          19.0
21.0          7.0
...
21988.0      4055.0
23915.0      4135.0
24121.0      4522.0
27870.0      5027.0
30450.0      5033.0
Name: total_bedrooms, Length: 2215, dtype: float64

```

# Grouping by Product and calculating total quantity sold

```

best_selling_homes =
california_df.groupby('housing_median_age')['households'].sum().sort_values(ascending=False)
print("\nBest-selling products by quantity:")
print(best_selling_homes)

```

```
Best-selling products by quantity:  
housing_median_age  
52.0    64943.0  
17.0    58184.0  
16.0    49321.0  
19.0    47612.0  
35.0    45376.0  
25.0    44133.0  
34.0    42328.0  
26.0    42320.0  
18.0    42040.0  
24.0    41335.0  
36.0    40843.0  
15.0    40482.0  
32.0    39534.0  
29.0    38879.0  
33.0    38627.0  
27.0    38492.0  
20.0    37554.0  
5.0     37454.0  
21.0    37112.0  
4.0     35466.0  
30.0    35027.0  
22.0    34291.0  
14.0    33256.0  
37.0    31574.0  
28.0    30872.0  
12.0    28560.0  
23.0    28165.0  
11.0    25067.0  
21.0    25022.0
```

```
# Saving the sales by region data to a CSV file  
california.to_csv('california.csv')  
# Saving the best-selling products data to a CSV file  
best_selling_homes.to_csv('best_selling_homes.csv')  
print("\nAnalysis results saved to CSV files.")
```

```
Analysis results saved to CSV files.
```

```
import yfinance as yf  
import pandas as pd  
import matplotlib.pyplot as plt  
  
# Step 2: Downloading Stock Market Data  
  
# Define the ticker symbols for Indian companies  
  
# Example: Reliance Industries (RELIANCE.NS), TCS (TCS.NS), Infosys (INFY.NS)  
tickers = ["RELIANCE.NS", "TCS.NS", "INFY.NS"]  
  
# Fetch historical data for the last 1 year  
data = yf.download(tickers, start="2022-10-01", end="2023-10-01",  
group_by='ticker')
```

```
# Display the first 5 rows of the dataset
print("First 5 rows of the dataset:")
print(data.head())
```

YF.download() has changed argument auto_adjust default to True [*****10%*****] 3 of 3 completedFirst 5 rows of the dataset:						
Ticker	RELIANCE.NS					
Price	Open	High	Low	Close	Volume	\
Date						
2022-10-03	1096.071886	1107.736072	1083.009806	1085.988892	11852723	
2022-10-04	1098.959251	1108.217280	1095.453061	1106.017334	8948850	
2022-10-06	1113.258819	1122.883445	1108.285998	1110.096313	13352162	
2022-10-07	1106.681897	1120.087782	1106.681897	1114.794189	7714340	
2022-10-10	1102.259136	1108.034009	1094.467737	1102.625854	6329527	
Ticker	TCS.NS					
Price	Open	High	Low	Close	Volume	\
Date						
2022-10-03	2894.197635	2919.032606	2873.904430	2884.485840	1763331	
2022-10-04	2927.970939	2993.730628	2921.254903	2987.111084	2145875	
2022-10-06	3006.293304	3018.855764	2988.367592	2997.547852	1790816	
2022-10-07	2993.150777	3000.495078	2955.173685	2961.744629	1939879	
2022-10-10	2908.692292	3021.754418	2903.860578	3013.588867	3064063	
Ticker	INFY.NS					
Price	Open	High	Low	Close	Volume	\
Date						
2022-10-03	1337.743240	1337.743240	1313.110574	1320.453003	4943169	
2022-10-04	1345.038201	1356.928245	1339.638009	1354.228149	6631341	
2022-10-06	1369.007786	1383.029504	1368.155094	1378.624023	6180672	
2022-10-07	1370.286797	1381.182015	1364.412900	1374.881714	3994466	
2022-10-10	1351.338576	1387.956005	1351.338576	1385.729614	5274677	

```
# Step 3: Basic Data Exploration
# Check the shape of the dataset
print("\nShape of the dataset:")
print(data.shape)

# Check column names
print("\nColumn names:")
print(data.columns)

# Summary statistics for a specific stock (e.g., Reliance)
reliance_data = data['RELIANCE.NS']
print("\nSummary statistics for Reliance Industries:")
print(reliance_data.describe())

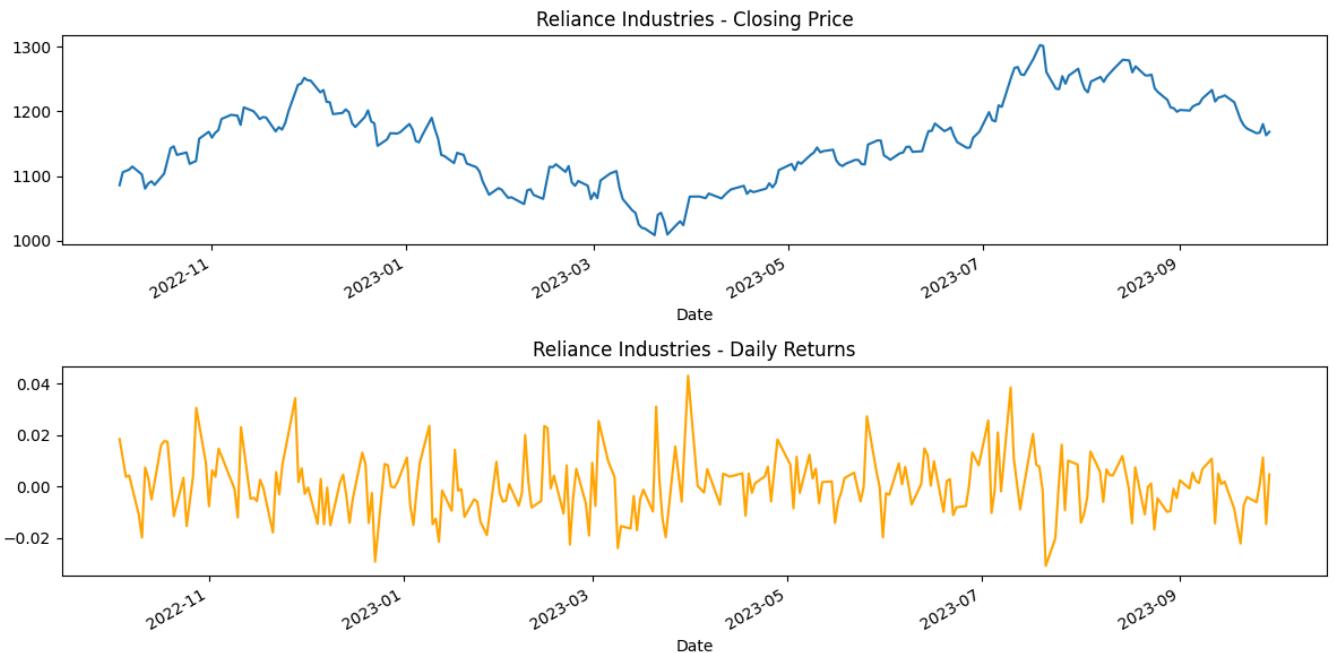
# Calculate daily returns
# Create a copy of the Reliance data to avoid modifying a slice of the original dataframe
reliance_data = data['RELIANCE.NS'].copy()
# Now, apply the calculation
```

```
reliance_data['Daily Return'] = reliance_data['Close'].pct_change()
```

```
Shape of the dataset:  
(247, 15)  
→ Column names:  
MultiIndex([(('RELIANCE.NS', 'Open'),  
            ('RELIANCE.NS', 'High'),  
            ('RELIANCE.NS', 'Low'),  
            ('RELIANCE.NS', 'Close'),  
            ('RELIANCE.NS', 'Volume'),  
            ('TCS.NS', 'Open'),  
            ('TCS.NS', 'High'),  
            ('TCS.NS', 'Low'),  
            ('TCS.NS', 'Close'),  
            ('TCS.NS', 'Volume'),  
            ('INFY.NS', 'Open'),  
            ('INFY.NS', 'High'),  
            ('INFY.NS', 'Low'),  
            ('INFY.NS', 'Close'),  
            ('INFY.NS', 'Volume')],  
           names=['Ticker', 'Price'])  
  
Summary statistics for Reliance Industries:  
Price      Open      High      Low     Close    Volume  
count  247.000000  247.000000  247.000000  247.000000  2.470000e+02  
mean   1155.033899  1163.758985  1144.612976  1154.002433  1.316652e+07  
std    65.890843   66.876907   65.755901   66.726021   6.754099e+06  
min   1015.178443  1017.470038  999.137216  1008.876526  3.370033e+06  
25%   1106.532938  1111.081861  1092.347974  1104.997559  8.717141e+06  
50%   1155.424265  1163.078198  1146.716157  1155.240967  1.158959e+07  
75%   1202.667031  1209.102783  1193.235594  1201.447937  1.530302e+07  
max   1297.045129  1308.961472  1281.920577  1302.476196  5.708188e+07
```

```
# Plot the closing price and daily returns
```

```
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()
```



```
# Step 4: Saving the Processed Data to a New CSV File
# Save the Reliance data to a CSV file
reliance_data.to_csv('reliance_stock_data.csv')
print("\nReliance stock data saved to 'reliance_stock_data.csv'.")
```

→ Reliance stock data saved to 'reliance\_stock\_data.csv'.

```
tickers = ["HDFCBANK.NS", "ICICIBANK.NS", "KOTAKBANK.NS"]
data = yf.download(tickers, start="2024-01-01", end="2024-12-30",
group_by='ticker')

# Display the first 5 rows of the dataset
print("First 5 rows of the dataset:")
print(data.head())
```

[*****100%*****] 3 of 3 completed						
First 5 rows of the dataset:						
Ticker	ICICIBANK.NS					
Price	Open	High	Low	Close	Volume	\
Date						
2024-01-01	983.086778	996.273246	982.541485	990.869812	7683792	
2024-01-02	988.490253	989.134730	971.883221	973.866150	16263825	
2024-01-03	976.295294	979.567116	966.777197	975.650818	16826752	
2024-01-04	977.980767	980.707295	973.519176	978.724365	22789140	
2024-01-05	979.567084	989.779158	975.402920	985.218445	14875499	
Ticker	HDFCBANK.NS					
Price	Open	High	Low	Close	Volume	\
Date						
2024-01-01	1683.017598	1686.125187	1669.206199	1675.223999	7119843	
2024-01-02	1675.914685	1679.860799	1665.950651	1676.210571	14621046	
2024-01-03	1679.071480	1681.735059	1646.466666	1650.363525	14194881	
2024-01-04	1655.394910	1672.116520	1648.193203	1668.071777	13367028	
2024-01-05	1664.421596	1681.932477	1645.628180	1659.538208	15944735	
Ticker	KOTAKBANK.NS					
Price	Open	High	Low	Close	Volume	\
Date						
2024-01-01	1906.909954	1916.899006	1891.027338	1907.059814	1425902	
2024-01-02	1905.911108	1905.911108	1858.063525	1863.008179	5120796	
2024-01-03	1861.959234	1867.952665	1845.627158	1863.857178	3781515	
2024-01-04	1869.451068	1869.451068	1858.513105	1861.559692	2865766	
2024-01-05	1863.457575	1867.852782	1839.383985	1845.577148	7799341	

```
HDFC = data['HDFCBANK.NS']

print("\nSummary statistics for HDFC:")

print(HDFC.describe())

# Calculate daily returns

# Create a copy of the Reliance data to avoid modifying a slice of the original dataframe

HDFC = data['HDFCBANK.NS'].copy()

# Now, apply the calculation

HDFC['Daily Return'] = HDFC['Close'].pct_change()
```

Summary statistics for HDFC:						
Price	Open	High	Low	Close	Volume	
count	244.000000	244.000000	244.000000	244.000000	2.440000e+02	
mean	1601.375295	1615.443664	1588.221245	1601.898968	2.119658e+07	
std	134.648125	134.183203	132.796819	133.748372	2.133860e+07	
min	1357.463183	1372.754374	1345.180951	1365.404785	8.798460e+05	
25%	1475.316358	1494.072805	1460.259509	1474.564087	1.274850e+07	
50%	1627.724976	1638.350037	1616.000000	1625.950012	1.686810e+07	
75%	1696.474976	1711.425018	1679.250000	1697.062531	2.295014e+07	
max	1877.699951	1880.000000	1858.550049	1871.750000	2.226710e+08	

```
ICICI = data['ICICIBANK.NS']

print("\nSummary statistics for ICICI:")

print(ICICI.describe())

# Calculate daily returns

# Create a copy of the Reliance data to avoid modifying a slice of the original dataframe

ICICI = data['ICICIBANK.NS'].copy()

# Now, apply the calculation
```

```
ICICI['Daily Return'] = ICICI['Close'].pct_change()
```

Summary statistics for ICICI:					
	Open	High	Low	Close	Volume
count	244.000000	244.000000	244.000000	244.000000	2.440000e+02
mean	1161.723560	1173.687900	1151.318979	1162.751791	1.539172e+07
std	104.905646	105.668229	105.083015	105.520481	9.503609e+06
min	965.637027	979.567116	961.869473	971.387512	1.007022e+06
25%	1073.818215	1085.368782	1067.386038	1075.107086	1.014533e+07
50%	1169.443635	1178.450012	1157.361521	1165.470703	1.291768e+07
75%	1248.512512	1261.399994	1236.649963	1250.812531	1.755770e+07
max	1344.900024	1362.349976	1340.050049	1346.099976	7.325777e+07

```
KOTAKBANK = data['KOTAKBANK.NS']

print("\nSummary statistics for KOTAKBANK:")

print(KOTAKBANK.describe())

# Calculate daily returns

# Create a copy of the Reliance data to avoid modifying a slice of the original dataframe

KOTAKBANK = data['KOTAKBANK.NS'].copy()

# Now, apply the calculation

KOTAKBANK['Daily Return'] = KOTAKBANK['Close'].pct_change()
```

Summary statistics for KOTAKBANK:					
	Open	High	Low	Close	Volume
count	244.000000	244.000000	244.000000	244.000000	2.440000e+02
mean	1771.245907	1787.548029	1754.395105	1770.792347	5.736598e+06
std	62.189675	61.978802	62.765980	62.594747	5.388927e+06
min	1581.266899	1586.161558	1542.159736	1545.006592	1.824890e+05
25%	1733.974927	1754.131905	1719.028421	1736.297058	3.300380e+06
50%	1769.500000	1789.450012	1758.099976	1773.681030	4.307680e+06
75%	1809.925018	1826.998164	1789.912506	1808.155670	6.159475e+06
max	1935.000000	1942.000000	1909.599976	1934.699951	6.617908e+07

```
# Plot the closing price and daily returns

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

plt.subplot(2, 1, 1)

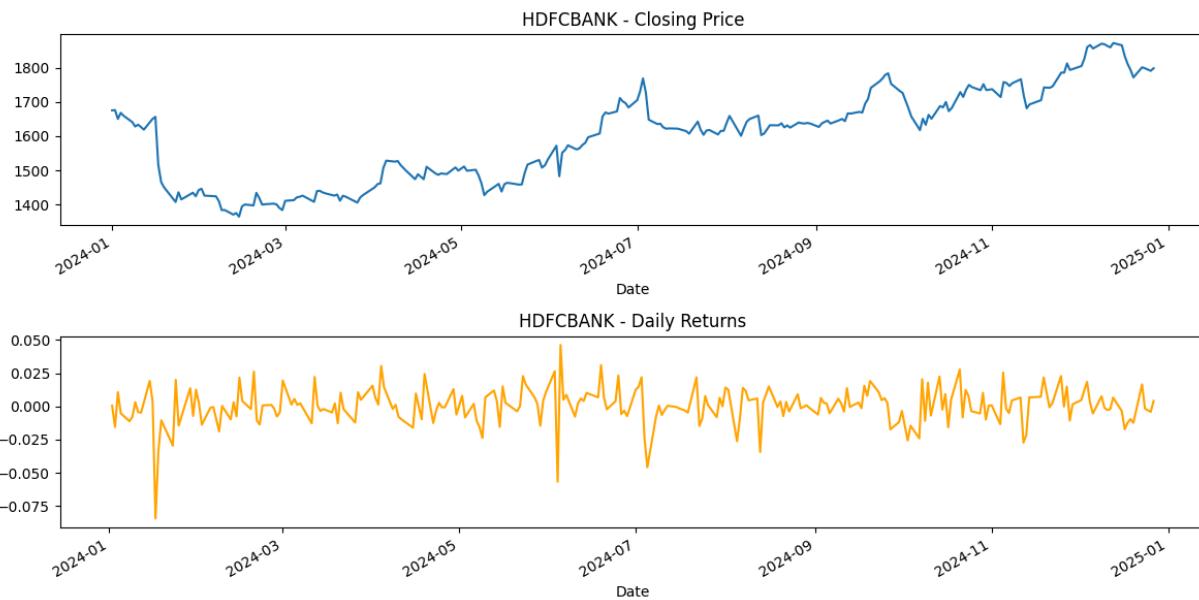
HDFC['Close'].plot(title="HDFCBANK - Closing Price")

plt.subplot(2, 1, 2)

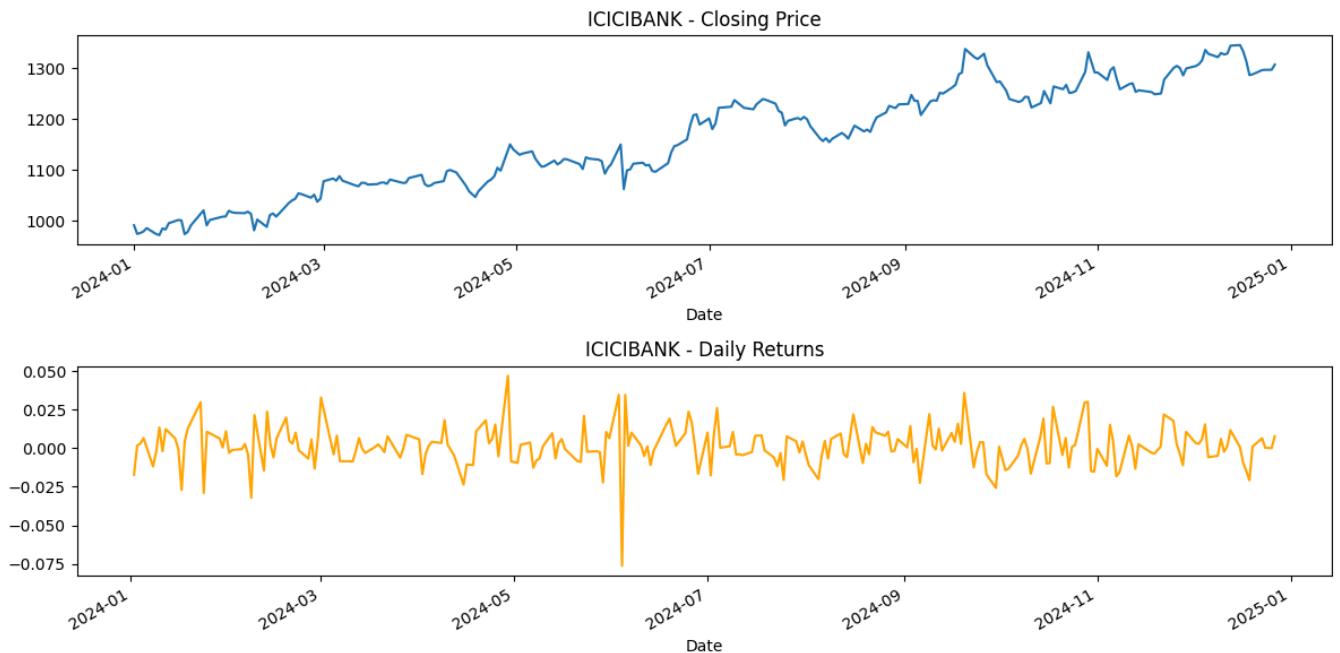
HDFC['Daily Return'].plot(title="HDFCBANK - Daily Returns", color='orange')

plt.tight_layout()

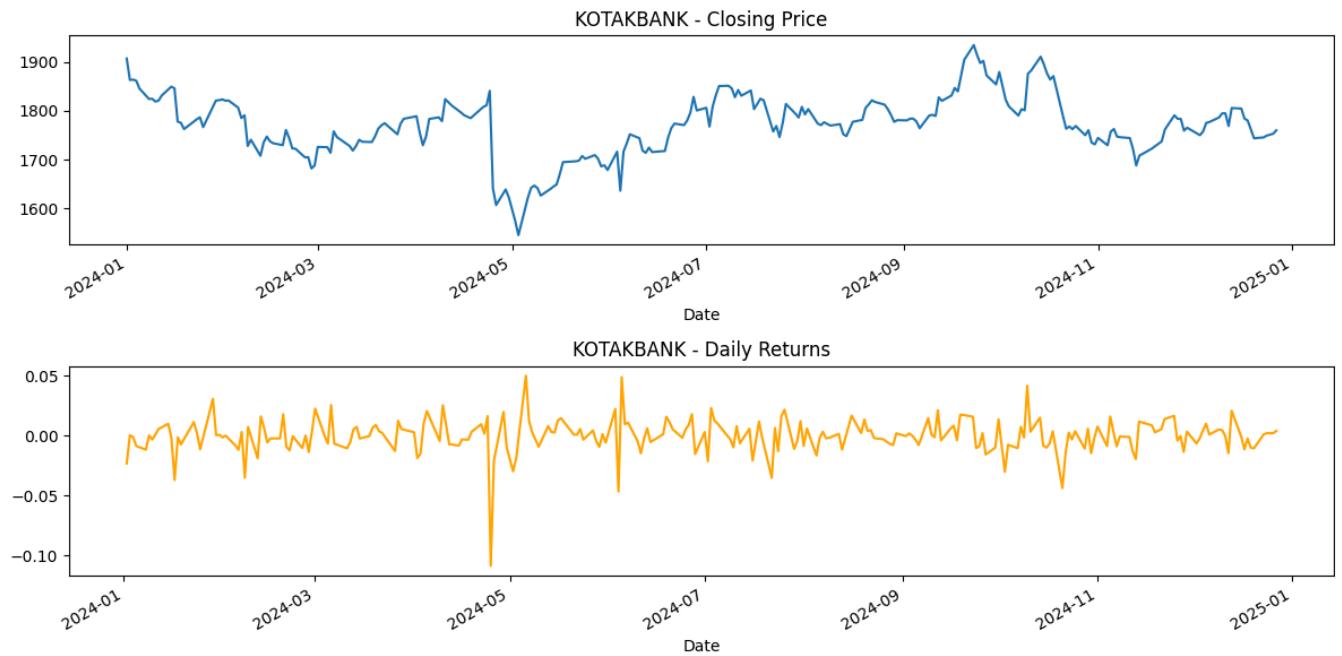
plt.show()
```



```
# Plot the closing price and daily returns
plt.figure(figsize=(12, 6))
plt.subplot(2, 1, 1)
ICICI['Close'].plot(title="ICICIBANK - Closing Price")
plt.subplot(2, 1, 2)
ICICI['Daily Return'].plot(title="ICICIBANK - Daily Returns", color='orange')
plt.tight_layout()
plt.show()
```



```
# Plot the closing price and daily returns
plt.figure(figsize=(12, 6))
plt.subplot(2, 1, 1)
KOTAKBANK['Close'].plot(title="KOTAKBANK - Closing Price")
plt.subplot(2, 1, 2)
KOTAKBANK['Daily Return'].plot(title="KOTAKBANK - Daily Returns", color='orange')
plt.tight_layout()
plt.show()
```



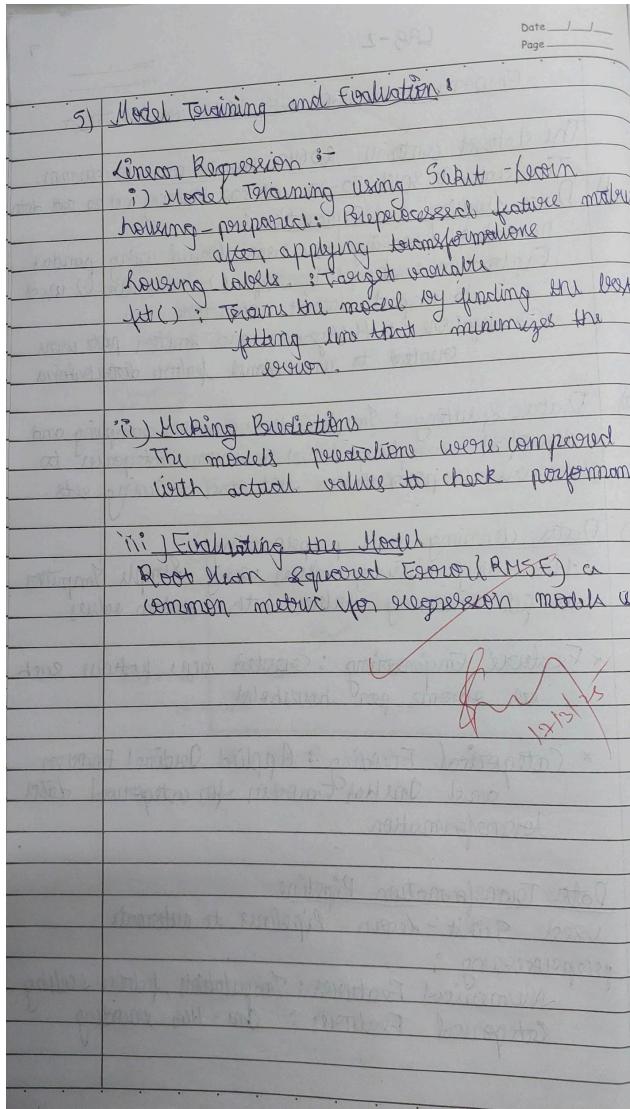
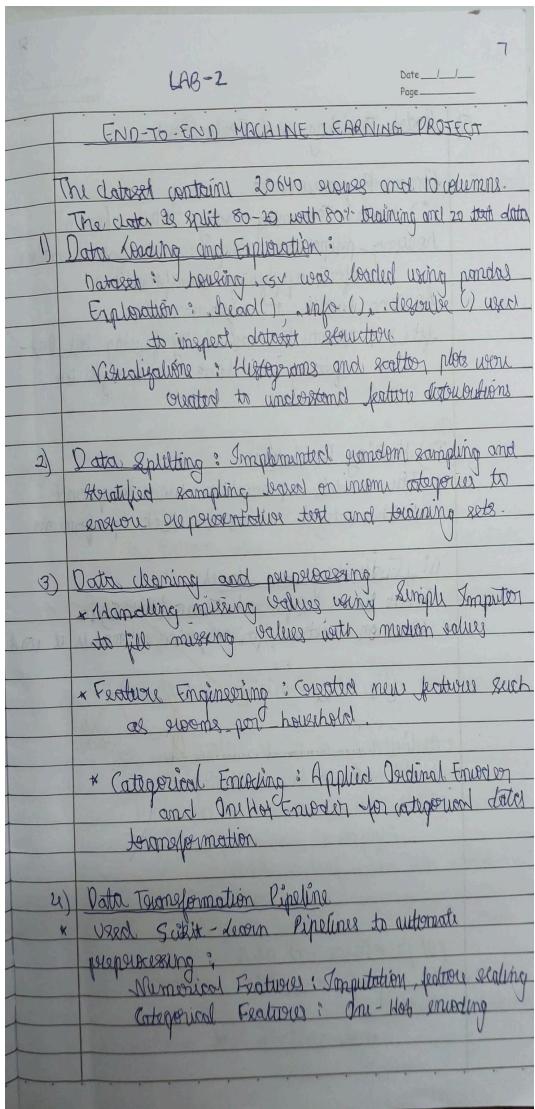
```
⌚ # Step 4: Saving the Processed Data to a New CSV File
# Save the Reliance data to a CSV file
HDFC.to_csv('HDFC.csv')
ICICI.to_csv('ICICI.csv')
KOTAKBANK.to_csv('KOTAKBANK.csv')
print("\nSAVED")
```

→ SAVED

## Program 2

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

### Screenshots



### Code:

```
import pandas as pd  
  
file_path = '/content/housing.csv'  
df = pd.read_csv(file_path)  
print("Sample data:")  
print(df.head())  
print("\n")
```

```

☒ Sample data:
   longitude  latitude  housing_median_age  total_rooms  total_bedrooms \
0      -122.23    37.88              41.0       880.0          129.0
1      -122.22    37.86              21.0      7099.0         1106.0
2      -122.24    37.85              52.0      1467.0          190.0
3      -122.25    37.85              52.0      1274.0         235.0
4      -122.25    37.85              52.0      1627.0         280.0

  population  households  median_income  median_house_value ocean_proximity
0      322.0        126.0           8.3252        452600.0     NEAR BAY
1     2401.0       1138.0           8.3014        358500.0     NEAR BAY
2      496.0        177.0           7.2574        352100.0     NEAR BAY
3      558.0        219.0           5.6431        341300.0     NEAR BAY
4      565.0        259.0           3.8462        342200.0     NEAR BAY

```

#To display information of all columns

```
print(df.info())
```

```

<bound method DataFrame.info of
   longitude  latitude  housing_median_age  total_rooms  total_bedrooms \
0      -122.23    37.88              41.0       880.0          129.0
1      -122.22    37.86              21.0      7099.0         1106.0
2      -122.24    37.85              52.0      1467.0          190.0
3      -122.25    37.85              52.0      1274.0         235.0
4      -122.25    37.85              52.0      1627.0         280.0
...
...
20635     -121.09    39.48              25.0      1665.0          374.0
20636     -121.21    39.49              18.0      697.0          150.0
20637     -121.22    39.43              17.0      2254.0          485.0
20638     -121.32    39.43              18.0      1860.0          409.0
20639     -121.24    39.37              16.0      2785.0          616.0

  population  households  median_income  median_house_value \
0      322.0        126.0           8.3252        452600.0
1     2401.0       1138.0           8.3014        358500.0
2      496.0        177.0           7.2574        352100.0
3      558.0        219.0           5.6431        341300.0
4      565.0        259.0           3.8462        342200.0
...
...
20635      845.0       330.0           1.5603        78100.0
20636      356.0       114.0           2.5568        77100.0
20637     1007.0       433.0           1.7000        92300.0
20638      741.0       349.0           1.8672        84700.0
20639     1387.0       530.0           2.3886        89400.0

  ocean_proximity
0      NEAR BAY
1      NEAR BAY
2      NEAR BAY
3      NEAR BAY
4      NEAR BAY
...
...
20635      INLAND
20636      INLAND
20637      INLAND
20638      INLAND
20639      INLAND

[20640 rows x 10 columns]>

```

#To display statistical information of all numerical

```
print(df.describe())
```

```

☒
   longitude  latitude  housing_median_age  total_rooms \
count  20640.000000  20640.000000  20640.000000  20640.000000
mean   -119.569704  35.631861  28.639486  2635.763081
std     2.003532  2.135952  12.585558  2181.615252
min    -124.350000  32.540000  1.000000  2.000000
25%    -121.800000  33.930000  18.000000  1447.750000
50%    -118.490000  34.260000  29.000000  2127.000000
75%    -118.010000  37.710000  37.000000  3148.000000
max    -114.310000  41.950000  52.000000  39320.000000

  total_bedrooms  population  households  median_income \
count  20433.000000  20640.000000  20640.000000  20640.000000
mean    537.870553  1425.476744  499.539680  3.870671
std     421.385070  1132.462122  382.329753  1.899822
min     1.000000  3.000000  1.000000  0.499900
25%    296.000000  787.000000  280.000000  2.563400
50%    435.000000  1166.000000  409.000000  3.534800
75%    647.000000  1725.000000  605.000000  4.743250
max    6445.000000  35682.000000  6082.000000  15.000100

  median_house_value
count  20640.000000
mean   206855.816909
std    115395.615874
min    14999.000000
25%    119600.000000
50%    179700.000000
75%    264725.000000
max    500001.000000

```

```
#To display the count of unique labels for “Ocean Proximity” column  
print(df['ocean_proximity'].value_counts())
```

```
→ ocean_proximity  
<1H OCEAN      9136  
INLAND        6551  
NEAR OCEAN    2658  
NEAR BAY       2290  
ISLAND          5  
Name: count, dtype: int64
```

```
#To display which attributes (columns) in a dataset have missing values count greater than zero  
print(df.isnull().sum())
```

```
→ longitude      0  
latitude        0  
housing_median_age 0  
total_rooms      0  
total_bedrooms    207  
population       0  
households        0  
median_income     0  
median_house_value 0  
ocean_proximity   0  
dtype: int64
```

```
import pandas as pd  
import numpy as np  
import matplotlib.pyplot as plt  
from sklearn.model_selection import train_test_split  
from sklearn.impute import SimpleImputer  
from sklearn.preprocessing import OrdinalEncoder, OneHotEncoder  
from sklearn.preprocessing import StandardScaler, MinMaxScaler  
from scipy import stats  
def createdata():  
    data = {  
        'Age': np.random.randint(18, 70, size=20),  
        'Salary': np.random.randint(30000, 120000, size=20),  
        'Purchased': np.random.choice([0, 1], size=20),  
        'Gender': np.random.choice(['Male', 'Female'], size=20),  
        'City': np.random.choice(['New York', 'San Francisco', 'Los Angeles'], size=20)  
    }  
    return data
```

```
df = pd.DataFrame(data)
```

```
return df
```

```
Vdf = createdata()
```

```
df.head(10)
```

	Age	Salary	Purchased	Gender	City
0	67	95582	0	Female	Los Angeles
1	58	75108	1	Female	San Francisco
2	64	94631	1	Male	New York
3	42	71454	0	Female	New York
4	44	108391	1	Male	San Francisco
5	20	106194	1	Male	New York
6	37	82085	0	Male	New York
7	27	110483	1	Female	New York
8	42	57678	1	Female	San Francisco
9	63	59239	0	Female	San Francisco

```
▶ df.shape
```

```
◀ (20, 5)
```

```
# Introduce some missing values for demonstration
```

```
df.loc[5, 'Age'] = np.nan
```

```
df.loc[10, 'Salary'] = np.nan
```

```
df.head(10)
```

	Age	Salary	Purchased	Gender	City
0	67.0	95582.0	0	Female	Los Angeles
1	58.0	75108.0	1	Female	San Francisco
2	64.0	94631.0	1	Male	New York
3	42.0	71454.0	0	Female	New York
4	44.0	108391.0	1	Male	San Francisco
5	NaN	106194.0	1	Male	New York
6	37.0	82085.0	0	Male	New York
7	27.0	110483.0	1	Female	New York
8	42.0	57678.0	1	Female	San Francisco
9	63.0	59239.0	0	Female	San Francisco

```
# Basic information about the dataset
```

```
print(df.info())
```

```

→ <class 'pandas.core.frame.DataFrame'>
RangeIndex: 20 entries, 0 to 19
Data columns (total 5 columns):
 #   Column    Non-Null Count  Dtype  
--- 
 0   Age        19 non-null    float64
 1   Salary     19 non-null    float64
 2   Purchased  20 non-null    int64  
 3   Gender     20 non-null    object  
 4   City       20 non-null    object  
dtypes: float64(2), int64(1), object(2)
memory usage: 932.0+ bytes
None

```

```
# Summary statistics
```

```
print(df.describe())
```

	Age	Salary	Purchased
count	19.000000	19.000000	20.000000
mean	45.947368	78821.315789	0.550000
std	15.356771	24850.883175	0.510418
min	19.000000	37052.000000	0.000000
25%	33.500000	58458.500000	0.000000
50%	42.000000	77139.000000	1.000000
75%	60.500000	101866.000000	1.000000
max	68.000000	112223.000000	1.000000

```
#Code to Find Missing Values
```

```
# Check for missing values in each column
```

```
missing_values = df.isnull().sum()
```

```
# Display columns with missing values
```

```
print(missing_values[missing_values > 0])
```

	Age	1
	Salary	1
		dtype: int64

```
#Set the values to some value (zero, the mean, the median, etc.).
```

```
# Step 1: Create an instance of SimpleImputer with the median strategy for Age and mean stratergy for Salary
```

```
imputer1 = SimpleImputer(strategy="median")
```

```
imputer2 = SimpleImputer(strategy="mean")
```

```
df_copy=df
```

```
# Step 2: Fit the imputer on the "Age" and "Salary"column
```

```
# Note: SimpleImputer expects a 2D array, so we reshape the column
```

```
imputer1.fit(df_copy[['Age']])
```

```
imputer2.fit(df_copy[['Salary']])
```

```
# Step 3: Transform (fill) the missing values in the "Age" and "Salary" column
df_copy["Age"] = imputer1.transform(df[["Age"]])
df_copy["Salary"] = imputer2.transform(df[["Salary"]])
# Verify that there are no missing values left
print(df_copy["Age"].isnull().sum())
print(df_copy["Salary"].isnull().sum())
```

 0  
0

#Handling Categorical Attributes

#Using Ordinal Encoding for gender COlumn and One-Hot Encoding for City Column

# Initialize OrdinalEncoder

```
ordinal_encoder = OrdinalEncoder(categories=[["Male", "Female"]])
```

# Fit and transform the data

```
df_copy["Gender_Encoded"] = ordinal_encoder.fit_transform(df_copy[["Gender"]])
```

# Initialize OneHotEncoder

```
onehot_encoder = OneHotEncoder()
```

# Fit and transform the "City" column

```
encoded_data = onehot_encoder.fit_transform(df[["City"]])
```

# Convert the sparse matrix to a dense array

```
encoded_array = encoded_data.toarray()
```

# Convert to DataFrame for better visualization

```
encoded_df = pd.DataFrame(encoded_array,
columns=onehot_encoder.get_feature_names_out(["City"]))
```

```
df_encoded = pd.concat([df_copy, encoded_df], axis=1)
```

```
df_encoded.drop("Gender", axis=1, inplace=True)
```

```
df_encoded.drop("City", axis=1, inplace=True)
```

```
print(df_encoded.head())
```

 Age Salary Purchased Gender\_Encoded City\_Los Angeles City\_New York \
0 67.0 95582.0 0 1.0 1.0 0.0
1 58.0 75108.0 1 1.0 0.0 0.0
2 64.0 94631.0 1 0.0 0.0 1.0
3 42.0 71454.0 0 1.0 0.0 1.0
4 44.0 108391.0 1 0.0 0.0 0.0

City\_San Francisco
0 0.0
1 1.0
2 0.0
3 0.0
4 1.0

```
#Data Transformation
```

```
# Min-Max Scaler/Normalization (range 0-1)
```

#Pros: Keeps all data between 0 and 1; ideal for distance-based models.

#Cons: Can distort data distribution, especially with extreme outliers.

```
normalizer = MinMaxScaler()
```

```
df_encoded[['Salary']] = normalizer.fit_transform(df_encoded[['Salary']])
```

```
df_encoded.head()
```

	Age	Salary	Purchased	Gender_Encoded	City_Los Angeles	City_New York	City_San Francisco
0	67.0	0.778625	0	1.0	1.0	0.0	0.0
1	58.0	0.506259	1	1.0	0.0	0.0	1.0
2	64.0	0.765974	1	0.0	0.0	1.0	0.0
3	42.0	0.457650	0	1.0	0.0	1.0	0.0
4	44.0	0.949023	1	0.0	0.0	0.0	1.0

```
# Standardization (mean=0, variance=1)
```

#Pros: Works well for normally distributed data; suitable for many models.

#Cons: Sensitive to outliers.

```
scaler = StandardScaler()
```

```
df_encoded[['Age']] = scaler.fit_transform(df_encoded[['Age']])
```

```
df_encoded.head()
```

	Age	Salary	Purchased	Gender_Encoded	City_Los Angeles	City_New York	City_San Francisco
0	1.456069	0.778625	0	1.0	1.0	0.0	0.0
1	0.839381	0.506259	1	1.0	0.0	0.0	1.0
2	1.250506	0.765974	1	0.0	0.0	1.0	0.0
3	-0.256953	0.457650	0	1.0	0.0	1.0	0.0
4	-0.119912	0.949023	1	0.0	0.0	0.0	1.0

```
#Removing Outliers
```

```
# Outlier Detection and Treatment using IQR
```

#Pros: Simple and effective for mild outliers.

#Cons: May overly reduce variation if there are many extreme outliers.

```
df_encoded_copy1=df_encoded
```

```
df_encoded_copy2=df_encoded
```

```
df_encoded_copy3=df_encoded
```

```
Q1 = df_encoded_copy1['Salary'].quantile(0.25)
```

```
Q3 = df_encoded_copy1['Salary'].quantile(0.75)
```

```
IQR = Q3 - Q1
```

```

lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR
df_encoded_copy1['Salary'] = np.where(df_encoded_copy1['Salary'] > upper_bound, upper_bound,
                                      np.where(df_encoded_copy1['Salary'] < lower_bound, lower_bound,
                                              df_encoded_copy1['Salary']))
print(df_encoded_copy1.head())

```

	Age	Salary	Purchased	Gender_Encoded	City_Los Angeles	\
0	1.456069	0.778625	0	1.0	1.0	
1	0.839381	0.506259	1	1.0	0.0	
2	1.250506	0.765974	1	0.0	0.0	
3	-0.256953	0.457650	0	1.0	0.0	
4	-0.119912	0.949023	1	0.0	0.0	
	City_New York	City_San Francisco				
0	0.0	0.0				
1	0.0	1.0				
2	1.0	0.0				
3	1.0	0.0				
4	0.0	1.0				

#Removing Outliers

# Z-score method

#Pros: Good for normally distributed data.

#Cons: Not suitable for non-normal data; may miss outliers in skewed distributions.

```

df_encoded_copy2['Salary_zscore'] = stats.zscore(df_encoded_copy2['Salary'])
df_encoded_copy2['Salary'] = np.where(df_encoded_copy2['Salary_zscore'].abs() > 3, np.nan,
                                      df_encoded_copy2['Salary']) # Replace outliers with NaN
print(df_encoded_copy2.head())

```

	Age	Salary	Purchased	Gender_Encoded	City_Los Angeles	\
0	1.456069	0.778625	0	1.0	1.0	
1	0.839381	0.506259	1	1.0	0.0	
2	1.250506	0.765974	1	0.0	0.0	
3	-0.256953	0.457650	0	1.0	0.0	
4	-0.119912	0.949023	1	0.0	0.0	
	City_New York	City_San Francisco	Salary_zscore			
0	0.0	0.0	0.710933			
1	0.0	1.0	-0.157507			
2	1.0	0.0	0.670595			
3	1.0	0.0	-0.312497			
4	0.0	1.0	1.254249			

#Removing Outliers

# Median replacement for outliers

#Pros: Keeps distribution shape intact, useful when capping isn't feasible.

#Cons: May distort data if outliers represent real phenomena.

```

df_encoded_copy3['Salary_zscore'] = stats.zscore(df_encoded_copy3['Salary'])
median_salary = df_encoded_copy3['Salary'].median()

```

```

df_encoded_copy3['Salary'] = np.where(df_encoded_copy3['Salary_zscore'].abs() > 3,
median_salary, df_encoded_copy3['Salary'])

print(df_encoded_copy3.head())

```

	Age	Salary	Purchased	Gender_Encoded	City_Los Angeles	\
0	1.456069	0.778625	0	1.0	1.0	
1	0.839381	0.506259	1	1.0	0.0	
2	1.250506	0.765974	1	0.0	0.0	
3	-0.256953	0.457650	0	1.0	0.0	
4	-0.119912	0.949023	1	0.0	0.0	
	City_New York	City_San Francisco	Salary_zscore			
0	0.0	0.0	0.710933			
1	0.0	1.0	-0.157507			
2	1.0	0.0	0.670595			
3	1.0	0.0	-0.312497			
4	0.0	1.0	1.254249			

## Diabetes

```

import pandas as pd

file_path = '/content/Dataset of Diabetes .csv'

df = pd.read_csv(file_path)

print("Sample data:")

print(df.head())

print("\n")

```

Sample data:													\
	ID	No_Pation	Gender	AGE	Urea	Cr	HbA1c	Chol	TG	HDL	LDL	VLDL	\
0	502	17975	F	50	4.7	46	4.9	4.2	0.9	2.4	1.4	0.5	
1	735	34221	M	26	4.5	62	4.9	3.7	1.4	1.1	2.1	0.6	
2	420	47975	F	50	4.7	46	4.9	4.2	0.9	2.4	1.4	0.5	
3	680	87656	F	50	4.7	46	4.9	4.2	0.9	2.4	1.4	0.5	
4	504	34223	M	33	7.1	46	4.9	4.9	1.0	0.8	2.0	0.4	
	BMI	CLASS											
0	24.0	N											
1	23.0	N											
2	24.0	N											
3	24.0	N											
4	21.0	N											

#1. Which columns in the dataset had missing values? How did you handle them ?

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

	ID	0
	No_Pation	0
	Gender	0
	AGE	0
	Urea	0
	Cr	0
	HbA1c	0
	Chol	0
	TG	0
	HDL	0
	LDL	0
	VLDL	0
	BMI	0
	CLASS	0
	dtype: int64	

#2. Which categorical columns did you identify in the dataset? How did you encode them ?

```
print(df.info())
```

```
→ <bound method DataFrame.info of      ID No_Patien Gender AGE Urea Cr HbA1c Chol TG HDL LDL VLDL \ 
  0   502    17975     F  50  4.7  46  4.9  4.2  0.9  2.4  1.4  0.5
  1   735    34221     M  26  4.5  62  4.9  3.7  1.4  1.1  2.1  0.6
  2   420    47975     F  50  4.7  46  4.9  4.2  0.9  2.4  1.4  0.5
  3   680    87656     F  50  4.7  46  4.9  4.2  0.9  2.4  1.4  0.5
  4   504    34223     M  33  7.1  46  4.9  4.9  1.0  0.8  2.0  0.4
  ..
  995 200    454317    M  71  11.0 97  7.0  7.5  1.7  1.2  1.8  0.6
  996 671    876534    M  31  3.0  60  12.3  4.1  2.2  0.7  2.4  15.4
  997 669    87654     M  30  7.1  81  6.7  4.1  1.1  1.2  2.4  8.1
  998 99     24004     M  38  5.8  59  6.7  5.3  2.0  1.6  2.9  14.0
  999 248    24054     M  54  5.0  67  6.9  3.8  1.7  1.1  3.0  0.7

      BMI CLASS
  0   24.0   N
  1   23.0   N
  2   24.0   N
  3   24.0   N
  4   21.0   N
  ..
  995 30.0   Y
  996 37.2   Y
  997 27.4   Y
  998 40.5   Y
  999 33.0   Y

[1000 rows x 14 columns]>
```

# Clean the Gender column: Convert all values to uppercase

```
df["Gender"] = df["Gender"].str.upper()
```

# Initialize OrdinalEncoder for Gender

```
ordinal_encoder = OrdinalEncoder(categories=[["F", "M"]], handle_unknown="use_encoded_value",
unknown_value=-1)
```

# Fit and transform the Gender column

```
df["Gender_Encoded"] = ordinal_encoder.fit_transform(df[["Gender"]])
```

# Initialize OneHotEncoder for CLASS

```
onehot_encoder = OneHotEncoder()
```

# Fit and transform the CLASS column

```
encoded_data = onehot_encoder.fit_transform(df[["CLASS"]])
```

# Convert the sparse matrix to a dense array

```
encoded_array = encoded_data.toarray()
```

# Convert to DataFrame for better visualization

```
encoded_df = pd.DataFrame(encoded_array,
```

```

columns=onehot_encoder.get_feature_names_out(["CLASS"]))
df_encoded = pd.concat([df, encoded_df], axis=1)
# Drop the original Gender and CLASS columns
df_encoded.drop("Gender", axis=1, inplace=True)
df_encoded.drop("CLASS", axis=1, inplace=True)
print(df_encoded.head())

```

	ID	No_Pation	AGE	Urea	Cr	HbA1c	Chol	TG	HDL	LDL	VLDL	BMI	\
0	502	17975	50	4.7	46	4.9	4.2	0.9	2.4	1.4	0.5	24.0	
1	735	34221	26	4.5	62	4.9	3.7	1.4	1.1	2.1	0.6	23.0	
2	420	47975	50	4.7	46	4.9	4.2	0.9	2.4	1.4	0.5	24.0	
3	680	87656	50	4.7	46	4.9	4.2	0.9	2.4	1.4	0.5	24.0	
4	504	34223	33	7.1	46	4.9	4.9	1.0	0.8	2.0	0.4	21.0	
Gender_Encoded	CLASS_N	CLASS_N	CLASS_P	CLASS_Y	CLASS_Y								
0	0.0	1.0	0.0	0.0	0.0								
1	1.0	1.0	0.0	0.0	0.0								
2	0.0	1.0	0.0	0.0	0.0								
3	0.0	1.0	0.0	0.0	0.0								
4	1.0	1.0	0.0	0.0	0.0								

## ADULT INCOME DATA

```

import pandas as pd
file_path = '/content/adult.csv'
df = pd.read_csv(file_path)
print("Sample data:")
print(df.head())
print("\n")

```

	Sample data:													
age	workclass	fnlwgt	education	educational-num	marital-status	occupation	relationship	race	gender	capital-gain	capital-loss	hours-per-week	native-country	income
0	25	Private	226802	11th	7	Never-married	Machine-op-inspct	Own-child	Black	Male	0	0	United-States	<=50K
1	38	Private	89814	HS-grad	9	Married-civ-spouse	Farming-fishing	Husband	White	Male	0	0	United-States	<=50K
2	28	Local-gov	336951	Assoc-acdm	12	Married-civ-spouse	Protective-serv	Husband	White	Male	0	0	United-States	<=50K
3	44	Private	160323	Some-college	10	Married-civ-spouse	Machine-op-inspct	Husband	Black	Male	7688	0	United-States	>50K
4	18	?	103497	Some-college	10	Never-married	?	Own-child	White	Female	0	0	United-States	<=50K

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

```

age          0
workclass    0
fnlwgt       0
education    0
educational-num 0
marital-status 0
occupation   0
relationship  0
race          0
gender         0
capital-gain  0
capital-loss  0
hours-per-week 0
native-country 0
income         0
dtype: int64
```

```
print(df.info())
```

```

<bound method DataFrame.info of
 0   25      Private  226802    age     11th    workclass   fnlwgt    education educational-num \
 1   38      Private  89814     7      HS-grad
 2   28  Local-gov  336951    9      Assoc-acdm
 3   44      Private 160323    12      Assoc-acdm
 4   18      ?  103497    10      Some-college
...   ...
48837  27      Private  257302    12      Assoc-acdm
48838  40      Private  154374    9      HS-grad
48839  58      Private  151910    9      HS-grad
48840  22      Private  201490    9      HS-grad
48841  52  Self-emp-inc  287927    9      HS-grad

      marital-status occupation relationship race gender \
 0  Never-married  Machine-op-inspct Own-child Black  Male
 1 Married-civ-spouse Farming-fishing Husband White  Male
 2 Married-civ-spouse Protective-serv Husband White  Male
 3 Married-civ-spouse Machine-op-inspct Husband Black  Male
 4 Never-married      ?  Own-child White Female
...   ...
48837 Married-civ-spouse Tech-support   Wife White Female
48838 Married-civ-spouse Machine-op-inspct Husband White  Male
48839 Widowed        Adm-clerical Unmarried White Female
48840 Never-married  Adm-clerical Own-child White  Male
48841 Married-civ-spouse Exec-managerial Wife White Female

      capital-gain capital-loss hours-per-week native-country income
 0        0           0            40 United-States <=50K
 1        0           0            50 United-States <=50K
 2        0           0            40 United-States >50K
 3      7688           0            40 United-States >50K
 4        0           0            30 United-States <=50K
...   ...
48837        0           0            38 United-States <=50K
48838        0           0            40 United-States >50K
48839        0           0            40 United-States <=50K
48840        0           0            20 United-States <=50K
48841     15024           0            40 United-States >50K

[48842 rows x 15 columns]>
```

```

# Encode binary categorical columns (e.g., gender) using OrdinalEncoder
binary_columns = ['gender']

# Initialize OrdinalEncoder for binary columns
ordinal_encoder = OrdinalEncoder(categories=[["Female", "Male"]],
handle_unknown="use_encoded_value", unknown_value=-1)
df[binary_columns] = ordinal_encoder.fit_transform(df[binary_columns])

# Encode multi-category columns using OneHotEncoder
multi_category_columns = ['workclass', 'education', 'marital-status', 'occupation', 'relationship', 'race',
'native-country']
onehot_encoder = OneHotEncoder(sparse_output=False, drop='first') # Drop first column to avoid
```

multicollinearity

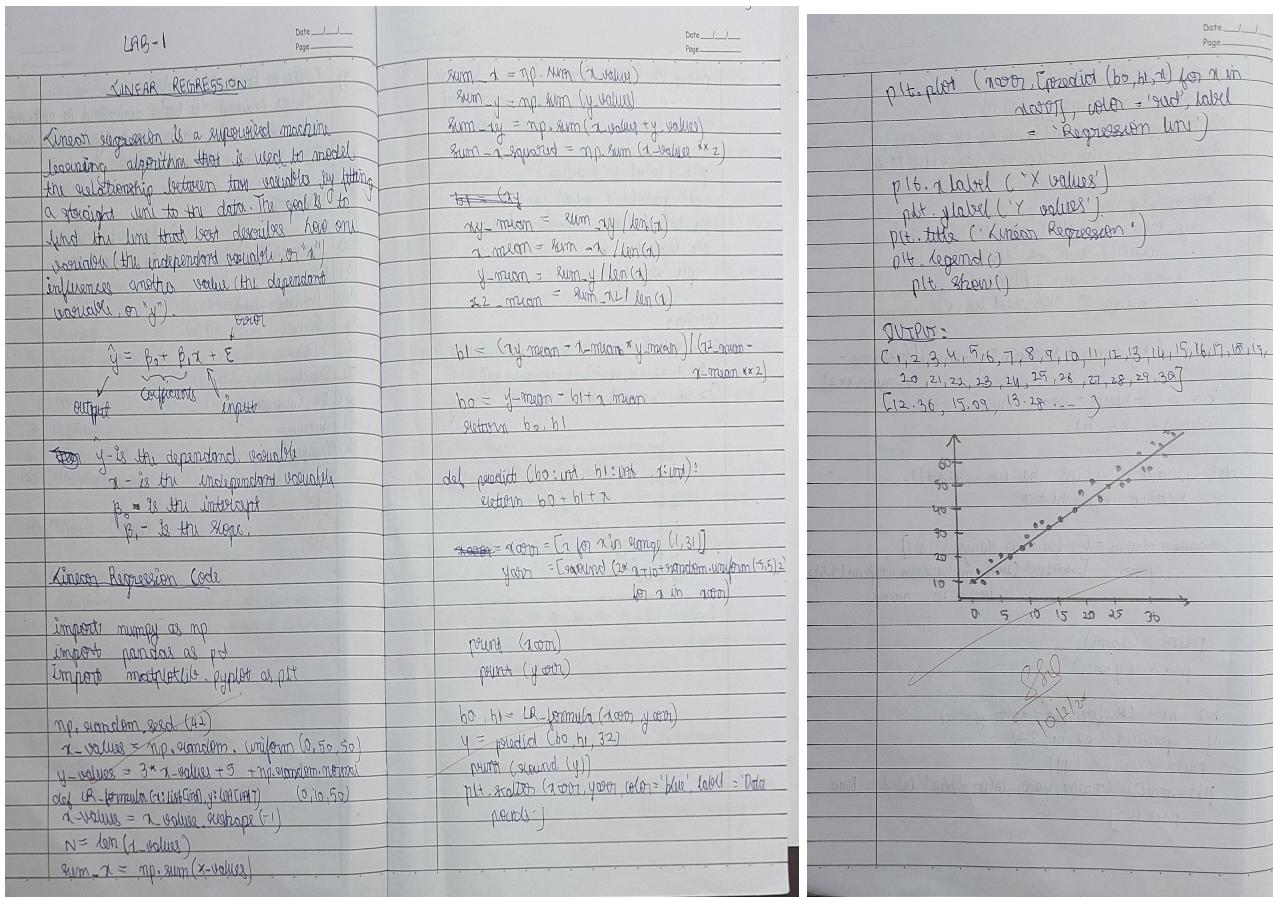
```
encoded_data = onehot_encoder.fit_transform(df[multi_category_columns])
# Convert encoded data to DataFrame
encoded_df = pd.DataFrame(encoded_data,
columns=onehot_encoder.get_feature_names_out(multi_category_columns))
# Concatenate encoded data with the original DataFrame
df_encoded = pd.concat([df.drop(multi_category_columns, axis=1), encoded_df], axis=1)
# Display the encoded DataFrame
print("\nEncoded DataFrame:")
print(df_encoded.head())
```

```
Encoded DataFrame:
   age fnlwt educational-num gender capital-gain capital-loss \
0   25  226802             7     1.0        0.0        0.0 \
1   38   89814              9     1.0        0.0        0.0 \
2   28  336951             12     1.0        0.0        0.0 \
3   44  160323              10     1.0      7688.0        0.0 \
4   18  103497              10     0.0        0.0        0.0 \
   hours-per-week income workclass_Federal-gov workclass_Local-gov ... \
0       40    <=50K            0.0            0.0    ... \
1       50    <=50K            0.0            0.0    ... \
2       40    >50K             0.0            0.0    1.0 ...
3       40    >50K             0.0            0.0    0.0 ...
4       30    <=50K            0.0            0.0    0.0 ...
   native-country_Portugal native-country_Puerto-Rico \
0                  0.0            0.0 \
1                  0.0            0.0 \
2                  0.0            0.0 \
3                  0.0            0.0 \
4                  0.0            0.0 \
   native-country_Scotland native-country_South native-country_Taiwan \
0                  0.0            0.0            0.0 \
1                  0.0            0.0            0.0 \
2                  0.0            0.0            0.0 \
3                  0.0            0.0            0.0 \
4                  0.0            0.0            0.0 \
   native-country_Thailand native-country_Trinadad&Tobago \
0                  0.0            0.0 \
1                  0.0            0.0 \
2                  0.0            0.0 \
3                  0.0            0.0 \
4                  0.0            0.0 \
   native-country_United-States native-country_Vietnam \
0                  1.0            0.0 \
1                  1.0            0.0 \
2                  1.0            0.0 \
3                  1.0            0.0 \
4                  1.0            0.0 \
   native-country_Yugoslavia
0                  0.0 \
1                  0.0 \
2                  0.0 \
3                  0.0 \
4                  0.0 \
[5 rows x 101 columns]
```

## Program 3

Implement Linear and Multi-Linear Regression algorithm using appropriate dataset

### Screenshots



### Code:

#### Linear Regression:

```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.datasets import fetch_california_housing
# Load the California Housing dataset
california_housing = fetch_california_housing()
# Assign the data (features) and target (house prices)
```

```

X = pd.DataFrame(california_housing.data, columns=california_housing.feature_names)
y = pd.Series(california_housing.target)
# Select features for Linear Regression
X = X[['MedInc', 'AveRooms']]
# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
# Create and train the Linear Regression model
model = LinearRegression()
model.fit(X_train, y_train)
# Make predictions
y_pred = model.predict(X_test)
# Print the actual vs predicted values
results = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred})
print("Linear Regression Results:")
print(results.head())

```

Linear Regression Results:		
	Actual	Predicted
20046	0.47700	1.162302
3024	0.45800	1.499135
15663	5.00001	1.955731
20484	2.18600	2.852755
9814	2.78000	2.001677

### Multiple Regression:

```

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.datasets import fetch_california_housing
california_housing = fetch_california_housing()
X = pd.DataFrame(california_housing.data, columns=california_housing.feature_names)
y = pd.Series(california_housing.target)
X = X[['MedInc', 'AveRooms']]

```

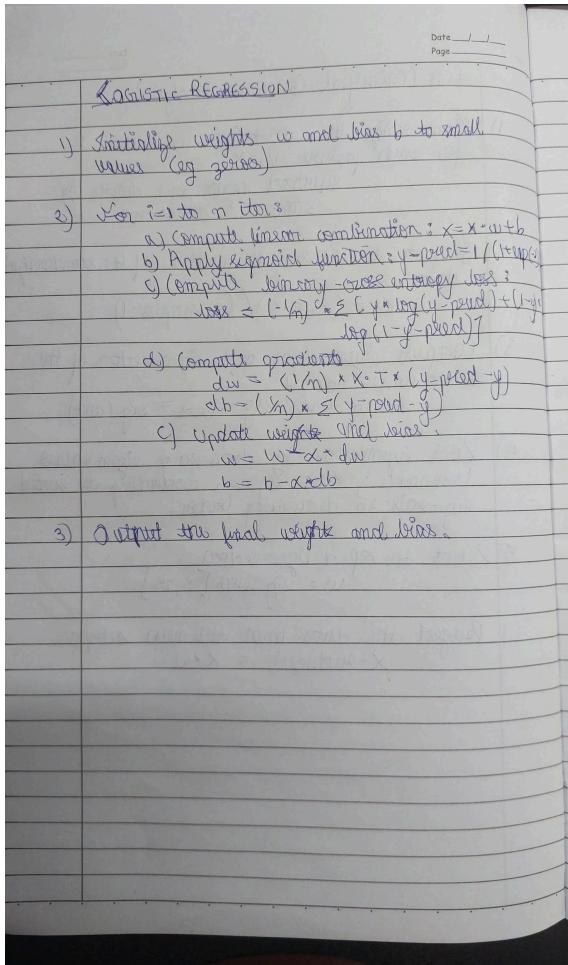
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
model = LinearRegression()
model.fit(X_train, y_train)
y_pred = model.predict(X_test)
# Print the actual vs predicted values
results = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred})
print(results.head())
```

	Actual	Predicted
20046	0.47700	1.162302
3024	0.45800	1.499135
15663	5.00001	1.955731
20484	2.18600	2.852755
9814	2.78000	2.001677

## Program 4

Build Logistic Regression Model for a given dataset

### Screenshots



### Code:

```
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.datasets import load_iris
# Load the Iris dataset
```

```

iris = load_iris()
# Assign the data (features) and target (species)
X = pd.DataFrame(iris.data, columns=iris.feature_names)
y = pd.Series(iris.target)
# For simplicity, we will classify only two classes (0 and 1)
X = X[y.isin([0, 1])] # Select only classes 0 and 1
y = y[y.isin([0, 1])]
# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
# Create and train the Logistic Regression model
model = LogisticRegression()
model.fit(X_train, y_train)
# Make predictions
y_pred = model.predict(X_test)
# Print the actual vs predicted values
results = pd.DataFrame({'Actual': y_test, 'Predicted': y_pred})
print("Logistic Regression Results:")
print(results.head())

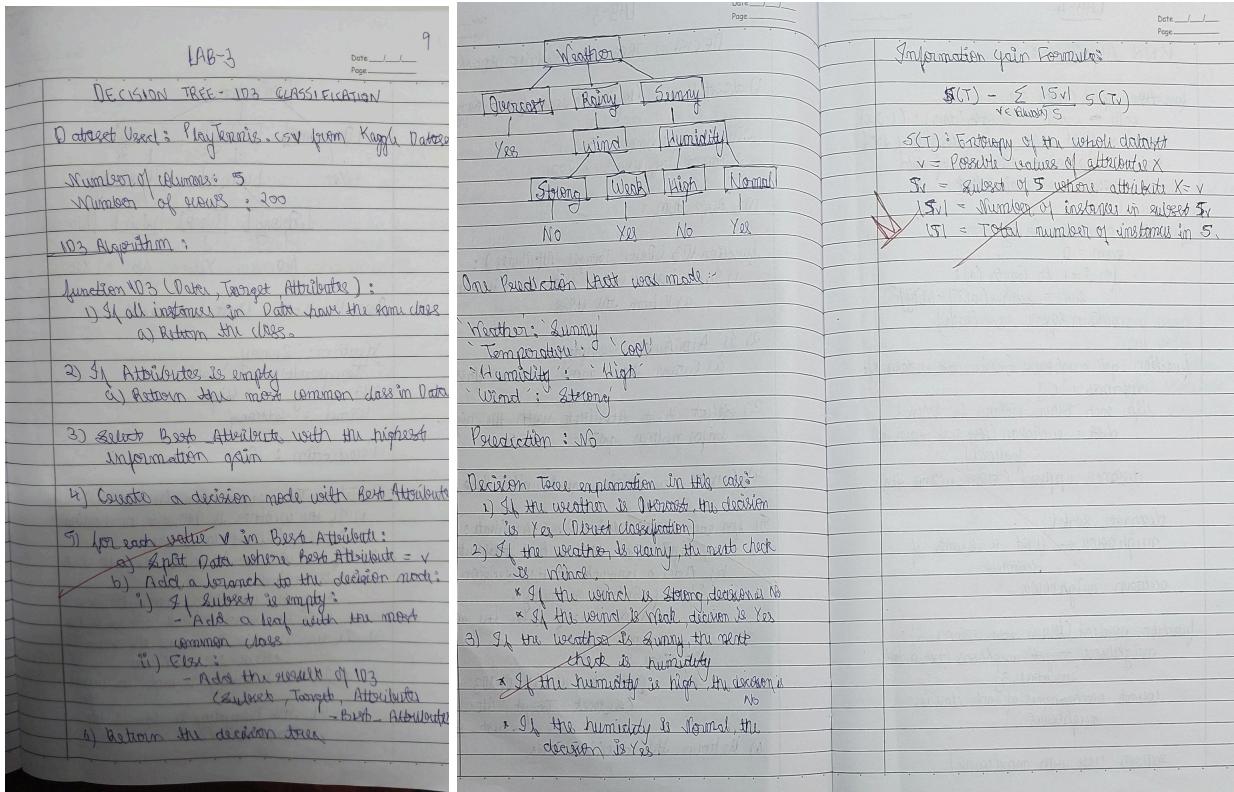
```

Logistic Regression Results:		
	Actual	Predicted
83	1	1
53	1	1
70	1	1
45	0	0
44	0	0

## Program 5

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

### Screenshots



### Code:

```
import pandas as pd
```

```
data = {
```

```

    'Outlook': ['Sunny', 'Sunny', 'Overcast', 'Rainy', 'Rainy', 'Rainy', 'Overcast', 'Sunny', 'Sunny',
    'Rainy', 'Sunny', 'Overcast', 'Overcast', 'Rainy'],
    'Temperature': ['Hot', 'Hot', 'Hot', 'Mild', 'Cool', 'Cool', 'Cool', 'Mild', 'Mild', 'Mild', 'Mild',
    'Hot', 'Mild'],
    'Humidity': ['High', 'High', 'High', 'High', 'Normal', 'Normal', 'Normal', 'High', 'Normal', 'Normal',
    'Normal', 'High', 'Normal', 'High'],
    'Windy': ['Weak', 'Strong', 'Weak', 'Weak', 'Weak', 'Strong', 'Strong', 'Weak', 'Weak', 'Weak', 'Weak',
    'Strong', 'Weak', 'Strong'],
    'PlayTennis': ['No', 'No', 'Yes', 'Yes', 'Yes', 'Yes', 'No', 'Yes', 'No', 'Yes', 'Yes', 'Yes', 'Yes', 'Yes', 'Yes', 'No']
  }
```

```

}

df = pd.DataFrame(data)

import math

def entropy(data):
    total = len(data)

    counts = data.value_counts()

    entropy_value = 0

    for count in counts:
        probability = count / total

        entropy_value -= probability * math.log2(probability)

    return entropy_value

def information_gain(data, feature, target):
    total_entropy = entropy(data[target])

    feature_values = data[feature].unique()

    weighted_entropy = 0

    for value in feature_values:
        subset = data[data[feature] == value]

        weighted_entropy += (len(subset) / len(data)) * entropy(subset[target])

    return total_entropy - weighted_entropy

def best_split(data, target):
    features = data.drop(columns=[target]).columns

    best_feature = None

    best_gain = -1

    for feature in features:
        gain = information_gain(data, feature, target)

        if gain > best_gain:
            best_gain = gain
            best_feature = feature

    return best_feature

def best_split(data, target):
    features = data.drop(columns=[target]).columns

    best_feature = None

```

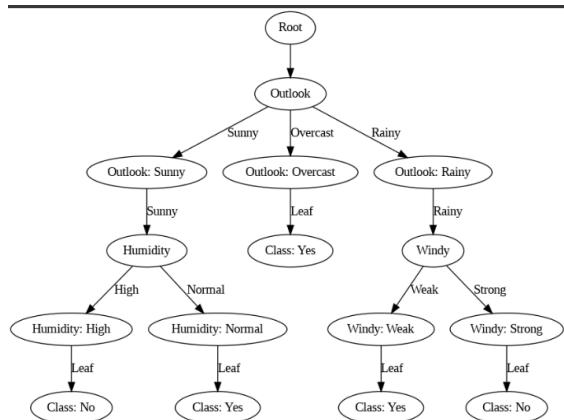
```

best_gain = -1
for feature in features:
    gain = information_gain(data, feature, target)
    if gain > best_gain:
        best_gain = gain
        best_feature = feature
return best_feature

# Build the decision tree using the dataset
tree = build_tree(df, target='PlayTennis')
print(tree)

```

```
→ {'Outlook': {'Sunny': {'Humidity': {'High': 'No', 'Normal': 'Yes'}, 'Overcast': 'Yes', 'Rainy': {'Windy': {'Weak': 'Yes', 'Strong': 'No'}}}}
```



## → California Housing Prices (Splitting)

```

import pandas as pd
housing = pd.read_csv("housing.csv")
housing.head()

```

	longitude	latitude	housing_median_age	total_rooms	total_bedrooms	population	households	median_income	median_house_value	ocean_proximity
0	-122.23	37.88	41.0	880.0	129.0	322.0	126.0	8.3252	452600.0	NEAR BAY
1	-122.22	37.86	21.0	7099.0	1106.0	2401.0	1138.0	8.3014	358500.0	NEAR BAY
2	-122.24	37.85	52.0	1467.0	190.0	496.0	177.0	7.2574	352100.0	NEAR BAY
3	-122.25	37.85	52.0	1274.0	235.0	558.0	219.0	5.6431	341300.0	NEAR BAY
4	-122.25	37.85	52.0	1627.0	280.0	565.0	259.0	3.8462	342200.0	NEAR BAY

```

▶ housing.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20640 entries, 0 to 20639
Data columns (total 10 columns):
 #   Column           Non-Null Count  Dtype  
--- 
 0   longitude        20640 non-null   float64
 1   latitude         20640 non-null   float64
 2   housing_median_age 20640 non-null   float64
 3   total_rooms      20640 non-null   float64
 4   total_bedrooms   20433 non-null   float64
 5   population       20640 non-null   float64
 6   households       20640 non-null   float64
 7   median_income    20640 non-null   float64
 8   median_house_value 20640 non-null   float64
 9   ocean_proximity  20640 non-null   object  
dtypes: float64(9), object(1)
memory usage: 1.6+ MB

▶ housing["ocean_proximity"].value_counts()

ocean_proximity
<1H OCEAN    9136
INLAND        6551
NEAR OCEAN    2658
NEAR BAY      2290
ISLAND         5
dtype: int64

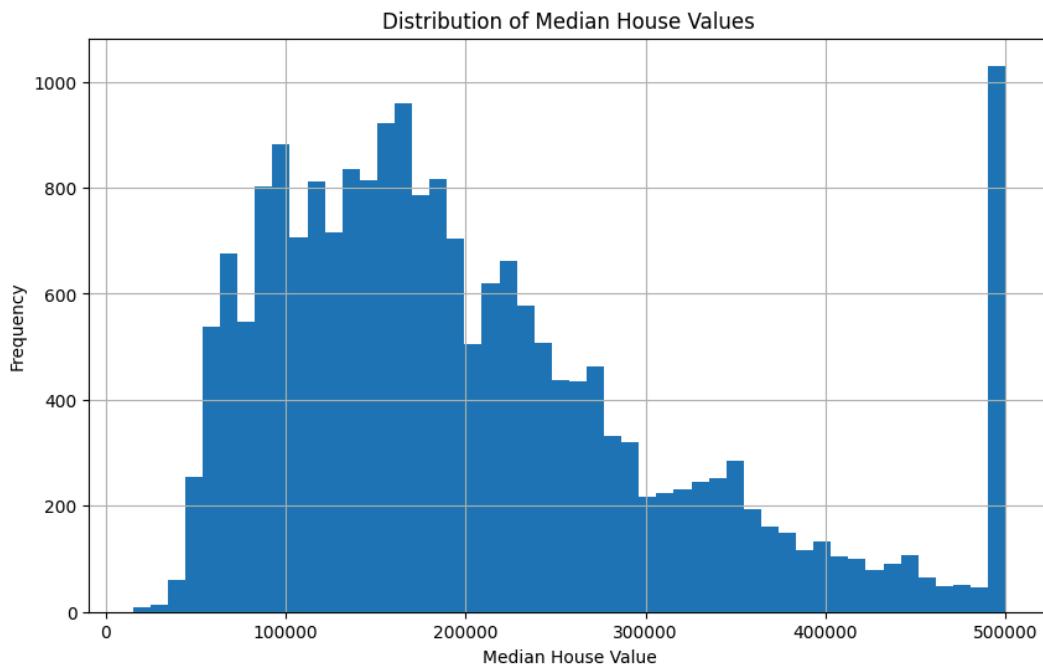
▶ housing.describe()

longitude    latitude    housing_median_age  total_rooms  total_bedrooms  population  households  median_income  median_house_value
count    20640.000000  20640.000000      20640.000000  20640.000000  20433.000000  20640.000000  20640.000000  20640.000000  20640.000000
mean     -119.569704   35.631861       28.639486   2635.763081   537.870553   1425.476744   499.539680   3.870671    206855.816909
std      2.003532     2.135952       12.585558   2181.615252   421.385070   1132.462122   382.329753   1.899822    115395.615874
min     -124.350000   32.540000       1.000000    2.000000     1.000000     3.000000     1.000000     0.499900    14999.000000
25%     -121.800000   33.930000       18.000000   1447.750000   296.000000   787.000000   280.000000   2.563400    119600.000000
50%     -118.490000   34.260000       29.000000   2127.000000   435.000000   1166.000000   409.000000   3.534800    179700.000000
75%     -118.010000   37.710000       37.000000   3148.000000   647.000000   1725.000000   605.000000   4.743250    264725.000000
max     -114.310000   41.950000       52.000000   39320.000000  6445.000000  35682.000000  6082.000000  15.000100   500001.000000
```

```

import matplotlib.pyplot as plt

# Plot a histogram of median house values
housing['median_house_value'].hist(bins=50, figsize=(10, 6))
plt.xlabel("Median House Value")
plt.ylabel("Frequency")
plt.title("Distribution of Median House Values")
plt.show()
```



```

import pandas as pd
from sklearn.model_selection import train_test_split
housing = pd.read_csv("housing.csv")
# Random sampling
train_set, test_set = train_test_split(housing, test_size=0.2, random_state=42)
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42, stratify=y)
# Separate into features (X) and target (y)
X = housing.drop("median_house_value", axis=1) # Features (all columns except the target)
y = housing["median_house_value"] # Target variable
# Split into train and test sets with stratification
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
import pandas as pd
from sklearn.model_selection import train_test_split
# Separate into features (X) and target (y)
X = housing.drop("median_house_value", axis=1) # Features (all columns except the target)
y = housing["median_house_value"] # Target variable
# Create categories for the target variable
housing["income_cat"] = pd.cut(housing["median_house_value"],
                                bins=[0, 100000, 200000, 300000, 400000, np.inf],

```

```

    labels=[1, 2, 3, 4, 5])

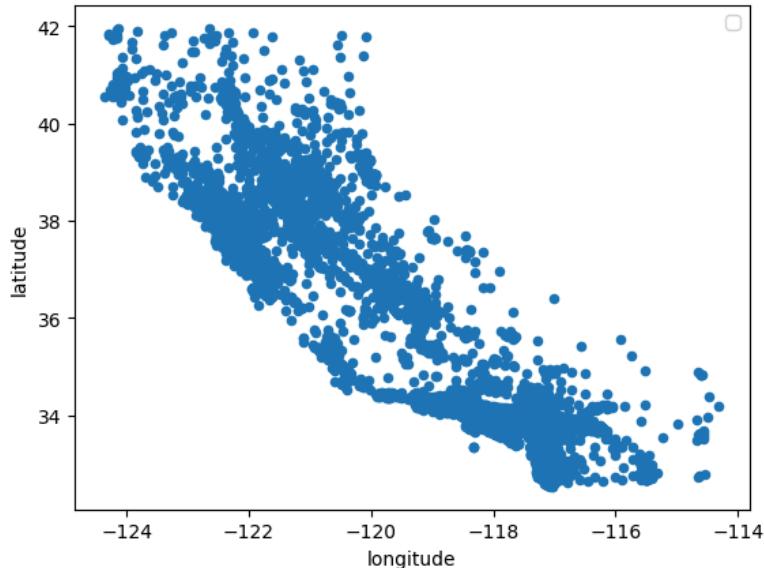
# Split into train and test sets with stratification
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42,
stratify=housing["income_cat"])

import matplotlib.pyplot as plt

# Add the target variable back to the training set for visualization
train_set = X_train.copy()
train_set["median_house_value"] = y_train

# Plot the training set
train_set.plot(kind="scatter", x="longitude", y="latitude")
plt.legend()

```



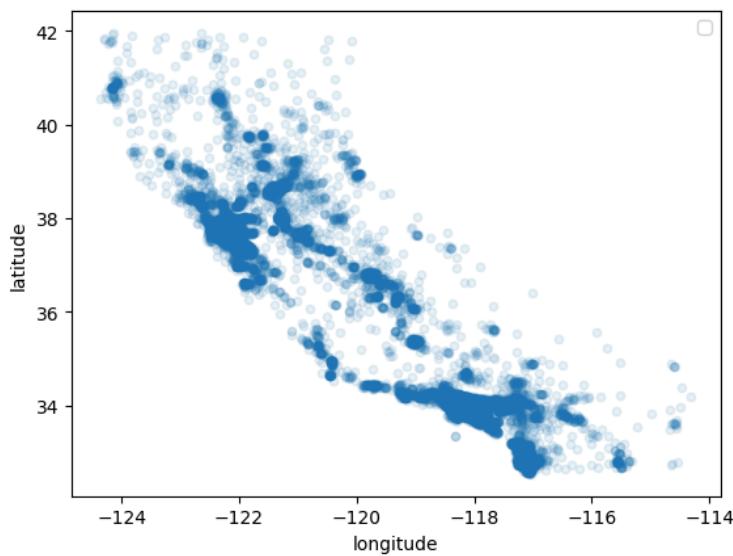
```

import matplotlib.pyplot as plt

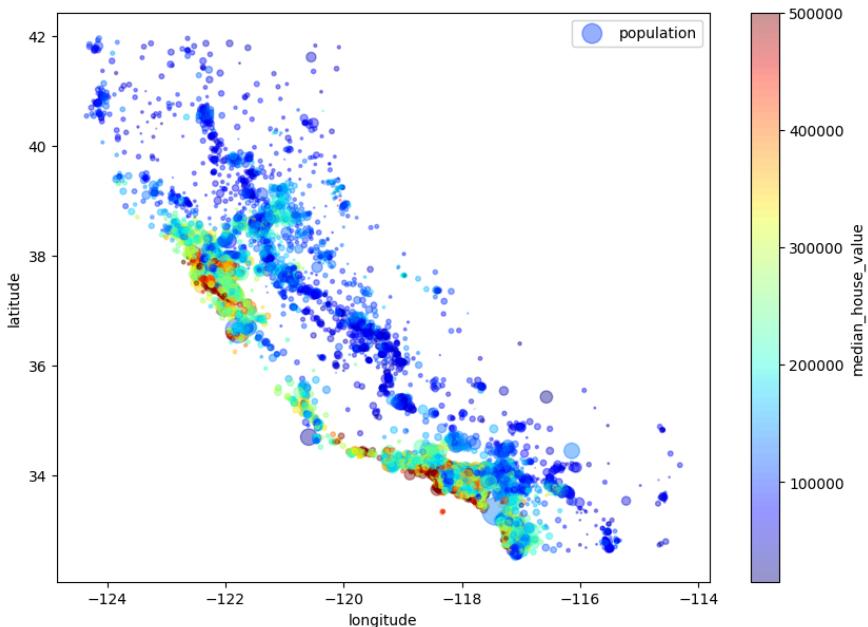
# Add the target variable back to the training set for visualization
train_set = X_train.copy()
train_set["median_house_value"] = y_train

# Plot the training set
train_set.plot(kind="scatter", x="longitude", y="latitude", alpha=0.1)
plt.legend()

```



```
train_set.plot(kind="scatter", x="longitude", y="latitude", alpha=0.4, s=train_set["population"]/100,
label="population", figsize=(10,7), c="median_house_value", cmap=plt.get_cmap("jet"), colorbar=True)
```



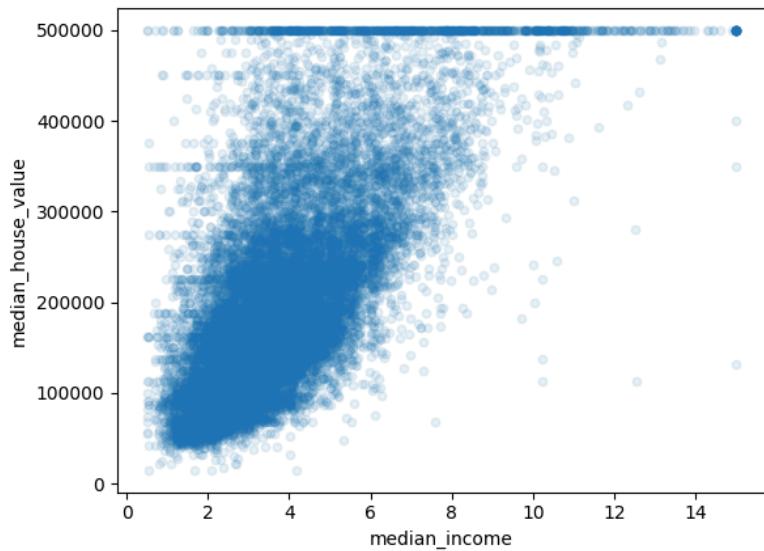
```
# Select only numerical columns (excluding categorical columns like 'ocean_proximity')
numerical_columns = housing.select_dtypes(include=['float64', 'int64'])

# Calculate the correlation matrix
correlation_matrix = numerical_columns.corr()

# Display the correlation of 'median_house_value' with other numerical columns
print(correlation_matrix["median_house_value"].sort_values(ascending=False))
```

```
median_house_value      1.000000
median_income          0.688075
total_rooms            0.134153
housing_median_age     0.105623
households             0.065843
total_bedrooms         0.049686
population             -0.024650
longitude              -0.045967
latitude               -0.144160
Name: median_house_value, dtype: float64
```

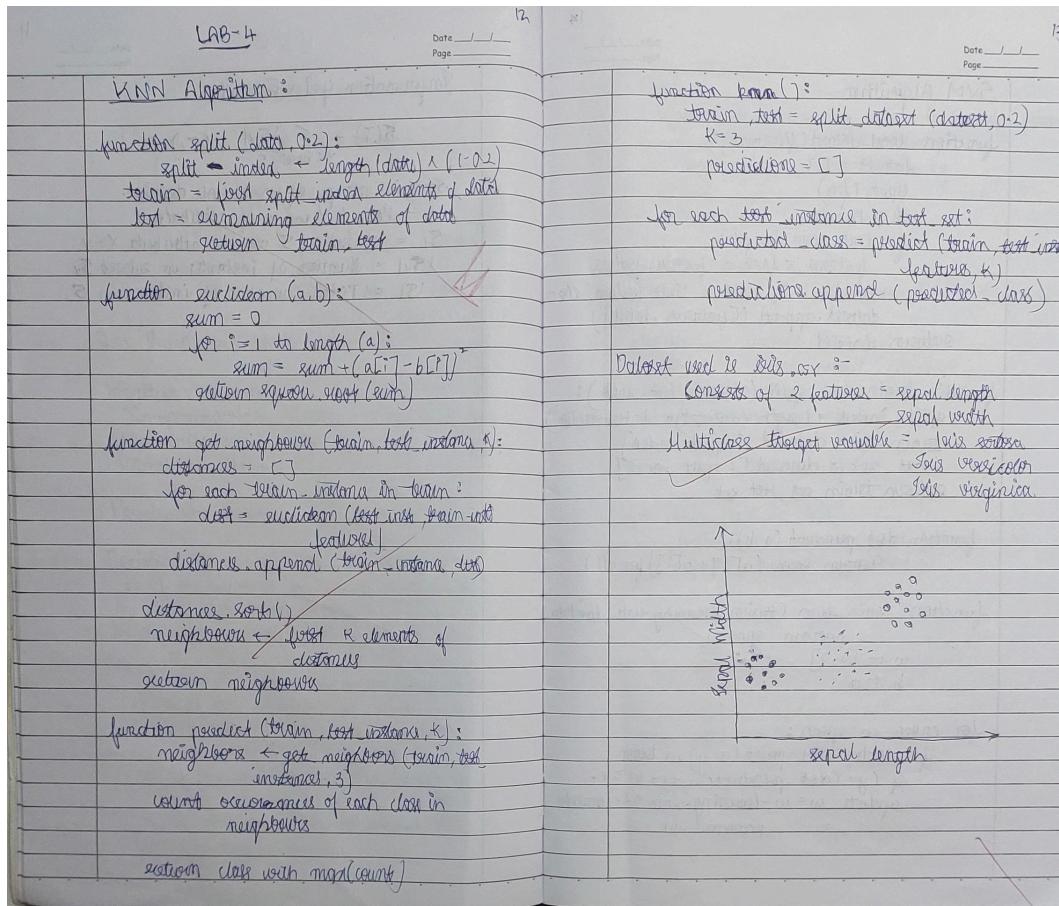
```
housing.plot(kind="scatter", x="median_income", y="median_house_value", alpha=0.1)
```



## Program 6

Build KNN Classification model for a given dataset

### Screenshots



### Code:

Using Iris Dataset and visualizing:

```

import numpy as np
import matplotlib.pyplot as plt
from sklearn import datasets
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score
# Load the Iris dataset
iris = datasets.load_iris()
X = iris.data[:, :2] # Only use the first two features (sepal length and sepal width)
  
```

```

y = iris.target # Target labels

# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)

# Create the KNN classifier (k=3 for this example)
knn = KNeighborsClassifier(n_neighbors=3)

knn.fit(X_train, y_train)

y_pred_knn = knn.predict(X_test)

# Create a mesh grid for plotting decision boundaries
x_min, x_max = X[:, 0].min() - 1, X[:, 0].max() + 1
y_min, y_max = X[:, 1].min() - 1, X[:, 1].max() + 1
xx, yy = np.meshgrid(np.arange(x_min, x_max, 0.01),
                     np.arange(y_min, y_max, 0.01))

# Plotting the decision boundaries for KNN
plt.figure(figsize=(7, 6))

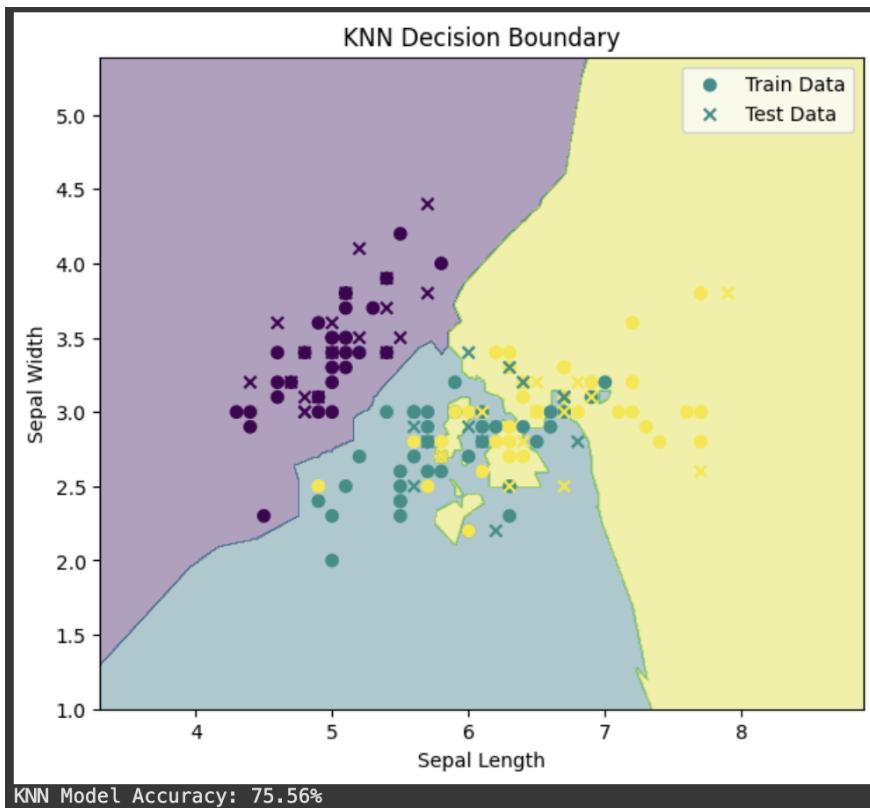
Z_knn = knn.predict(np.c_[xx.ravel(), yy.ravel()])
Z_knn = Z_knn.reshape(xx.shape)

plt.contourf(xx, yy, Z_knn, alpha=0.4)

plt.scatter(X_train[:, 0], X_train[:, 1], c=y_train, marker='o', label="Train Data")
plt.scatter(X_test[:, 0], X_test[:, 1], c=y_test, marker='x', label="Test Data")
plt.title("KNN Decision Boundary")
plt.xlabel("Sepal Length")
plt.ylabel("Sepal Width")
plt.legend()
plt.show()

# Print accuracy
accuracy_knn = accuracy_score(y_test, y_pred_knn)
print(f"KNN Model Accuracy: {accuracy_knn * 100:.2f}%")

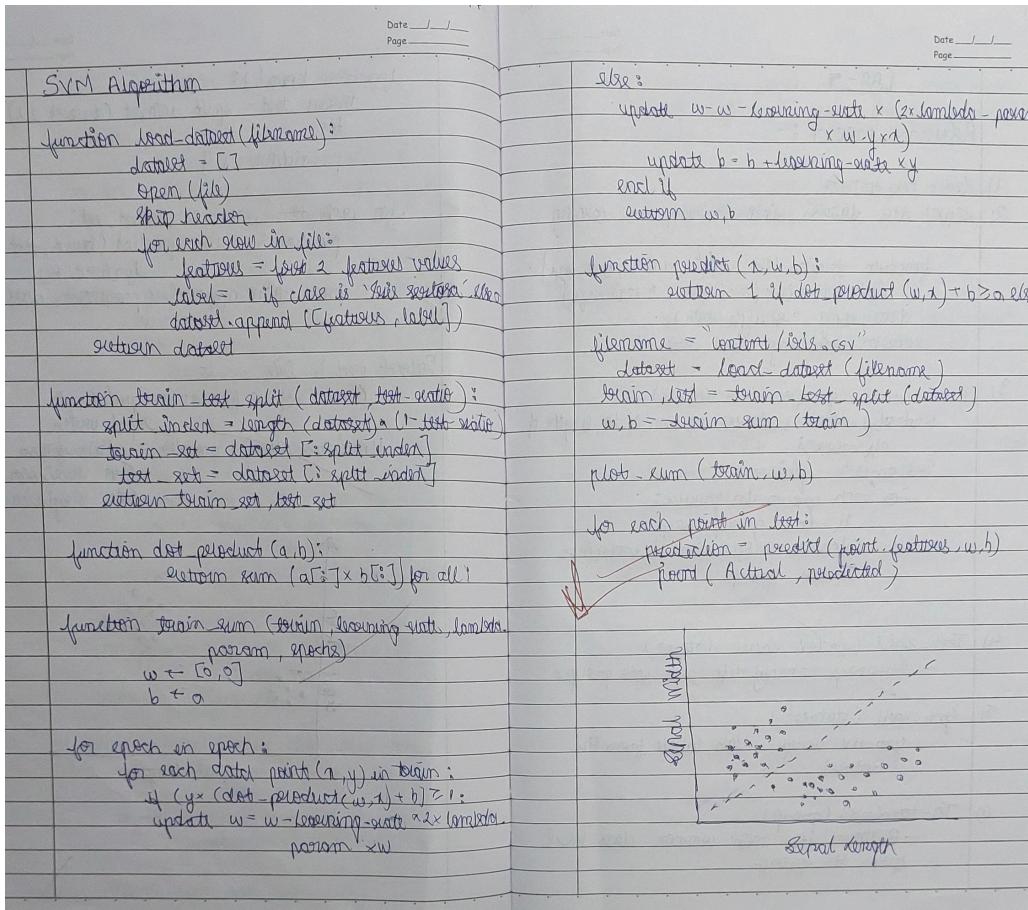
```



## Program 7

Build Support vector machine model for a given dataset

### Screenshots



### Code:

Using Iris Dataset and visualizing:

```

import numpy as np
import matplotlib.pyplot as plt
from sklearn import datasets
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score
# Load the Iris dataset
iris = datasets.load_iris()
X = iris.data[:, :2] # Only use the first two features (sepal length and sepal width)

```

```

y = iris.target # Target labels

# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)

# Create the SVM classifier (using a linear kernel for this example)
svm = SVC(kernel='linear')

svm.fit(X_train, y_train)

y_pred_svm = svm.predict(X_test)

# Create a mesh grid for plotting decision boundaries
x_min, x_max = X[:, 0].min() - 1, X[:, 0].max() + 1
y_min, y_max = X[:, 1].min() - 1, X[:, 1].max() + 1
xx, yy = np.meshgrid(np.arange(x_min, x_max, 0.01),
                     np.arange(y_min, y_max, 0.01))

# Plotting the decision boundaries for SVM
plt.figure(figsize=(7, 6))

Z_svm = svm.predict(np.c_[xx.ravel(), yy.ravel()])

Z_svm = Z_svm.reshape(xx.shape)

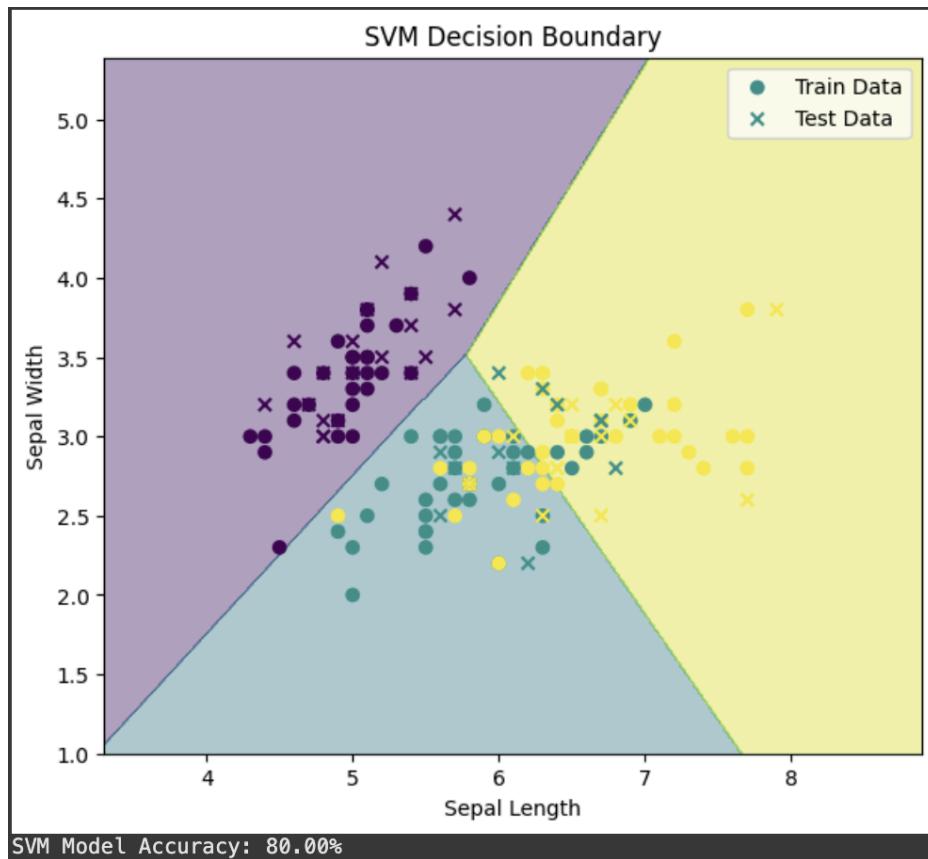
plt.contourf(xx, yy, Z_svm, alpha=0.4)

plt.scatter(X_train[:, 0], X_train[:, 1], c=y_train, marker='o', label="Train Data")
plt.scatter(X_test[:, 0], X_test[:, 1], c=y_test, marker='x', label="Test Data")

plt.title("SVM Decision Boundary")
plt.xlabel("Sepal Length")
plt.ylabel("Sepal Width")
plt.legend()
plt.show()

# Print accuracy
accuracy_svm = accuracy_score(y_test, y_pred_svm)
print(f"SVM Model Accuracy: {accuracy_svm * 100:.2f}%")

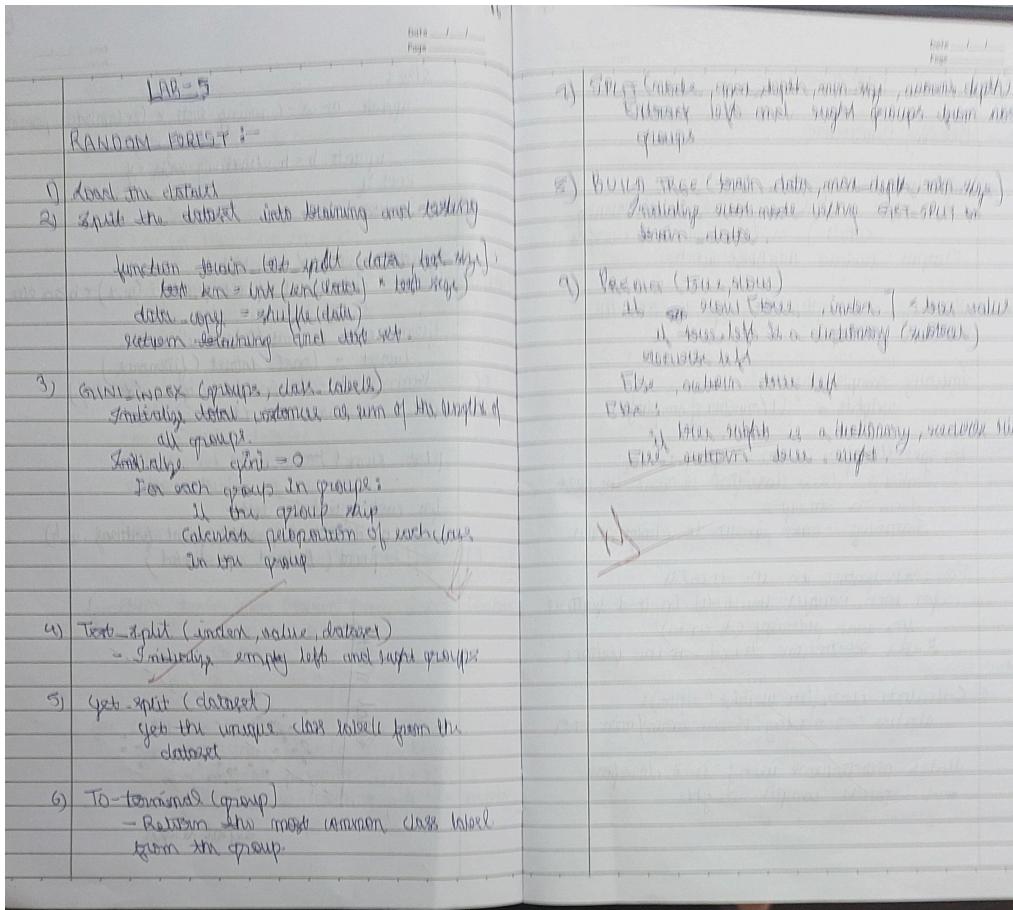
```



## Program 8

Implement Random forest ensemble method on a given dataset.

### Screenshots



### Code:

Using Iris Dataset and visualizing:

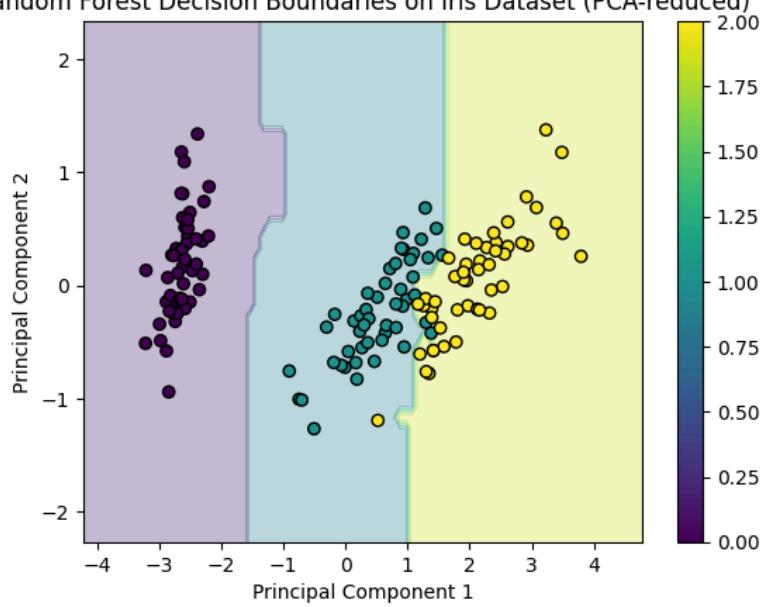
```
import numpy as np
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
from sklearn.ensemble import RandomForestClassifier
from sklearn.decomposition import PCA
# Load Iris dataset
iris = load_iris()
X = iris.data
y = iris.target
```

```

# Apply PCA for 2D visualization (reduce to 2 components)
pca = PCA(n_components=2)
X_pca = pca.fit_transform(X)
# Initialize Random Forest Classifier
clf = RandomForestClassifier(n_estimators=100, random_state=42)
# Train the model
clf.fit(X_pca, y)
# Create a mesh grid to plot decision boundaries
x_min, x_max = X_pca[:, 0].min() - 1, X_pca[:, 0].max() + 1
y_min, y_max = X_pca[:, 1].min() - 1, X_pca[:, 1].max() + 1
xx, yy = np.meshgrid(np.arange(x_min, x_max, 0.1),
                     np.arange(y_min, y_max, 0.1))
# Predict on mesh grid
Z = clf.predict(np.c_[xx.ravel(), yy.ravel()])
Z = Z.reshape(xx.shape)
# Plot decision boundaries
plt.contourf(xx, yy, Z, alpha=0.3, cmap='viridis')
plt.scatter(X_pca[:, 0], X_pca[:, 1], c=y, edgecolors='k', cmap='viridis')
plt.title('Random Forest Decision Boundaries on Iris Dataset (PCA-reduced)')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.colorbar()
plt.show()

```

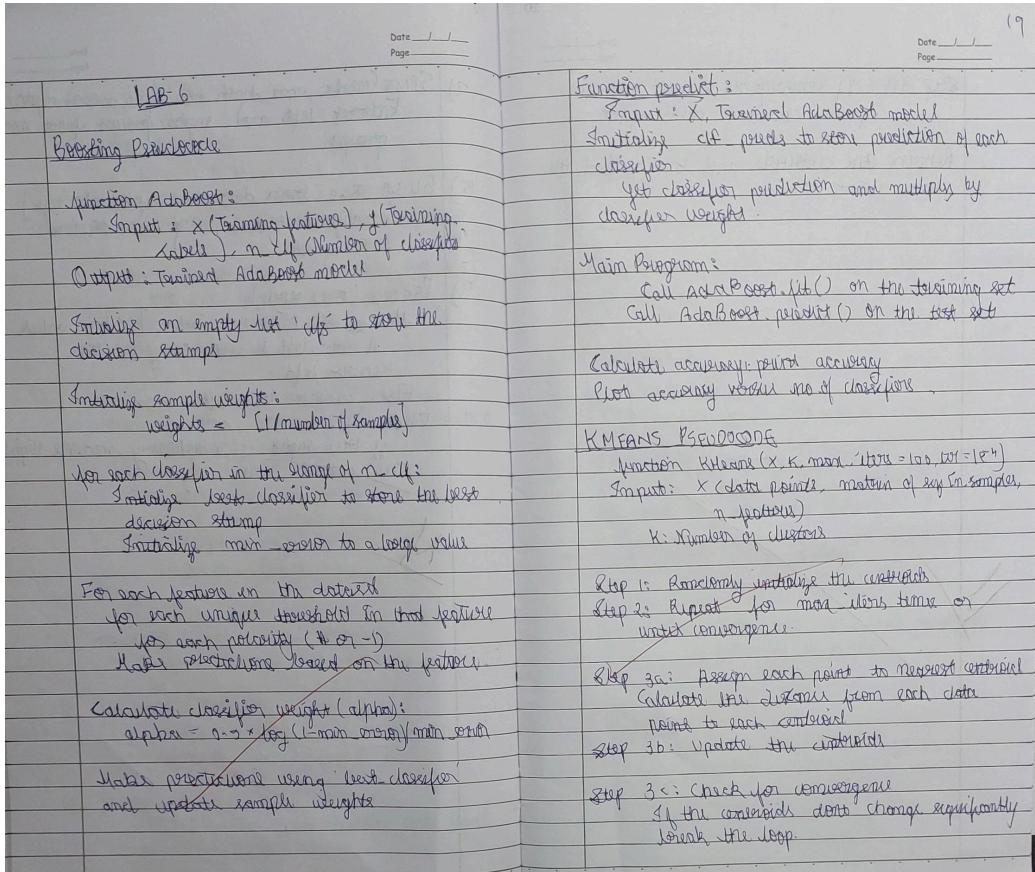
Random Forest Decision Boundaries on Iris Dataset (PCA-reduced)



## Program 9

Implement Boosting ensemble method on a given dataset.

### Screenshots



### Code:

Using Iris Dataset and visualizing:

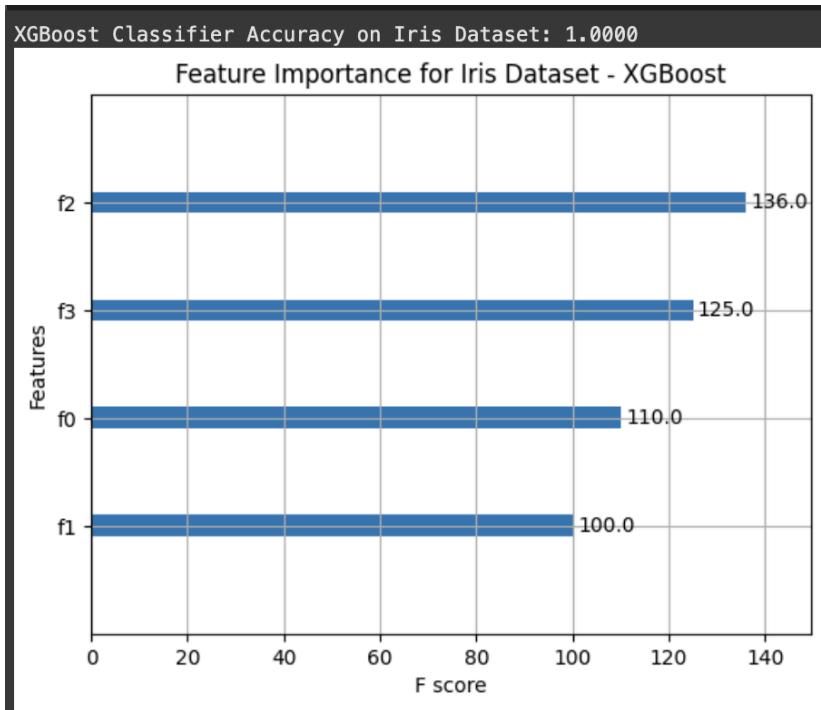
```
# XGBoost on Iris Dataset with Feature Importance Visualization

import matplotlib.pyplot as plt
import xgboost as xgb
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
# Load Iris dataset
iris = load_iris()
X = iris.data
y = iris.target
# Split dataset into training and testing sets
```

```

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
# Initialize XGBoost Classifier
xgb_clf = xgb.XGBClassifier(n_estimators=100, random_state=42)
# Train the model
xgb_clf.fit(X_train, y_train)
# Make predictions
y_pred = xgb_clf.predict(X_test)
# Calculate accuracy
accuracy = (y_pred == y_test).mean()
print(f'XGBoost Classifier Accuracy on Iris Dataset: {accuracy:.4f}')
# Feature importance visualization
xgb.plot_importance(xgb_clf, importance_type='weight', max_num_features=10)
plt.title('Feature Importance for Iris Dataset - XGBoost')
plt.show()

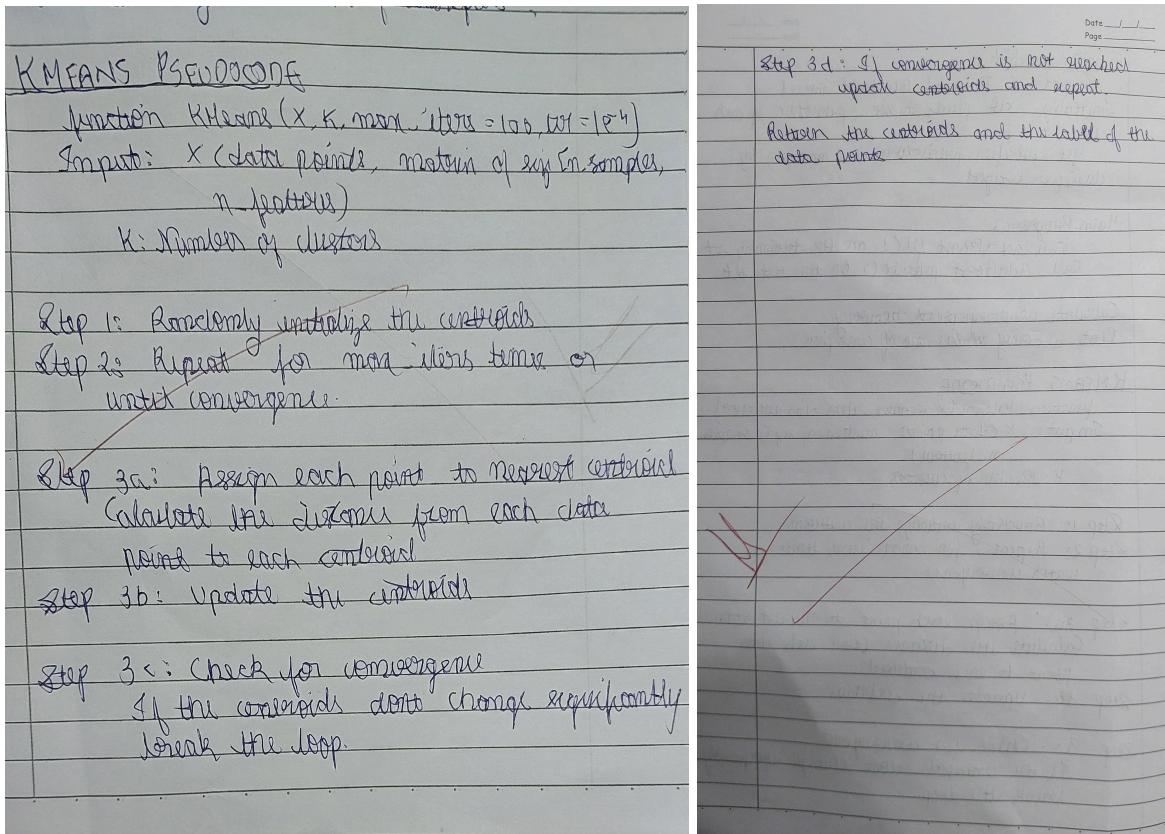
```



## Program 10

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

### Screenshots



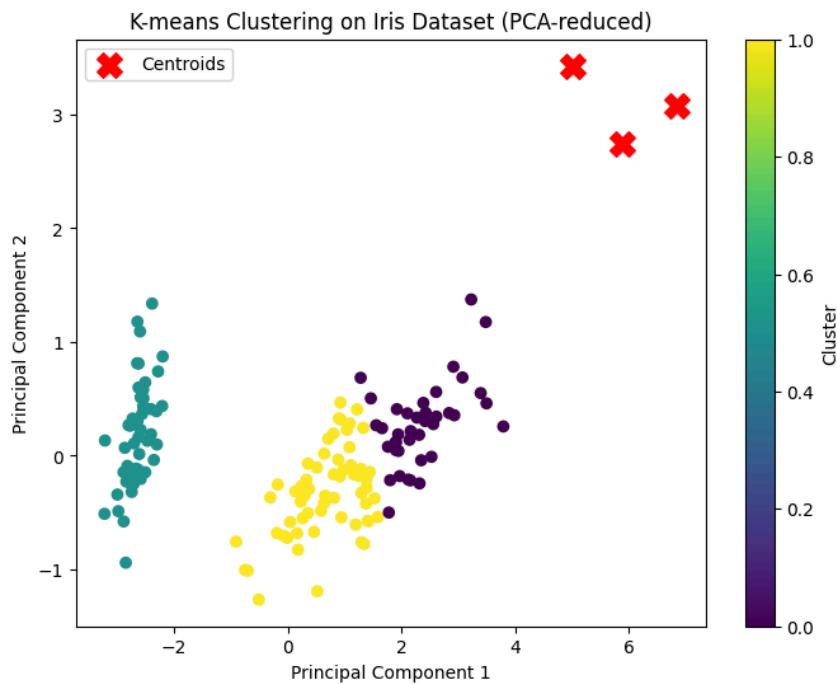
### Code:

```
# K-means on Iris Dataset with Visualization
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
from sklearn.cluster import KMeans
from sklearn.decomposition import PCA
# Load Iris dataset
iris = load_iris()
X = iris.data
y = iris.target
# Apply PCA for 2D visualization (reduce to 2 components)
pca = PCA(n_components=2)
```

```

X_pca = pca.fit_transform(X)
# Perform K-means clustering (3 clusters for 3 species in Iris)
kmeans = KMeans(n_clusters=3, random_state=42)
y_kmeans = kmeans.fit_predict(X)
# Visualize the clustering result in 2D (PCA-reduced space)
plt.figure(figsize=(8, 6))
plt.scatter(X_pca[:, 0], X_pca[:, 1], c=y_kmeans, cmap='viridis')
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s=200, c='red', marker='X',
label='Centroids')
plt.title('K-means Clustering on Iris Dataset (PCA-reduced)')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.colorbar(label='Cluster')
plt.legend()
plt.show()

```



```

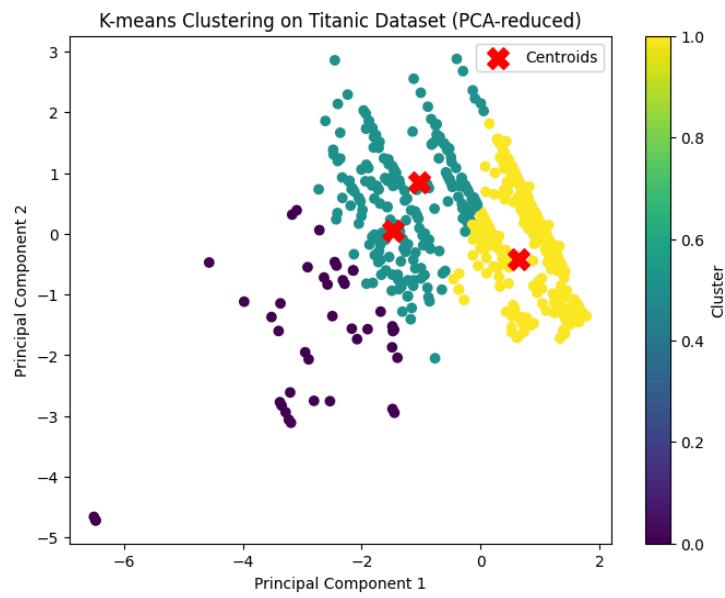
# K-means on Kaggle Titanic Dataset with Visualization
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans

```

```

from sklearn.decomposition import PCA
# Load Titanic dataset (You can replace the URL with your own Kaggle dataset link)
url = "https://raw.githubusercontent.com/datasets/master/titanic.csv"
data = pd.read_csv(url)
# Preprocessing: Selecting relevant features and dropping missing values
data = data.dropna(subset=['Pclass', 'Age', 'Fare'])
X = data[['Pclass', 'Age', 'Fare']]
# Normalize the data (optional, but helps with clustering)
X = (X - X.mean()) / X.std()
# Apply K-means clustering (let's assume we use 3 clusters for this example)
kmeans = KMeans(n_clusters=3, random_state=42)
y_kmeans = kmeans.fit_predict(X)
# Apply PCA for 2D visualization (reduce to 2 components)
pca = PCA(n_components=2)
X_pca = pca.fit_transform(X)
# Plot the clusters in 2D
plt.figure(figsize=(8, 6))
plt.scatter(X_pca[:, 0], X_pca[:, 1], c=y_kmeans, cmap='viridis')
plt.scatter(kmeans.cluster_centers_[:, 0], kmeans.cluster_centers_[:, 1], s=200, c='red', marker='X',
label='Centroids')
plt.title('K-means Clustering on Titanic Dataset (PCA-reduced)')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.colorbar(label='Cluster')
plt.legend()
plt.show()

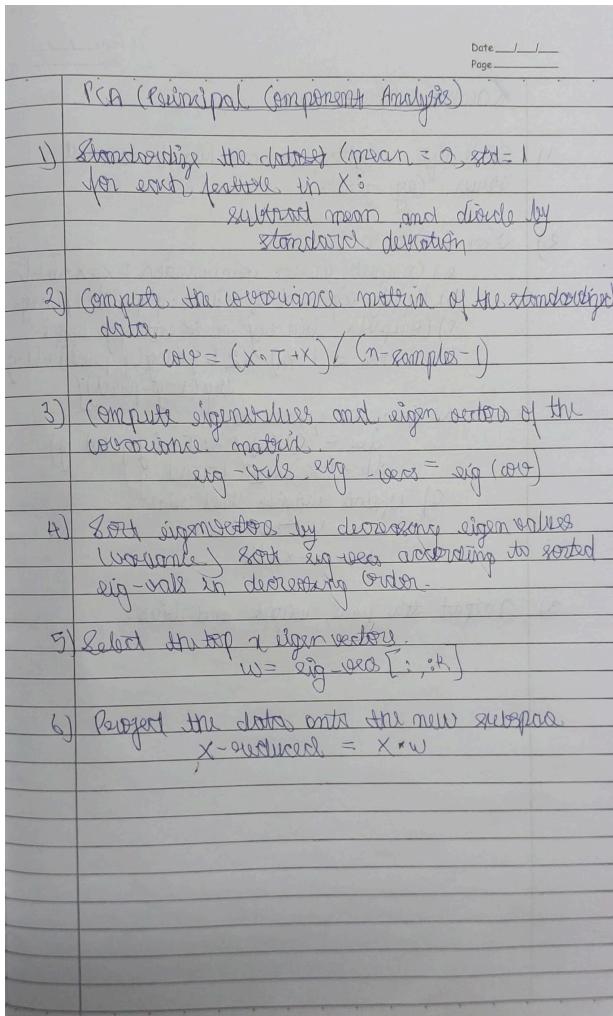
```



## Program 11

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

### Screenshots



### Code:

Using Iris Dataset and visualizing:

```
# PCA on Iris Dataset with Visualization
import matplotlib.pyplot as plt
from sklearn.datasets import load_iris
from sklearn.decomposition import PCA
# Load Iris dataset
iris = load_iris()
X = iris.data
```

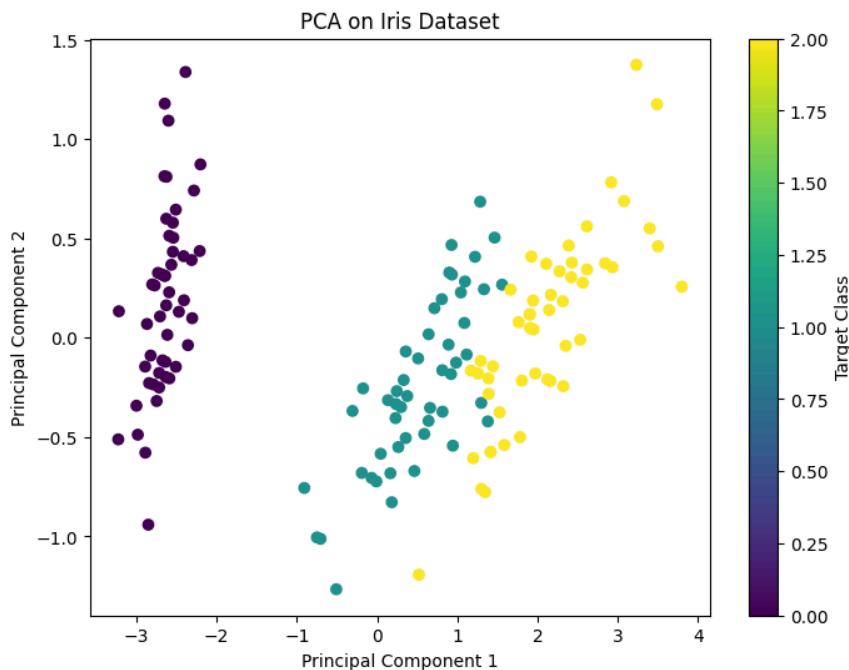
```

y = iris.target

# Apply PCA to reduce data to 2D
pca = PCA(n_components=2)
X_pca = pca.fit_transform(X)

# Plot the PCA-reduced data
plt.figure(figsize=(8, 6))
plt.scatter(X_pca[:, 0], X_pca[:, 1], c=y, cmap='viridis')
plt.title('PCA on Iris Dataset')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.colorbar(label='Target Class')
plt.show()

```



*Using Kaggle Titanic Dataset and visualizing:*

```

# PCA on Kaggle Titanic Dataset with Visualization
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.decomposition import PCA
from sklearn.preprocessing import LabelEncoder
# Load Titanic dataset (Replace with your dataset URL or local file path)

```

```

url = "https://raw.githubusercontent.com/datasets/master/titanic.csv"
data = pd.read_csv(url)

# Preprocess the dataset: Handle missing values and encode categorical features
data = data.dropna(subset=['Pclass', 'Age', 'Fare'])
data['Sex'] = LabelEncoder().fit_transform(data['Sex'])

# Select relevant features
X = data[['Pclass', 'Age', 'Fare']]
y = data['Survived']

# Apply PCA to reduce data to 2D
pca = PCA(n_components=2)
X_pca = pca.fit_transform(X)

# Plot the PCA-reduced data
plt.figure(figsize=(8, 6))
plt.scatter(X_pca[:, 0], X_pca[:, 1], c=y, cmap='coolwarm')
plt.title('PCA on Titanic Dataset')
plt.xlabel('Principal Component 1')
plt.ylabel('Principal Component 2')
plt.colorbar(label='Survived (0=No, 1=Yes)')
plt.show()

```

