SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur-603203

DEPARTMENT OF INFORMATION TECHNOLOGY

ACADEMIC YEAR: 2025-2026 ODD

SEMESTER

LAB MANUAL

(REGULATION - 2023)

AD3364 – DATA EXPLORATION AND VISUALIZATION LABORATORY

THIRD SEMESTER

B. Tech – INFORMATION TECHNOLOGY

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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. To afford the necessary background in the field of Information Technology to deal with engineering problems to excel as engineering professionals in industries.
2. To improve the qualities like creativity, leadership, teamwork and skill thus contributing towards the growth and development of society.
3. To develop ability among students towards innovation and entrepreneurship that caters to the needs of Industry and society.
4. To inculcate and attitude for life-long learning process through the use of information technology sources.
5. To prepare then to be innovative and ethical leaders, both in their chosen profession and in other activities.

PROGRAMME OUTCOMES (POs)

After going through the four years of study, Information Technology Graduates will exhibit ability to:

PO#	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineering activities, with an understanding of the limitations.
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs)

By the completion Bachelor of Technology in Information Technology program the student will have the following Program specific outcomes.

1. Design secured database applications involving planning, development, and maintenance using state-of-the-art methodologies based on ethical values.
2. Design and develop solutions for modern business environments coherent with advanced technologies and tools.
3. Design, plan, and set up a network that is helpful for contemporary business environments using the latest hardware components.
4. Planning and defining test activities by preparing test cases that can predict and correct errors ensuring a socially transformed product catering all technological needs.

AD336 DATA EXPLORATION AND VISUALIZATION LABORATORY **L T P C**

0 0 3 1.5

OBJECTIVES:

- To understand the key techniques behind data visualization.
- To learn about various visualization structures.
- To evaluate the information visualization systems.
- To design and build data visualization systems.
- To analyze and identify trends in data sets.

LIST OF EXPERIMENTS

1. Install Data Analysis and Visualization tools: R/Python/Tableau Public/Power BI.
2. Perform Exploratory Data Analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames, Basic Plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualizations techniques.
6. Perform Data Analysis and representation on map using map data sets with Mouse Rollover effect, user interaction, etc.
7. Build Cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
8. Perform EDA on Wine Quality Data Set.
9. Use a case study on a data set and apply the various EDA and visualizations techniques and present an analysis report.

TOTAL: 45 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

SOFTWARE:

Standalone desktops with Python 3 interpreter for Windows / Linux 30 Nos. (or) Server with Python 3 interpreter for Windows/Linux supporting 30 terminals or more.

HARDWARE:

Standalone Desktops: 30 Nos.

COURSE OUTCOMES

AD3364.1	Understand the fundamentals of exploratory data analysis.
AD3364.2	Implement the data visualization using Matplotlib.
AD3364.3	Perform univariate data exploration and analysis.
AD3364.4	Apply bivariate data exploration and analysis.
AD3364.5	Use data exploration and visualization techniques for multivariate and time series data.

CO- PO-PSO MATRIX

CO	PO												PSO			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
1	3	-	3	-	-	-	-	-	-	-	-	-	2	-	-	1
2	-	2	-	-	1	-	-	-	-	2	-	-		-	-	-
3	-	-	3	1	-	-	-	-	-	3	-	2		-	-	-
4	2	-	-	-	-	-	-	-	1	-	-	-	2	-	1	2
5	-	3	1	3	1	-	-	-	1	-	-	2	3	1	-	-
Average	**2.5**	**2.5**	**2.3**	**2.0**	**1.0**	**-**	**-**	**-**	**1.0**	**2.5**	**-**	**2.0**		**1.0**	**1.0**	**1.5**

EVALUATION PROCEDURE FOR EACH EXPERIMENT

S. No	Description	Mark
1.	Aim & Procedure	20
2.	Observation	30
3.	Conduction and Execution	30
4.	Output & Result	10
5.	Viva	10
Total		**100**

INTERNAL ASSESSMENT FOR LABORATORY

S. No	Description	Mark
1.	Conduction & Execution of Experiment	30
2.	Record	10
3.	Model Test	20
Total		**60**

Ex. No: 1 INSTALLING DATA ANALYSIS AND VISUALIZATION TOOL

AIM

To write a step to install data analysis and visualization tool: R / Python / Tableau Public / Power BI.

PROCEDURE

1. **R:**
   - Download R:
     - Visit the official R website (https://cran.r-project.org/) and download the installer for your operating system (Windows, macOS, or Linux).
   - Install R by following the instructions provided in the installer.

2. **Python:**
   - Download Python:
     - Visit the official website (https://www.python.org/downloads/) and download the Python installer for your OS (Windows, macOS, or Linux).
   - Install Python by running the installer and making sure to check the option to add Python to your system's PATH during installation.

(i) INSTALL NUMPY WITH PIP

NumPy (Numerical Python) is an open-source core Python library for scientific computations. It is a general-purpose array and matrices processing package.

```
pip install numpy
```

(ii) INSTALL JUPYTER LAB

Install Jupyter Lab with pip:

```
pip install jupyterlab
```

Once installed, launch Jupyter Lab with:

```
jupyter-lab
```

(iii) JUPYTER NOTEBOOK

Install the classic Jupyter Notebook with:

```
pip install notebook
```

To run the notebook:

```
Jupyter notebook
```

(iv) INSTALL SCIPY

Scipy is a Python library that is useful in solving many mathematical equations and algorithms. It is designed on the top of Numpy library. SCIPY means Scientific Python.

```
pip install scipy
```

(v) INSTALL PANDAS

Pandas is a Python Package that provides fast, flexible, and expressive data structures designed to make working with “relational” or “labeled” data botheasy and intuitive.

```
pip install pandas
```

(vi) INSTALL MATPLOTLIB

Matplotlib is a comphrehensive library for creating static, animated, and interactive visualizations in Python. Working with “relational” or “labeled” data botheasy and intuitive.

```
pip install matplotlib
```

3. Tableau Public:

- Tableau Public

4. It is a web-based tool, so there's no installation required. Simply visit the Tableau Public Website (https"//public.tableau.com/s/gallery) and create an account to start using it.Power Bi:
    - Download Power BI Desktop:
        - Go to the official Power BI wenbsite (https://powerbi.microsoft.com/en-us/desktop/) and download Power BI Desktop.
    - Installer Power BI Desktop by running the installer.

PROGRAM 1

```
import numpy as np
import pandas as pd
hafeez = ['Hafeez', 19]
aslam = ['Aslam', 21]
kareem = ['kareem', 18]
dataframe = pd.DataFrame([hafeez, aslam, kareem], columns = ['Name', 'Age'])
print(dataframe)
```

Output 1

	Name	Age
0	Hafeez	19
1	Aslam	21
2	Kareem	18

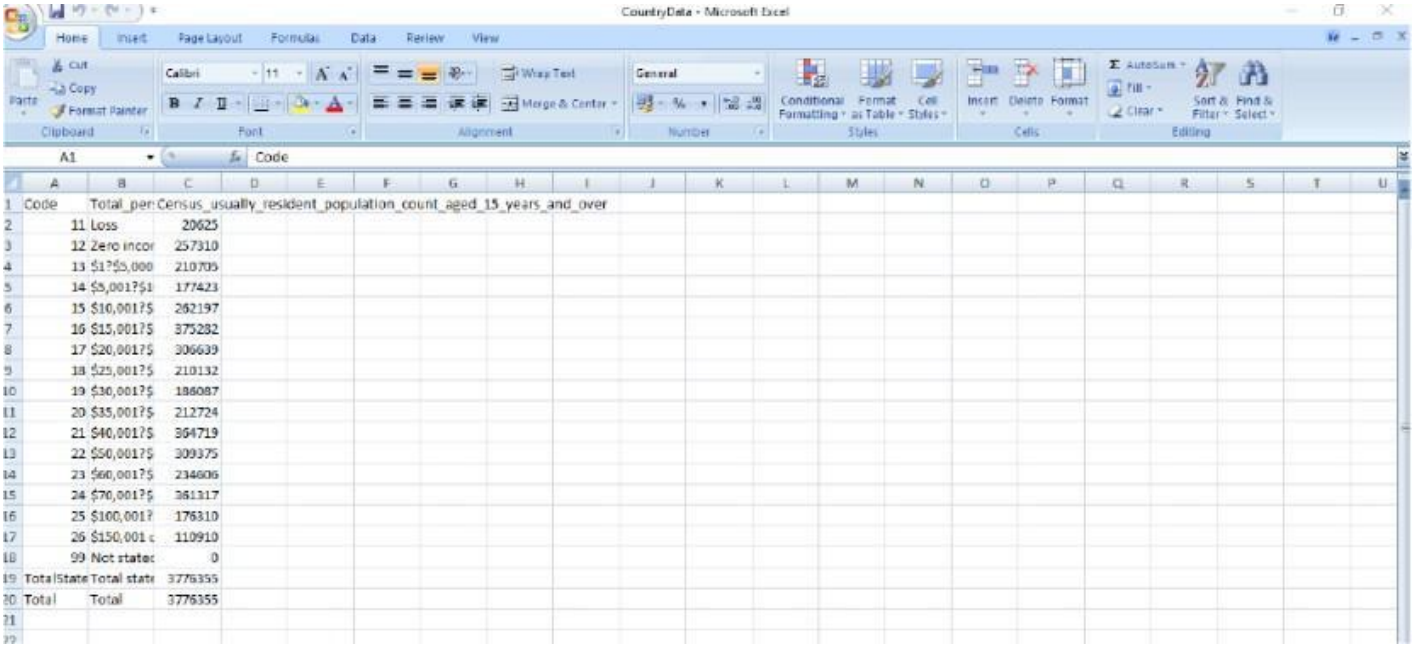
PROGRAM 1

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
data = pd.read_csv("CountryData.csv")
plt.hist(data)
plt.xlabel("code")
plt.ylabel("Total_personal_income")
plt.show()
```

CREATE A CSV FILE IN EXCEL:

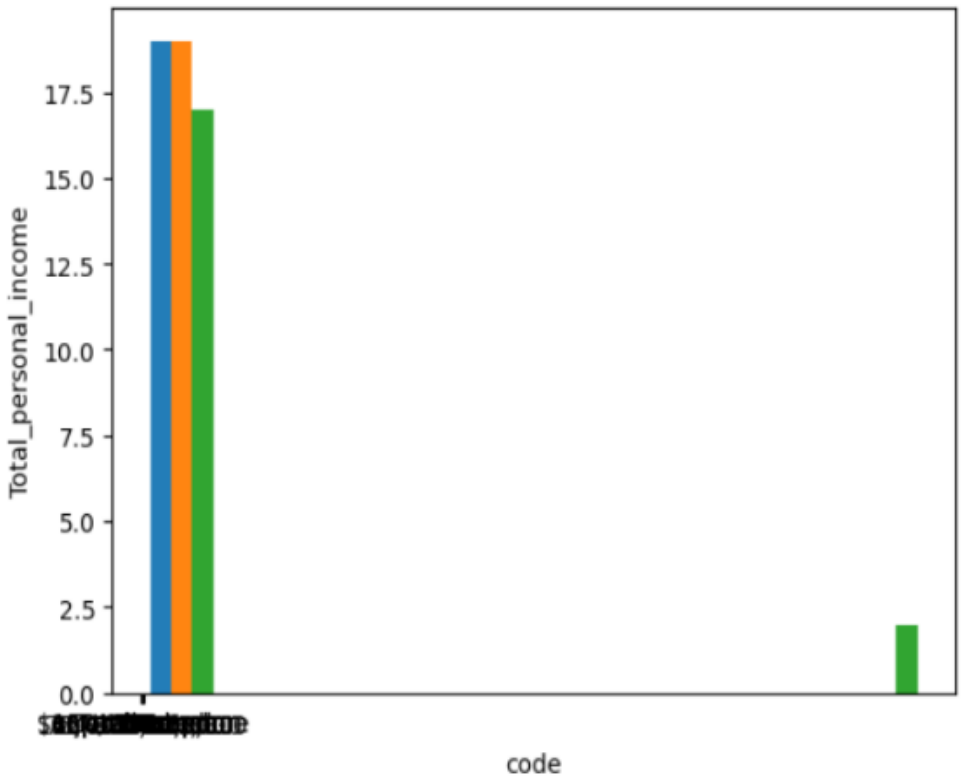
- First create a CSV file in excel with attributes 'code' and 'Total_personal_income'.
- Save the file with filename mentioned above "CountryData" with extension as .csv

file.



Code		Total_per	Census_usually_resident_population_count_aged_15_years_and_over
	11	Loss	20625
	12	Zero incor	257310
	13	$1?$5,000	210705
	14	$5,001?$1	177423
	15	$10,001?$	262197
	16	$15,001?$	375282
	17	$20,001?$	306639
	18	$25,001?$	210132
	19	$30,001?$	186087
	20	$35,001?$	212724
	21	$40,001?$	364719
	22	$50,001?$	309375
	23	$60,001?$	234606
	24	$70,001?$	361317
	25	$100,001?	176310
	26	$150,001 c	110910
	99	Not statec	0
Tota	State	Total state	3776355
Total		Total	3776355

Output 2



RESULT

Thus, the python program to install data analysis and visualization tools like R, Python, Tableau Public, or Power BI, and their features were explored successfully.

Ex. No: 2 EXPLORATORY DATA ANALYSIS (EDA) ON WITH DATASETS

AIM

To perform exploratory data analysis (EDA) on with datasets like email data set.

PROCEDURE

Exploratory Data Analysis (EDA) on email datasets involves importing the data, cleaning it, visualizing it, and extracting insights. Here's a step-by-step guide on how to perform EDA on an email dataset using Python and Pandas

1. **Import Necessary Libraries:**
   Import the required Python libraries for data analysis and visualization.

2. **Load Email Data:**
   Assuming you have a folder containing email files (e.g., .eml files), you can use the email library to parse and extract the email contents.

3. **Data Cleaning:**
   Depending on your dataset, you may need to clean and preprocess the data. Common cleaning steps include handling missing values, converting dates to datetime format, and removing duplicates.

4. **Data Exploration:**
   Now, you can start exploring the dataset using various techniques. Here are some common EDA tasks:
   Basic Statistics:
   Get summary statistics of the dataset.
   Distribution of Dates:
   Visualize the distribution of email dates.

5. **Word Cloud for Subject or Message:**
   Create a word cloud to visualize common words in email subjects or messages.

6. **Top Senders and Recipients:**
   Find the top email senders and recipients.
   Depending on your dataset, you can explore further, analyze sentiment, perform network analysis, or any other relevant analysis to gain insights from your email data.

PROGRAM

 # Import necessary libraries

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

```
import seaborn as sns
 # Load the dataset
df = pd.read_csv('D:\ARCHANA\dxv\LAB\DXV\Emaildataset.csv')
        # Display basic information about the dataset
print(df.info())
        # Display the first few rows of the dataset
print(df.head())
        # Descriptive statistics
print(df.describe())
        # Check for missing values
print(df.isnull().sum())
        # Visualize the distribution of numerical variables
sns.pairplot(df) plt.show()
        # Visualize the distribution of categorical variables
sns.countplot(x='label', data=df) plt.show()
        # Correlation matrix for numerical variables
correlation_matrix = df.corr()
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
plt.show()
# Word cloud for text data (if you have a column with text data) from wordcloud
import WordCloud text_data = ' '.join(df['text_column']) wordcloud =
WordCloud(width=800, height=400, random_state=21,
max_font_size=110).generate(text_data)
plt.figure(figsize=(10, 7))
plt.imshow(wordcloud, interpolation="bilinear")
plt.axis('off')
plt.show()
```

OUTPUT

```
Data columns (total 4 columns):
 # Column Non-Null Count Dtype
-- ---- ---------- -----
```

0 Unnamed: 0 5171 non-null int64

1 label 5171 non-null object

2 text 5171 non-null object

3 label_num 5171 non-null int64

dtypes: int64(2), object(2)

memory usage: 161.7+ KB

None

Unnamed: 0 label text label_num

0 605 ham Subject: enron methanol; meter #: 988291\r\n... 0

1 2349 ham Subject: hpl nom for january 9 , 2001\r\n(see... 0

2 3624 ham Subject: neon retreat\r\nho ho ho , we ' re ar... 0

3 4685 spam Subject: photoshop , windows , office . cheap ... 1

4 2030 ham Subject: re : indian springs\r\nthis deal is t... 0

	Unnamed: 0	label_num
count	5171.000000	5171.000000
mean	2585.000000	0.289886
std	1492.883452	0.453753
min	0.000000	0.000000
25%	1292.500000	0.000000
50%	2585.000000	0.000000
75%	3877.500000	1.000000
max	5170.000000	1.000000

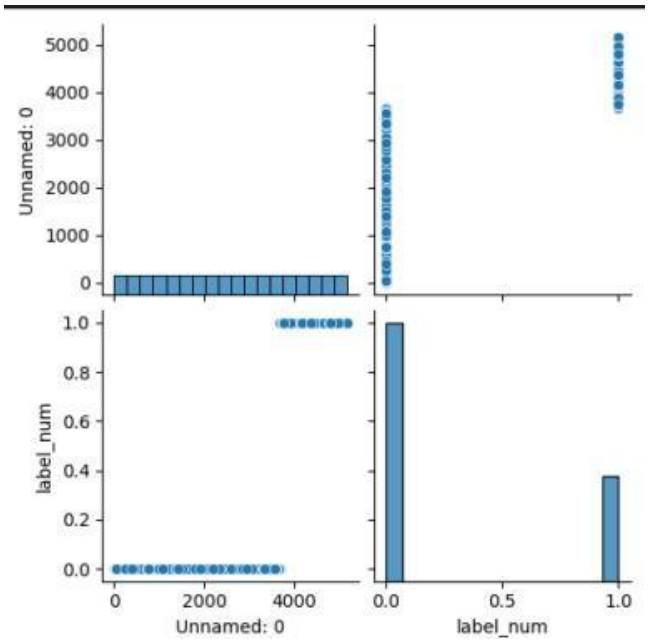
Unnamed: 0 0

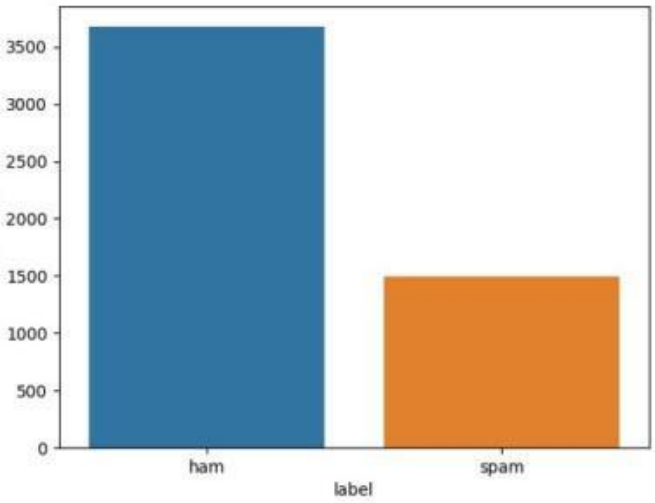
label 0

text 0

label_num 0

dtype: int64





RESULT

Thus, the above Performing exploratory data analysis (EDA) on with datasets like email data set has been performed successfully.

Ex. No:3 WORKING WITH NUMPY ARRAYS, PANDAS DATA FRAMES, BASIC PLOTS USING MATPLOTLIB

AIM

To write the steps for Working with Numpy arrays, Pandas data frames, Basic plots using Matplotlib

PROCEDURE

1. **NumPy:**

   NumPy is a fundamental library for numerical computing in Python. It provides support for multi-dimensional arrays and various mathematical functions. To get started, you'll first need to install

   pip install numpy

   NumPy if you haven't already (you can use pip):

Once NumPy is installed, you can use it as follows:

```
import numpy as np
# Creating NumPy arrays
arr = np.array([1,2,3,4,5])
print(arr)
# Basic operations
mean = np.mean(arr)
sum = np.sum(arr)
# Mathematical functions
square_root = np.sqrt(arr)
exponential = np.exp(arr)
# Indexing and Slicing
first_element = arr[0]
sub_array = arr[1:4]
# Array Operations
Combined_array = np.concatenate([arr, sub_array])
```

OUTPUT

2. **Pandas:**

   Pandas is a powerful library for data manipulation and analysis.

   You can install pandas using pip:

pip install pandas

Here's how to work with Pandas DataFrames:

```
import pandas as pd
    # Creating a DataFrame from a dictionary
data = { 'Name': ['Alice', 'Bob', 'Charlie', 'David', 'Emily'], 'Age': [25, 30, 35, 28, 22], 'City': ['New York', 'Los Angeles', 'Chicago', 'Houston', 'Miami']
}
df = pd.DataFrame(data)
    # Display the entire DataFrame
print("DataFrame:")
print(df)
# Accessing specific columns
print("\n Accessing 'Name' Column:")
print(df['Name'])
    # Adding a new column
df['Salary'] = [50000, 60000, 75000, 48000, 55000]
    # Filtering data
 print("\nPeople older than 30:")
```

```
print(df[df['Age'] > 30])
```

 # Sorting by a column

```
print("\nSorting by 'Age' in descending order:")
print(df.sort_values(by='Age', ascending=False))
```

 # Aggregating data

```
print("\nAverage age:")
print(df['Age'].mean())
```

 # Grouping and aggregation

```
grouped_data = df.groupby('City')['Salary'].mean()
print("\nAverage salary by city:")
print(grouped_data)
```

 # Applying a function to a column

```
df['Age_Squared'] = df['Age'].apply(lambda x: x **
```

2) **# Removing a column**

```
df = df.drop(columns=['Age_Squared'])
```

 # Saving the DataFrame to a CSV file

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

 # Reading a CSV file into a DataFrame

```
new_df = pd.read_csv('output.csv')
print("\nDataFrame from CSV file:")
print(new_df)
```

OUTPUT

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

```
0    Alice   25     New York
1      Bob   30  Los Angeles
2  Charlie   35      Chicago
3    David   28      Houston
4    Emily   22        Miami

Accessing 'Name' column:
0      Alice
1        Bob
2    Charlie
3      David
4      Emily
Name: Name, dtype: object
```

```
People older than 30:
      Name  Age     City  Salary
2  Charlie   35  Chicago   75000

Sorting by 'Age' in descending order:
      Name  Age         City  Salary
2  Charlie   35      Chicago   75000
1      Bob   30  Los Angeles   60000
3    David   28      Houston   48000
0    Alice   25     New York   50000
4    Emily   22        Miami   55000

Average age:
28.0

Average salary by city:
City
Chicago        75000.0
Houston        48000.0
Los Angeles    60000.0
Miami          55000.0
New York       50000.0
Name: Salary, dtype: float64

DataFrame from CSV file:
      Name  Age         City  Salary
0    Alice   25     New York   50000
1      Bob   30  Los Angeles   60000
2  Charlie   35      Chicago   75000
3    David   28      Houston   48000
4    Emily   22        Miami   55000
PS D:\ARCHANA\dxv\LAB>
```


3. **Matplotlib:**

   Matplotlib is a popular library for creating static, animated, or interactive plots and graphs.

   Install Matplotlib using pip:

   pip install matplotlib

   Here's a simple example of creating a basic plot:

   import matplotlib.pyplot as plt

   # Sample data

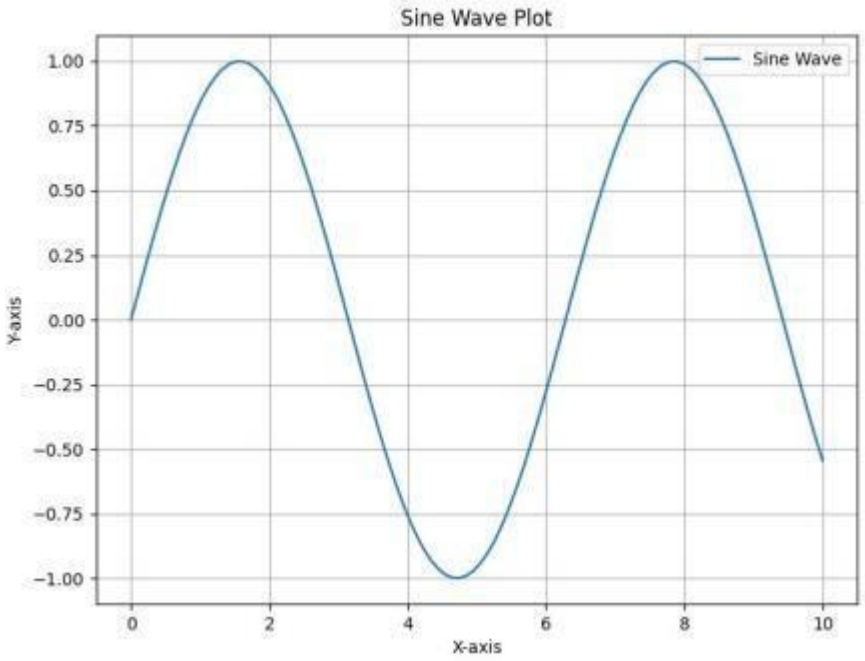
   x = np.linspace (0, 10, 100)

   y = np.sin(x)

   # Create a line plot

```
plt.figure(figsize=(8, 6))
plt.plot(x, y, label='Sine
Wave') plt.title('Sine Wave
Plot') plt.xlabel('X-axis')
plt.ylabel('Y-axis')
plt.legend()
plt.grid(True)
plt.show()
```

OUTPUT



RESULT

Thus, the above working with numpy, pandas, and matplotlib has been completed successfully.

Ex. No: 4 EXPLORING VARIOUS VARIABLE AND ROW FILTERS IN R FOR CLEANING DATA

AIM

To exploring various variable and row filters in R for cleaning data.

PROCEDURE

Data Preparation and Cleaning

First, let's create a sample dataset and then explore various variable and row filters to clean the data.

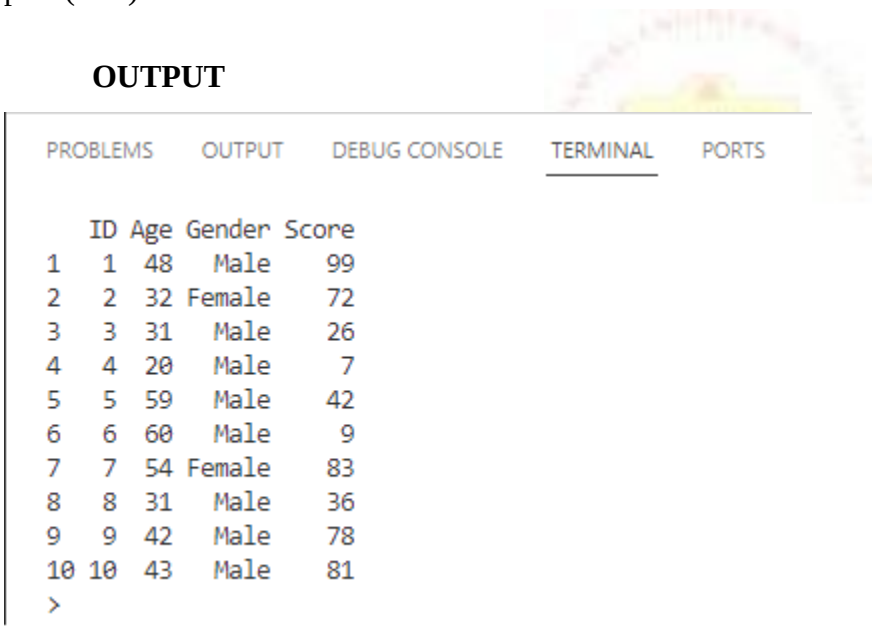
 # Create a sample dataset

```
set.seed(123)
data <- data.frame( ID = 1:10, Age = sample(18:60, 10, replace = TRUE), Gender = sample(c("Male", "Female"), 10, replace = TRUE), Score = sample(1:100, 10) )
```

 # Print the sample data

```
print(data)
```

OUTPUT



Variable Filters

1. **Filtering by s Specific Value:**

   To filter rows based on a specific value in a variable (e.g., only show rows where Age is greater than 30): filtered_data <-data [data$Age>30,]

2. **Filtering by Multiple Conditions:**

   You can filter row based on multiple conditions using the & (AND) or | (OR) operators (e.g., show rows

where Age is greater than 30 and Gender is “Male”): filtered_data <- data [data$Age > 30 & data$Gender == “Male”,]

Row Filters

1. **Removing Duplicate Rows:**
   To remove duplicate rows based on certain columns (e.g., remove duplicates based on ‘ID’):
   cleaned_data <- unique (data [, c(“ID”, “Age”, “Gender”)])
2. **Removing Rows with Missing Values:**
   To remove rows with missing values (NA):
   cleaned_data <-na.omit (data)

Data Visualization

Apply various plot features using the ggplot2 package to visualize the cleaned data.

 # Load the ggplot2 package library (ggplot2)

 # Create a scatterplot of Age vs. Score with points colored by Gender

Ggplot (data = cleaned_data, aes(x = Age, y = Score, color = Gender)) + geom_point () + labs(title = "Scatterplot of Age vs. Score", x = "Age", y = "Score")

 # Create a histogram of Age

Ggplot (data = cleaned_data, aes(x = Age)) + geom_histogram (binwidth = 5, fill = "blue", alpha = 0.5) + labs (title = "Histogram of Age", x = "Age", y = "Frequency")

 # Create a bar chart of Gender distribution

Ggplot (data = cleaned_data, aes(x = Gender)) + geom_bar (fill = "green", alpha = 0.7) + labs (title = "Gender Distribution", x = "Gender", y = "Count")

RESULT

Thus, the above exploring various variable and row filters in R for cleaning data was successfully completed.

Ex. No: 5 TIME SERIES ANALYSIS USING VARIOUS VISUALIZATION TECHNIQUES

AIM

To perform time series analysis and apply the various visualization techniques.

PROCEDURE

DOWNLOAD DATASET

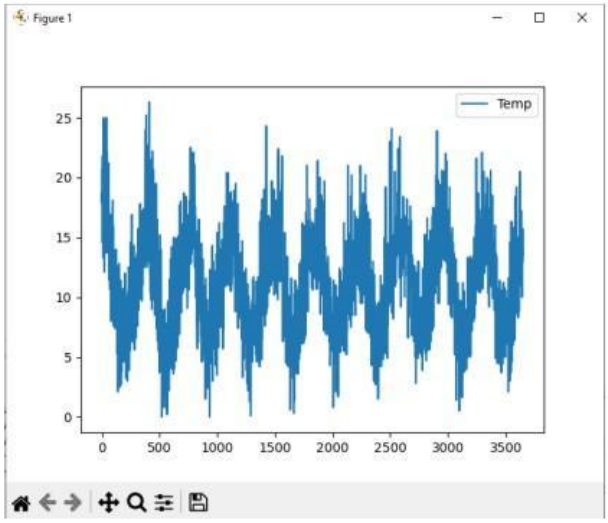
Step 1: Open google and type the following path in the address bar and download a dataset.

http://github.com/jbrownlee/Datasets.

Step 2: Write the following code to get the details.

```
from pandas import read_csv
from matplotlib import pyplot
series = read_csv ('pathname')
print (series.head ( ))
series.plot ( )
pyplot.show ( )
```

OUTPUT



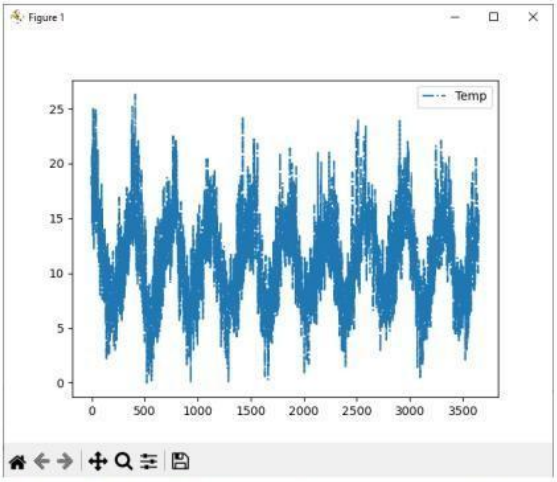

```
PS D:\ARCHANA\dxv\LAB> & C:/Users/ADMIN/AppData/Local/Microsoft/WindowsApps/python3.11.exe d:/ARCHANA/dxv/LAB/DXV/exno5new.py
        Date  Temp
0  01-01-1981  20.7
1  02-01-1981  17.9
2  03-01-1981  18.8
3  04-01-1981  14.6
4  05-01-1981  15.8
```

Step 3: To get the time series line plot:

series.plot (style='-.')

pyplot.show ( )

OUTPUT



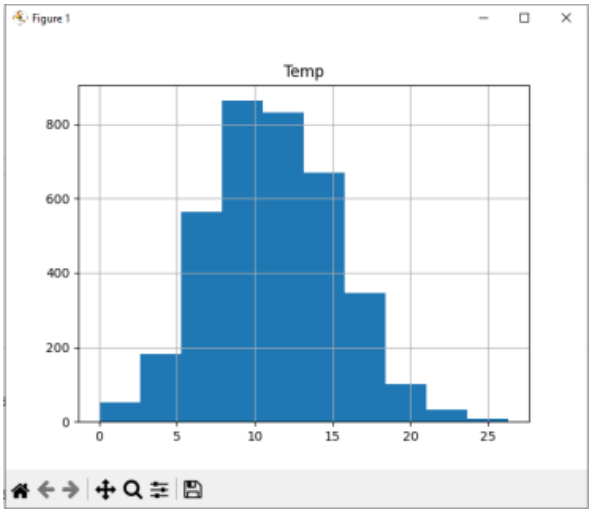

```
PS D:\ARCHANA\dxv\LAB> & C:/Users/ADMIN/AppData/Local/Microsoft/WindowsApps/python3.11.exe d:/ARCHANA/dxv/LAB/DXV/exno5new.py
         Date  Temp
0  01-01-1981  20.7
1  02-01-1981  17.9
2  03-01-1981  18.8
3  04-01-1981  14.6
4  05-01-1981  15.8
```

Step 4: To create a Histogram:

series.hist ( )

pyplot.show ( )

OUTPUT

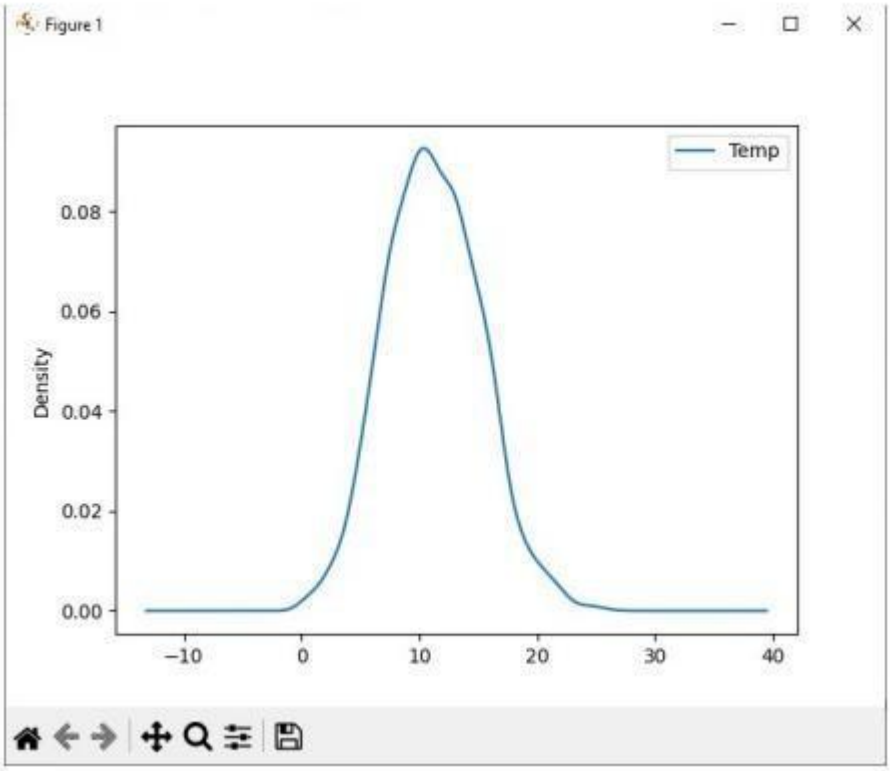


Step 5: To create density plot:

series.plot (kind = ‘kde’)

pyplot.show ( )

OUTPUT



RESULT

Thus, the above time analysis has been checked with various visualization techniques.

Ex. No: 6 **DATA ANALYSIS AND REPRESENTATION ON MAP**

AIM

Write a program to perform data analysis and representation on a map using various map data sets with mouse rollover effect, user interaction etc.

PROCE

DURE STEP

1:

- Make sure to install the necessary libraries.

pip install geopandas folium bokeh

PROGRAM

```
from bokeh.io import show
from bokeh.models import ColumnDataSource, HoverTool
from bokeh.plotting import figure
from bokeh.layouts import column
import pandas as pd
import folium
```

 # Load your data

```
data = pd.read_csv('D:\ARCHANA\dxv\LAB\DXV\geographic.csv')
```

 # Create a Bokeh figure

```
p = figure(width=800, height=400, tools='pan,wheel_zoom,reset')
```

 # Create a ColumnDataSource to hold data

```
source = ColumnDataSource(data)
```

 # Add circle markers to the figure

```
p.circle(x='Longitude', y='Latitude', size=10, source=source, color='orange')
```

 # Create a hover tool for mouse rollover effect

```
hover = HoverTool() hover.tooltips = [("Info", "@Info"), ("Latitude", "@Latitude"), ("Longitude",
"@Longitude")]
p.add_tools(hover)
```

 # Display the Bokeh plot

layout = column(p)show(layout)

 # Create a map centered at a specific location

m = folium.Map(location=[latitude, longitude], zoom_start=10)

 # Add markers for your data points

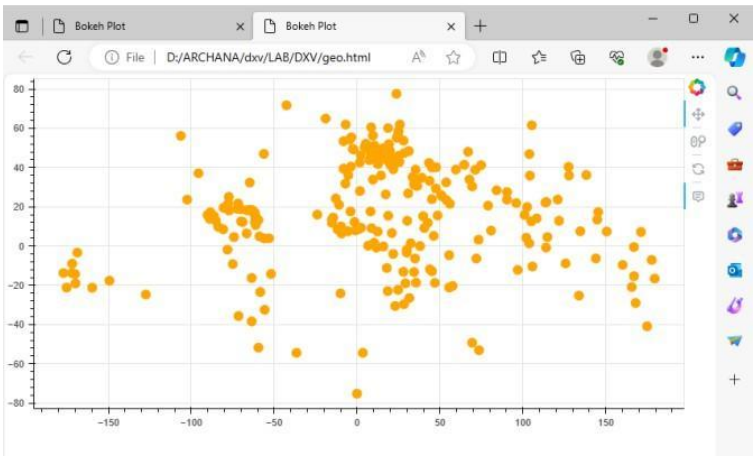
for index, row in data.iterrows():

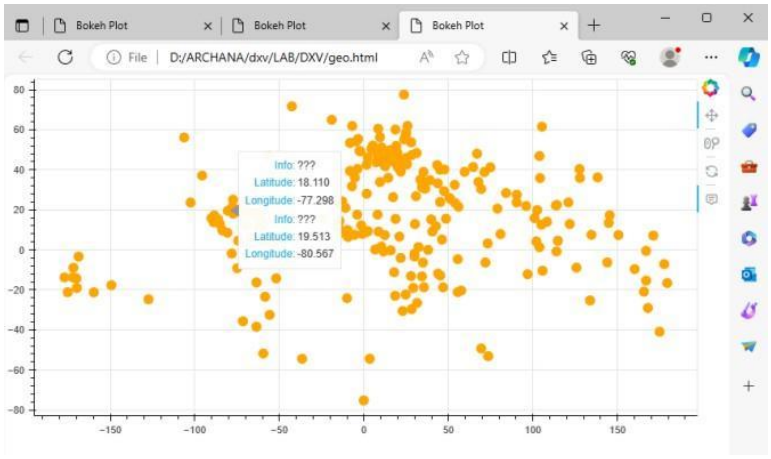
folium.Marker(location=[row['Latitude'], row['Longitude']], popup=row['Info'], # Display additional info on mouse click).add_to(m)

 # Save the map to an HTML file

m.save('map.html')

OUTPUT





RESULT

Thus, the data analysis and representation on a map using various map data sets with mouse rollover effect, use interaction has been completed successfully.

Ex. No: 7 BUILDING CARTOGRAPHIC VISUALIZATION

AIM

Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.

PROCE

DURE STEP

1:

Collect Datasets

Gather the datasets containing geographical information for countries, states, or districts. Make sure these datasets include the necessary attributes for mapping (e.g., country/state/district names, codes, and relevant data).

STEP 2:

pip install geopandas matplotlib

Install Required Libraries:

STEP 3:

Load Geographic Data:

Use Geopandas to load the geographic data for countries, states, or districts. Make sure to match the geographical data with your datasets based on the common attributes.

STEP 4:

Merge Datasets:

Merge your datasets with the geographic data based on common attributes. This step is crucial for linking your data to the corresponding geographic regions.

STEP 5:

Create Cartographic Visualizations:

Use Matplotlib to create cartographic visualizations. You can create separate plots for different datasets or overlay them on a single map.

STEP 6:

Customize and Enhance:

Customize your visualizations based on your needs. You can add legends, labels, titles, and other elements to enhance the interpretability of your maps.

STEP 7:

Save and Share:

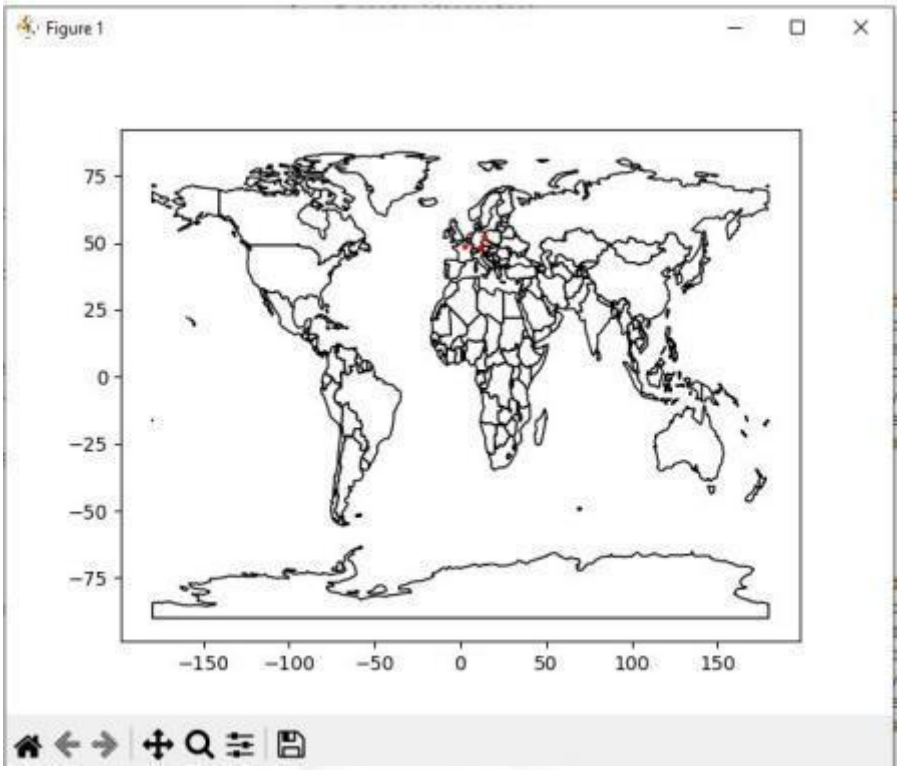
Save your visualizations as image files or interactive plots if needed. You can then share these visualizations with others.

PROGRAM:

```
import pandas as pd
import geopandas as gpd
import shapely
# needs 'descartes'
import matplotlib.pyplot as plt
df = pd.DataFrame({'city': ['Berlin', 'Paris', 'Munich'], 'latitude': [52.518611111111, 48.856666666667, 48.137222222222], 'longitude': [13.408333333333, 2.3516666666667, 11.575555555556]})
gdf = gpd.GeoDataFrame(df.drop(['latitude', 'longitude'], axis=1), crs={'init': 'epsg:4326'}, geometry=[shapely.geometry.Point(xy) for xy in zip(df.longitude, df.latitude)])
print (gdf)
world = gpd.read_file(gpd.datasets.get_path('naturalearth_lowres'))
base = world.plot(color='white', edgecolor='black')
gdf.plot (ax=base, marker='o', color='red', markersize=5)
plt.show ( )
```

OUTPUT

```
city                    geometry
 0     Berlin POINT (13.40833 52.51861)
 1       Paris POINT (2.35167 48.85667)
 2    Munich POINT (11.57556 48.13722)
```



RESULT

Build cartographic visualization for multiple datasets involving various countries of the world; has been visualized successfully.

Ex. No: 8 PERFORM EDA ON WINE QUALITY DATA SET.

AIM

To write a program to peform EDA on Wine Quality Data Set.

PROGRAM

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
# Load the dataset
data = pd.read_csv("pathname")
# Display the first few rows of the dataset
print(data.head())
# Get information about the dataset
print(data.info())
# Summary statistics
print (data.describe())
# Distribution of wine quality
sns.countplot (data ['quality'])
plt.title (" Wine Quality data set")
plt.show ( )
# Box plots for selected features by wine quality
features = ['alcohol', 'volatile acidity', 'citric acid', 'residual sugar']
for feature in features:
    plt.figure (figsize=(8, 6))
    sns.boxplot(x='quality', y=feature, data=data)
    plt.title (f'{feature} by Wine Quality')
    plt.show ( )
# Pair plot of selected features
sns.pairplot (data, vars= ['alcohol', 'volatile acidity', 'citric acid', 'residual sugar'], hue='quality', diag_kind='kde')
plt.suptitle ("Pair Plot of Selected Features")
plt.show ( )
```

 # Correlation heatmap

```
corr_matrix = data.corr ( )
plt.figure (figsize = (10, 8))
sns.heatmap (corr_matrix, annot=True, cmap="coolwarm", fmt=".2f")
plt.title ("Correlation Heatmap")
plt.show ( )
```

 # Histograms of selected features

```
features = ['alcohol', 'volatile acidity', 'citric acid', 'residual sugar']
for feature in features:
    plt.figure (figsize = (6, 4))
    sns.histplot (data [feature], kde=True, bins=20)
    plt.title (f"Distribution of {feature}")
    plt.show ( )
```

OUTPUT

```
PS D:\ARCHANA\dxv\LAB> & C:/Users/ADMIN/AppData/Local/Microsoft/WindowsApps/python3.11.exe d:/ARCHANA/dxv/LAB/DXV/exno6.py
    type  alcohol  volatile acidity  citric acid  residual sugar  chlorides  free sulfur dioxide  total sulfur dioxide  density    pH  sulphates  quality  fixed acidity
0  white      8.8              0.27         0.36            20.7      0.045                 45.0                 170.0   1.0010  3.00       0.45        6            7.0
1  white      9.5              0.30         0.34             1.6      0.049                 14.0                 132.0   0.9940  3.30       0.49        6            6.3
2  white     10.1              0.28         0.40             6.9      0.050                 30.0                  97.0   0.9951  3.26       0.44        6            8.1
3  white      9.9              0.23         0.32             8.5      0.058                 47.0                 186.0   0.9956  3.19       0.40        6            7.2
4  white      9.9              0.23         0.32             8.5      0.058                 47.0                 186.0   0.9956  3.19       0.40        6            7.2
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6497 entries, 0 to 6496
Data columns (total 13 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   type                  6497 non-null   object
 1   alcohol               6497 non-null   float64
 2   volatile acidity      6489 non-null   float64
 3   citric acid           6494 non-null   float64
 4   residual sugar        6495 non-null   float64
 5   chlorides             6495 non-null   float64
 6   free sulfur dioxide   6497 non-null   float64
 7   total sulfur dioxide  6497 non-null   float64
 8   density               6497 non-null   float64
 9   pH                    6488 non-null   float64
 10  sulphates             6493 non-null   float64
 11  quality               6497 non-null   int64
 12  fixed acidity         6487 non-null   float64
dtypes: float64(11), int64(1), object(1)
memory usage: 660.0+ KB
None
           alcohol  volatile acidity  citric acid  residual sugar    chlorides  free sulfur dioxide  total sulfur dioxide      density           pH    sulphates      quality  fixed acidity
count  6497.000000       6489.000000  6494.000000     6495.000000  6495.000000          6497.000000           6497.000000  6497.000000  6488.000000  6493.000000  6497.000000    6487.000000
mean     10.491801          0.339691     0.318722        5.444326     0.056042            30.525319            115.744574     0.994697     3.218395     0.531215     5.818378       7.216579
std       1.192712          0.164649     0.145265        4.758125     0.035036            17.749400             56.521855     0.002999     0.160748     0.148814     0.873255       1.296750
min       8.000000          0.000000     0.000000        0.600000     0.009000             1.000000              6.000000     0.987110     2.720000     0.220000     3.000000       3.800000
25%       9.500000          0.230000     0.250000        1.800000     0.038000            17.000000             77.000000     0.992340     3.110000     0.430000     5.000000       6.400000
50%      10.300000          0.290000     0.310000        3.000000     0.047000            29.000000            118.000000     0.994890     3.210000     0.510000     6.000000       7.000000
75%      11.300000          0.400000     0.390000        8.100000     0.065000            41.000000            156.000000     0.996990     3.320000     0.600000     6.000000       7.700000
max      14.900000          1.580000     1.660000       65.800000     0.611000           289.000000            440.000000     1.038980     4.010000     2.000000     9.000000      15.900000
```

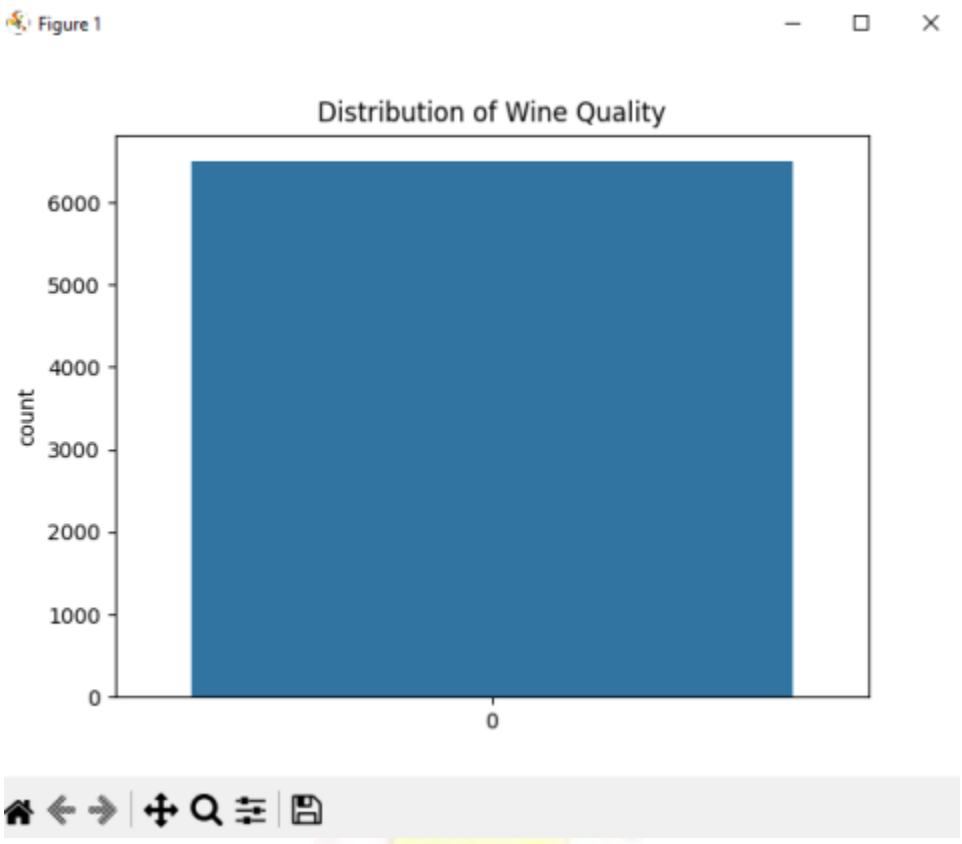


Figure 1
Distribution of Wine Quality
count
6000
5000
4000
3000
2000
1000
0
0

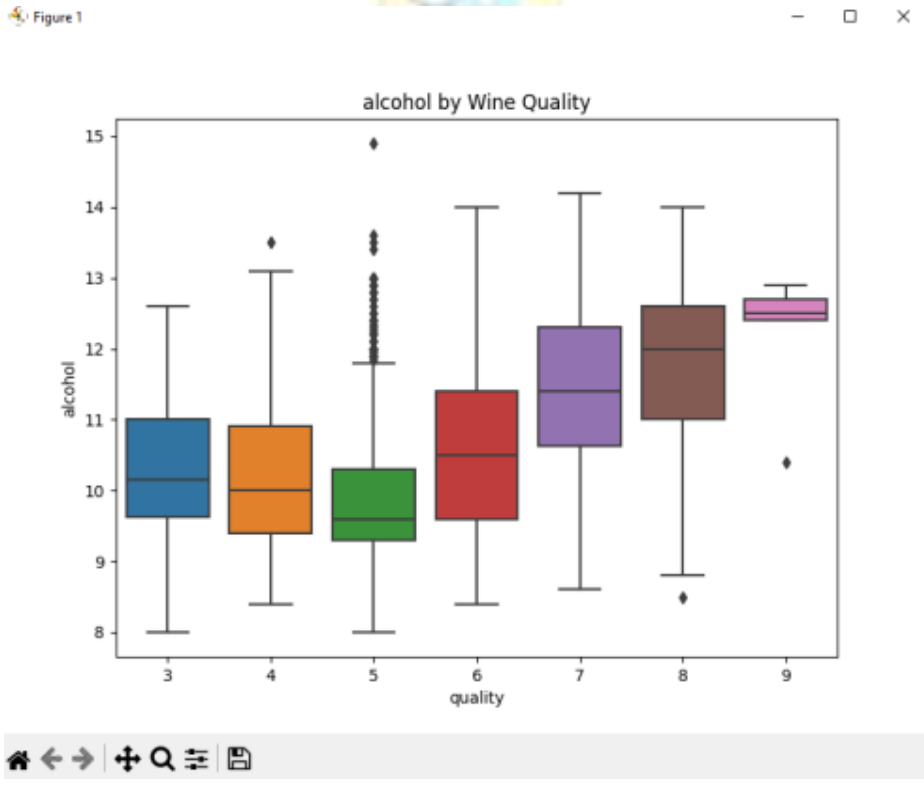
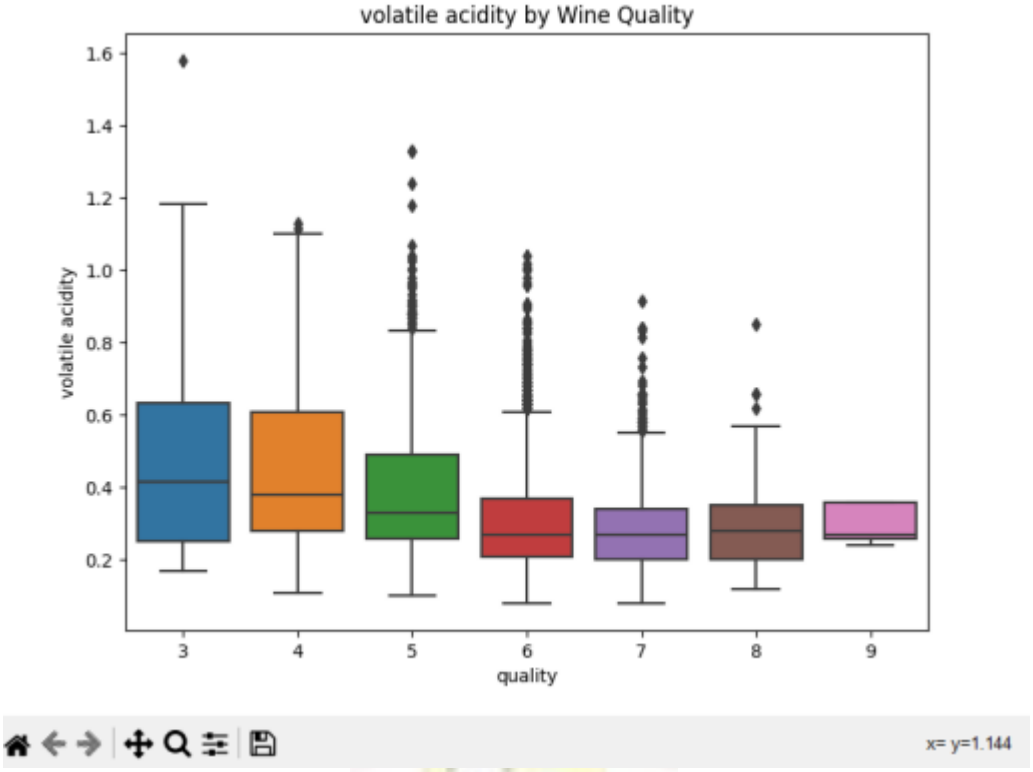


Figure 1
alcohol by Wine Quality
alcohol
15
14
13
12
11
10
9
8
3
4
5
6
7
8
9
quality


volatile acidity by Wine Quality
volatile acidity
quality
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
3
4
5
6
7
8
9
x= y=1.144

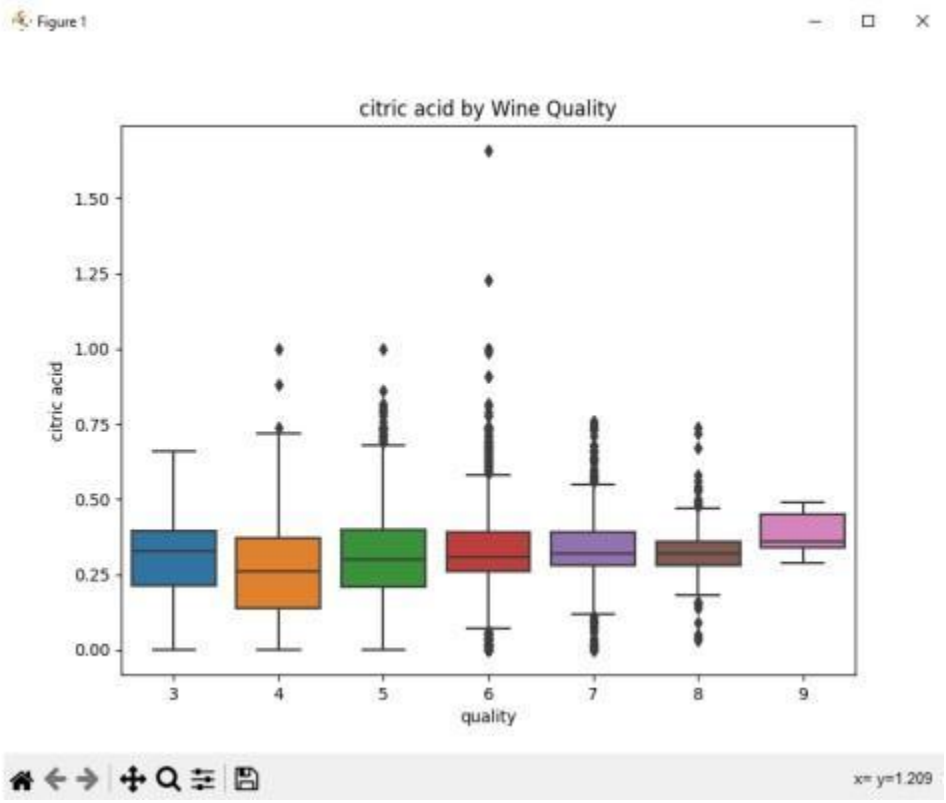
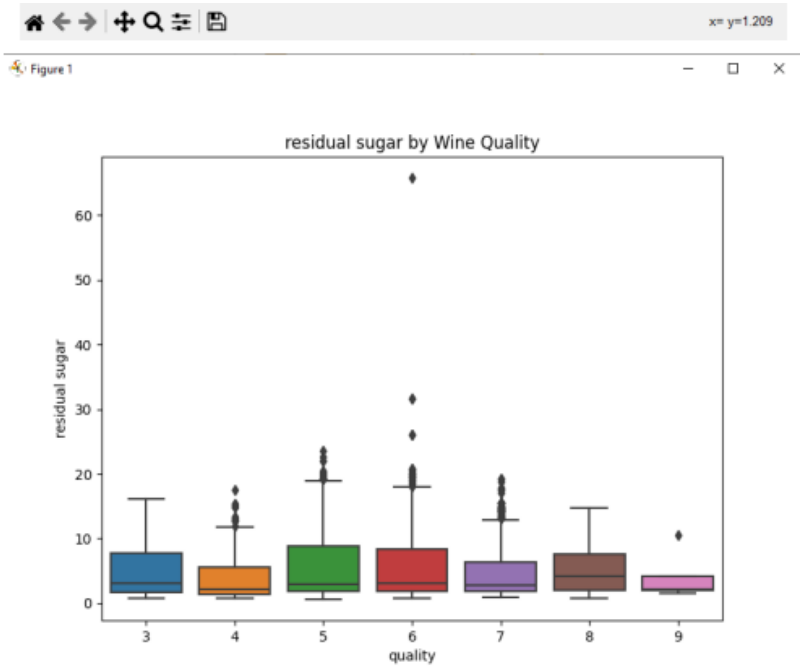
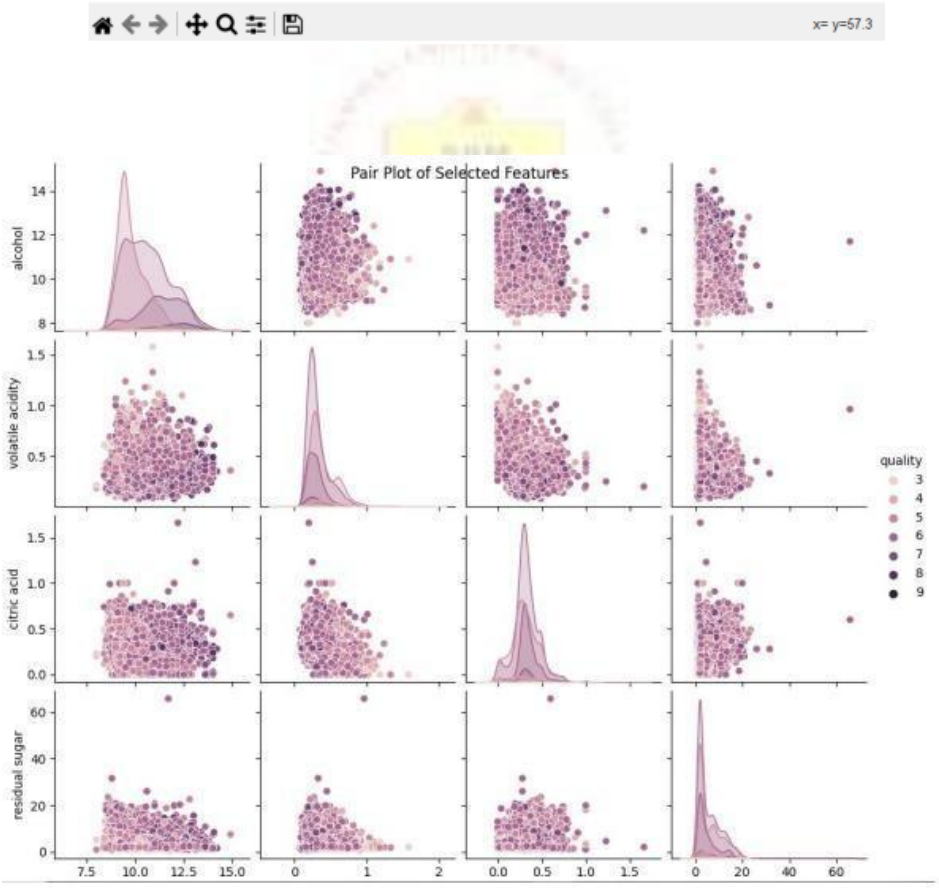


Figure 1
citric acid by Wine Quality
citric acid
quality
1.50
1.25
1.00
0.75
0.50
0.25
0.00
3
4
5
6
7
8
9
x= y=1.209





RESULT

Thus the above program to perform EDA on Wine Quality Data Set.

Ex. No: 9 VISUALIZING VARIOUS EDA TECHNIQUES AS CASE STUDY FOR IRIS DATASET

AIM

The Mini Project to predict the time taken to solve a problem given the current status of the user using Random Forest Regressor Model.

PROCEDURE

Import Libraries:

Start by importing the necessary libraries and loading the dataset.

Descriptive Statistics:

Compute and display descriptive statistics.

python

Check for Missing Values:

Verify if there are any missing values in the dataset.

Visualize Data Distributions:

Visualize the distribution of numerical variables.

python

Correlation Heatmap:

Examine the correlation between numerical variables.

Boxplots for Categorical Variables:

Use boxplots to visualize the distribution of features by species.

Violin Plots:

Combine box plots with kernel density estimation for better visualization.

Correlation between Features:

Visualize pair-wise feature correlations.

Conclusion and Summary:

Summarize key findings and insights from the analysis.

This case study provides a comprehensive analysis of the Iris dataset, including data exploration, descriptive statistics, and visualization of data distributions, correlation analysis, and feature-specific visualizations