Practical-1

Write a python program to perform data preprocessing and cleaning tasks on a dataset using the NumPy library

AIM: perform basic data preprocessing and cleaning tasks on a dataset using the NumPy library.

SOURCE CODE:

```
import numpy as np

# Example dataset: rows represent data points, columns are features
data = np.array([
    [1, 2, np.nan],
    [4, np.nan, 6],
    [7, 8, 9],
    [4, np.nan, 6],  # Duplicate row
    [np.nan, 5, 9],
])

print("Original Data:")
print(data)

# 1. Handle missing values (e.g., replace with mean of the column)
col_means = np.nanmean(data, axis=0)
indices = np.where(np.isnan(data))
data[indices] = np.take(col_means, indices[1])

print("\nData after handling missing values (replacing with column means):")
print(data)

# 2. Remove duplicate rows
data_unique = np.unique(data, axis=0)

print("\nData after removing duplicates:")
print(data_unique)

# 3. Normalize data (scale to 0-1 range)
data_min = np.min(data_unique, axis=0)
data_max = np.max(data_unique, axis=0)
normalized_data = (data_unique - data_min) / (data_max - data_min)

print("\nNormalized Data (scaled to 0-1):")
print(normalized_data)
```

OUTPUT:

```
Original Data:
[[ 1.  2. nan]
 [ 4. nan  6.]
 [ 7.  8.  9.]
 [ 4. nan  6.]
 [nan  5.  9.]]
```

Data after handling missing values (replacing with column means):
[[1. 2. 7.5]
[4. 5. 6.]
[7. 8. 9.]
[4. 5. 6.]
[4. 5. 9.]]

Data after removing duplicates:
[[1. 2. 7.5]
[4. 5. 6.]
[4. 5. 9.]
[7. 8. 9.]]

Normalized Data (scaled to 0-1):
[[0. 0. 0.5]
[0.5 0.5 0.]
[0.5 0.5 1.]
[1. 1. 1.]]

Practical-2

Write a python program to perform statistical analysis technique on a dataset using the Pandas library

AIM: Calculate central tendency measures such as mean, median, and mode

SOURCE CODE:

```
import pandas as pd

# Real-life example: Exam scores of 10 students in three subjects
data = {
    'Student': ['Alice', 'Bob', 'Charlie', 'David', 'Eva', 'Frank', 'Grace', 'Helen', 'Ian', 'Jack'],
    'Math': [85, 78, 92, 88, 95, 73, 81, 89, 76, 91],
    'Science': [90, 85, 87, 91, 94, 78, 82, 88, 80, 92],
    'English': [88, 79, 85, 86, 93, 77, 84, 91, 79, 88]
}

# Create a DataFrame
df = pd.DataFrame(data)

# Display the original dataset
print("Original Data:")
print(df)

# 1. Mean Calculation: The average score in each subject
mean_scores = df[['Math', 'Science', 'English']].mean()
print("\nMean Scores (Average):")
print(mean_scores)

# 2. Median Calculation: The middle value of scores in each subject
median_scores = df[['Math', 'Science', 'English']].median()
print("\nMedian Scores:")
print(median_scores)

# 3. Mode Calculation: The most frequent score in each subject
mode_scores = df[['Math', 'Science', 'English']].mode().iloc[0]  # .iloc[0] to get the first mode if multiple modes exist
print("\nMode Scores:")
print(mode_scores)
```

OUTPUT:

Original Data:

	Student	Math	Science	English
0	Alice	85	90	88
1	Bob	78	85	79
2	Charlie	92	87	85
3	David	88	91	86
4	Eva	95	94	93
5	Frank	73	78	77
6	Grace	81	82	84

```
7    Helen    89       88       91
8      Ian    76       80       79
9     Jack    91       92       88

Mean Scores (Average):
Math       84.8
Science    86.7
English    85.0
dtype: float64

Median Scores:
Math       86.5
Science    87.5
English    85.5
dtype: float64

Mode Scores:
Math       73.0
Science    78.0
English    79.0
Name: 0, dtype: float64
```

Practical-3

Write a python program to perform basic visualization using the matplotlib

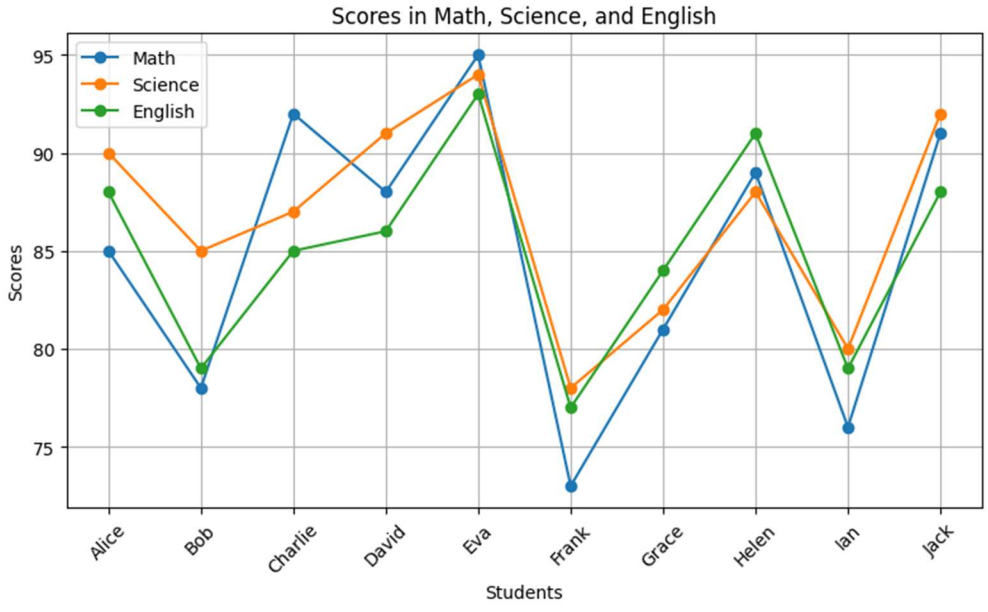
AIM:

To perform a basic visualization using the matplotib library

SOURCE CODE:

```
import matplotlib.pyplot as plt
import numpy as np

# Example dataset: Students' exam scores in Math, Science, and English
students = ['Alice', 'Bob', 'Charlie', 'David', 'Eva', 'Frank', 'Grace', 'Helen', 'Ian', 'Jack']
math_scores = [85, 78, 92, 88, 95, 73, 81, 89, 76, 91]
science_scores = [90, 85, 87, 91, 94, 78, 82, 88, 80, 92]
english_scores = [88, 79, 85, 86, 93, 77, 84, 91, 79, 88]

# Line Plot (Math, Science, English Scores Over Students)
plt.figure(figsize=(8, 5))
plt.plot(students, math_scores, label='Math', marker='o')
plt.plot(students, science_scores, label='Science', marker='o')
plt.plot(students, english_scores, label='English', marker='o')
plt.title('Scores in Math, Science, and English')
plt.xlabel('Students')
plt.ylabel('Scores')
plt.xticks(rotation=45)
plt.legend()
plt.grid(True)
plt.tight_layout()
plt.show()
```

OUTPUT:



Practical-4

Write a python program to perform visualization of frequency curve using the seaborn

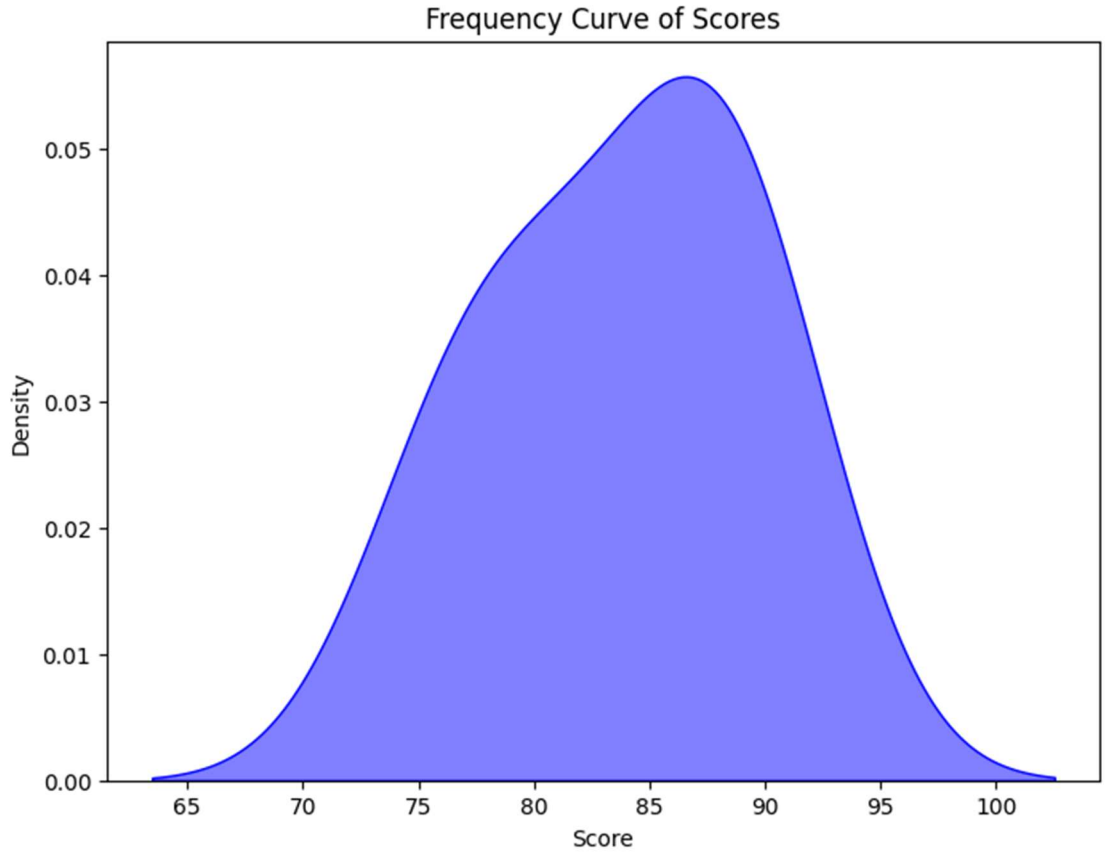
AIM: To plot frequency curve using csv dataset

SOURCE CODE:

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

# Create a sample dataset on education
data = {
    "Student_ID": [1, 2, 3, 4, 5],
    "Name": ["Alice", "Bob", "Charlie", "David", "Eva"],
    "Age": [15, 16, 15, 17, 16],
    "Gender": ["Female", "Male", "Male", "Male", "Female"],
    "Grade_Level": ["10th", "11th", "10th", "12th", "11th"],
    "Attendance_Rate": [95, 87, 92, 78, 88],
    "Subject": ["Math", "Science", "Math", "History", "Science"],
    "Score": [88, 76, 90, 85, 80],
    "Socioeconomic_Status": ["Middle", "Low", "Middle", "High", "Middle"],
    "Hours_Studied": [5, 3, 6, 4, 5],
    "Parental_Involvement": ["High", "Medium", "High", "Low", "Medium"]
}

# Create DataFrame
df = pd.DataFrame(data)

# Save DataFrame to CSV
csv_file_path = "education_dataset.csv"
df.to_csv(csv_file_path, index=False)

print(f"CSV file '{csv_file_path}' created successfully!")

# Load the dataset from the CSV file
df_loaded = pd.read_csv(csv_file_path)

# Create a KDE plot of scores
plt.figure(figsize=(8, 6))
sns.kdeplot(data=df_loaded, x='Score', fill=True, color='blue', alpha=0.5)

# Add labels and title
plt.xlabel("Score")
plt.ylabel("Density")
plt.title("Frequency Curve of Scores")

# Display the plot
plt.show()
```

OUTPUT:

CSV file 'education_dataset.csv' created successfully!



Practical-5

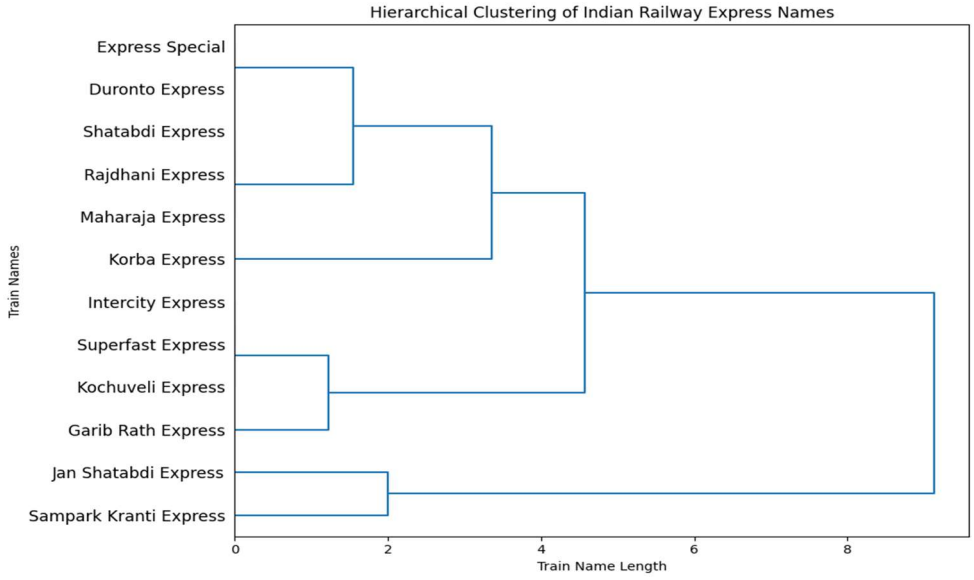
Write a python program to perform hierarchal clustering using the scipy

AIM: To use the SciPy library to analyze a dataset of Indian Railway Express names.

SOURCE CODE:

```
import numpy as np
from scipy.cluster.hierarchy import dendrogram, linkage
import matplotlib.pyplot as plt

# Example dataset: Indian Railway Express names (fictional)
train_names = [
    "Rajdhani Express", "Shatabdi Express", "Duronto Express", "Sampark Kranti Express",
    "Jan Shatabdi Express", "Maharaja Express", "Garib Rath Express", "Express Special",
    "Superfast Express", "Intercity Express", "Korba Express", "Kochuveli Express"
]

# 1. Convert train names to a simple numeric feature representation
# We will use the length of each train name as a feature for simplicity
train_name_lengths = np.array([len(name) for name in train_names]).reshape(-1, 1)

# 2. Perform hierarchical clustering on the train name lengths
Z = linkage(train_name_lengths, method='ward')

# 3. Create a dendrogram to visualize the clustering
plt.figure(figsize=(10, 7))
dendrogram(Z, labels=train_names, orientation='right', color_threshold=0)
plt.title('Hierarchical Clustering of Indian Railway Express Names')
plt.xlabel('Train Name Length')
plt.ylabel('Train Names')
plt.tight_layout()
plt.show()
```

OUTPUT:



Practical-6
Write a python program to perform EDA on real time data

AIM: The aim of this program is to perform Exploratory Data Analysis (EDA) on a dataset related to agriculture in India.

SOURCE CODE:

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# Load the dataset (replace with actual dataset path)
file_path = r"C:\Users\Admin\Downloads\agriculture_yield_data.csv"  # Update with the correct file path
data = pd.read_csv(file_path)

# 1. Data Overview
print("First few rows of the dataset:")
print(data.head())

# 2. Check for missing values
missing_values = data.isnull().sum()
print("\nMissing values in each column:")
print(missing_values)

# 3. Summary Statistics for Numeric Columns
print("\nSummary Statistics:")
print(data.describe())

# 4. Distribution of Numeric Columns
numeric_columns = data.select_dtypes(include=['number']).columns
for column in numeric_columns:
    plt.figure(figsize=(8, 6))
    sns.histplot(data[column], kde=True)
    plt.title(f'Distribution of {column}')
    plt.xlabel(column)
    plt.ylabel('Frequency')
    plt.show()

# 5. Correlation Heatmap for Numeric Columns (only numeric columns)
numeric_data = data.select_dtypes(include=['number'])  # Selecting only numeric columns
correlation_matrix = numeric_data.corr()
plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt='.2f', linewidths=0.5)
plt.title("Correlation Matrix of Numeric Features")
plt.show()

# 6. Visualizing Categorical Columns (If applicable)
categorical_columns = data.select_dtypes(include=['object']).columns
for column in categorical_columns:
    plt.figure(figsize=(10, 6))
    sns.countplot(data=data, x=column)
```

```
plt.title(f'Count Plot of {column}')
plt.xlabel(column)
plt.ylabel('Count')
plt.xticks(rotation=45)
plt.show()
```

OUTPUT:

First few rows of the dataset:

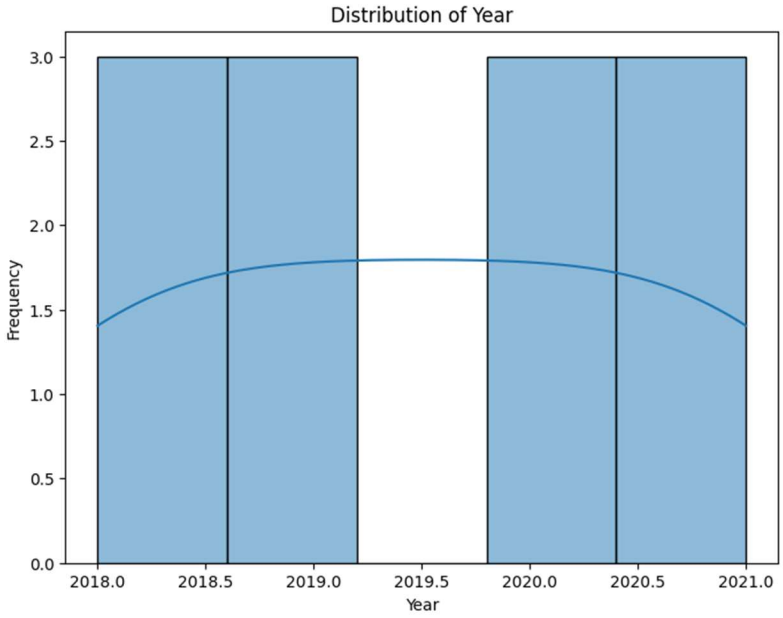
	Year	Region	Crop	Yield
0	2018	North	Wheat	4.5
1	2018	South	Wheat	3.2
2	2018	East	Wheat	4.0
3	2019	North	Wheat	5.0
4	2019	South	Wheat	3.5

Missing values in each column:

```
Year      0
Region    0
Crop      0
Yield     0
dtype: int64
```

Summary Statistics:

	Year	Yield
count	12.000000	12.000000
mean	2019.500000	4.366667
std	1.167748	0.716473
min	2018.000000	3.200000
25%	2018.750000	3.950000
50%	2019.500000	4.400000
75%	2020.250000	4.775000
max	2021.000000	5.600000



Practical-7

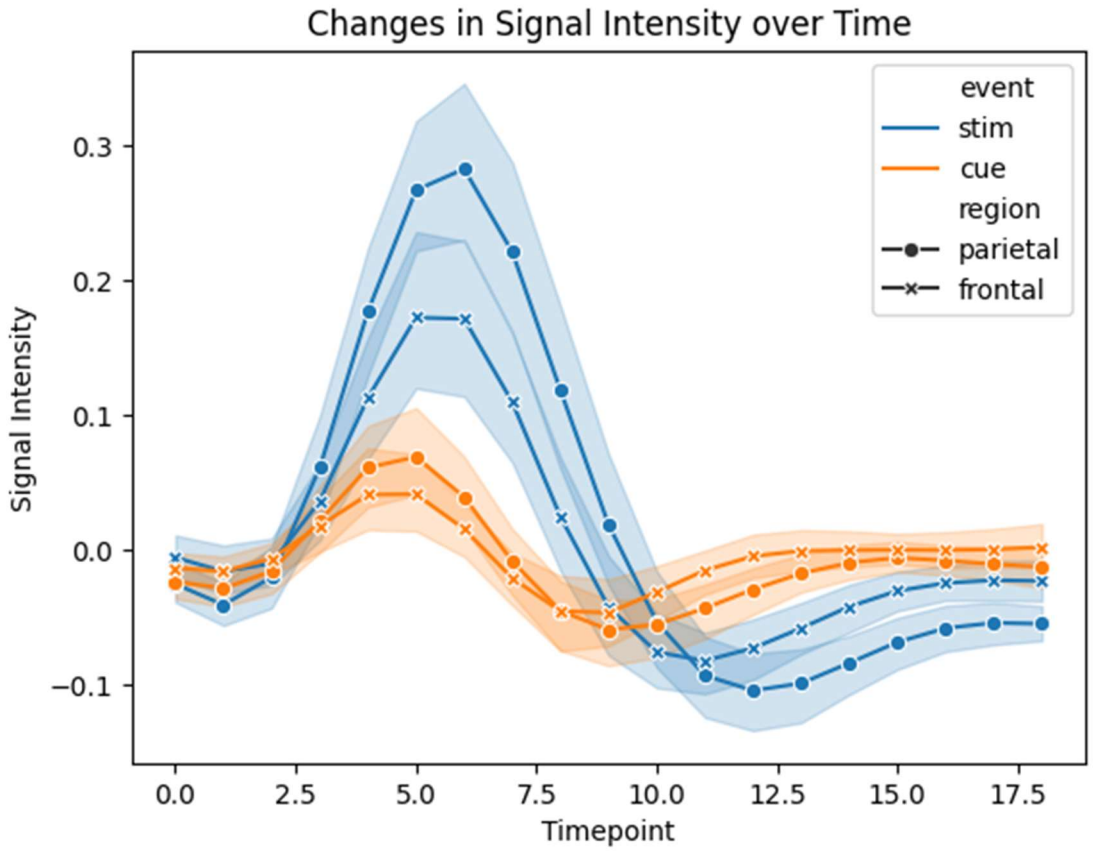
Write a python program to perform advance visualization on real time data

AIM: Performing a advance level plotting seaborn and matplotlib library

SOURCE CODE:

```
import seaborn as sns
import matplotlib.pyplot as plt
fmri = sns.load_dataset("fmri")
# cusomize the line plot
sns.lineplot(x="timepoint", y="signal", hue="event", style="region", markers=True, dashes=False, data=fmri)
# add labels and title
plt.xlabel("Timepoint")
plt.ylabel("Signal Intensity")
plt.title("Changes in Signal Intensity over Time")
# display the plot
plt.show()
```

OUTPUT:



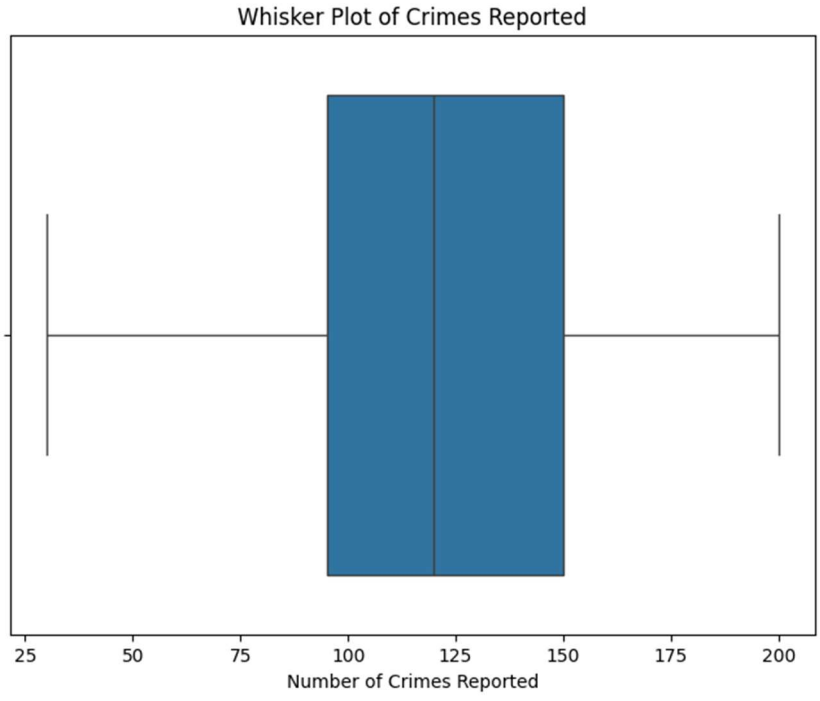
Practical-8
Write a python program to perform whiskers Plot.

AIM; to plot a simple whisker plot

SOURCE CODE;

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# Example Data (replace with your own dataset)
data = {
   'Crime_Reported': [120, 85, 150, 95, 30, 200, 50, 120, 110, 175, 180, 95, 130]
}

# Create DataFrame
df = pd.DataFrame(data)

# Plotting the Whisker Plot (Boxplot)
plt.figure(figsize=(8, 6))
sns.boxplot(x=df['Crime_Reported'])

# Add title and labels
plt.title('Whisker Plot of Crimes Reported')
plt.xlabel('Number of Crimes Reported')

# Show the plot
plt.show()
```

OUTPUT:



Practical-9

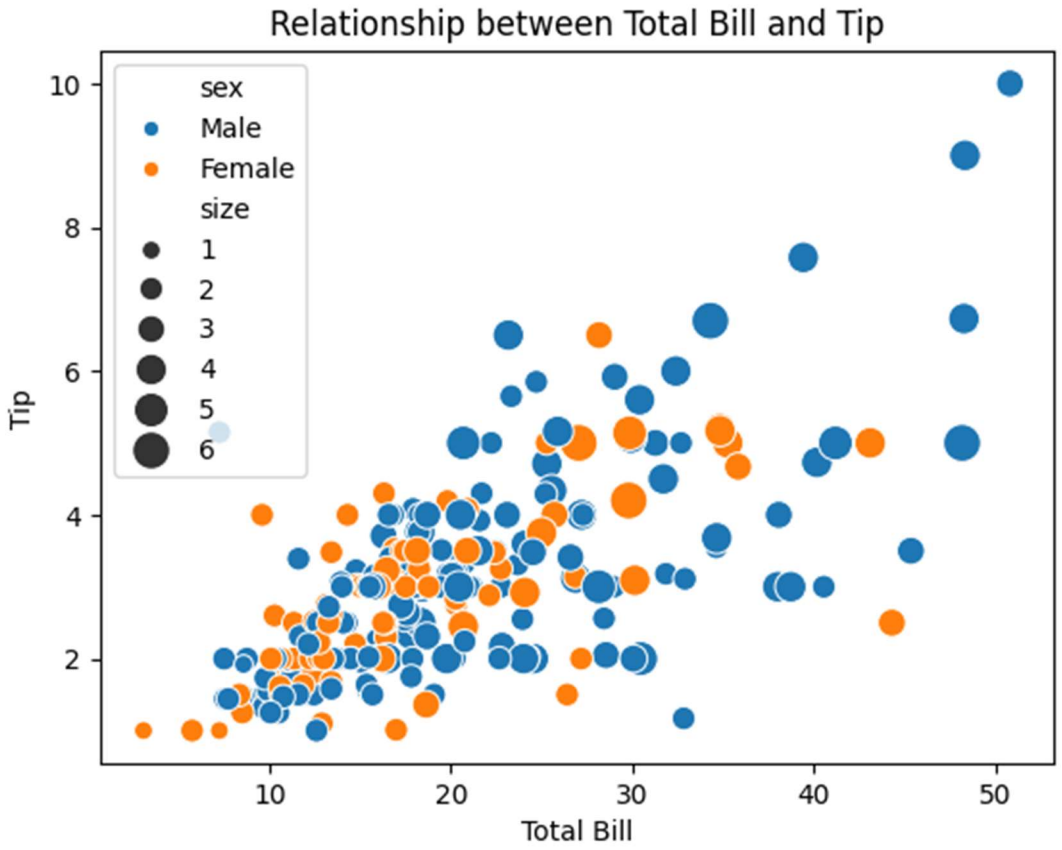
Write a python program to perform scatter plot using csv file.

AIM: to implement scatter plot using csv dataset

SOURCE CODE:

```
import seaborn as sns
import matplotlib.pyplot as plt
tips = sns.load_dataset("tips")
# customize the scatter plot
sns.scatterplot(x="total_bill", y="tip", hue="sex", size="size", sizes=(50, 200), data=tips)
# add labels and title
plt.xlabel("Total Bill")
plt.ylabel("Tip")
plt.title("Relationship between Total Bill and Tip")
# display the plot
plt.show()
```

OUTPUT:



Practical-10

Write a python programs using seaborn library to plot line chart of a csv dataset.

AIM: to plot a line chart of csv dataset using seaborn

SOURCE CODE:

```
# Import necessary libraries
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# Load the dataset (make sure the CSV file is in the same directory or adjust the path accordingly)
df = pd.read_csv(r"C:\Users\Admin\Downloads\agriculture_yield_data.csv")

# Set the style for the plots
sns.set_style("whitegrid")

# Create a line plot showing yield trends over the years for each region
plt.figure(figsize=(10, 6))
sns.lineplot(data=df, x="Year", y="Yield", hue="Region", marker="o")
plt.title("Crop Yield Trends by Region (2018-2021)")
plt.ylabel("Yield (tons/ha)")
plt.xlabel("Year")
plt.legend(title="Region")
plt.show()
```

OUTPUT: