RAJALAKSHMI ENGINEERING COLLEGE

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Department of Computer Science and Engineering

CS23334 Fundamentals of Data Science Lab

III semester II Year (2023R)

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In [ ]:
```
Q: Create a pandas DataFrame using the following dictionary:
python
CopyEdit
data = {
'Name': ['Alice', 'Bob', 'Charlie'],
'Age': [25, 30, 35],
'City': ['New York', 'Los Angeles', 'Chicago']
}
```

In [1]:
```
import pandas as pd

data = {
'Name': ['Alice', 'Bob', 'Charlie'],
'Age': [25, 30, 35],
'City': ['New York', 'Los Angeles', 'Chicago']
}

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

```
      Name  Age         City
0    Alice   25     New York
1      Bob   30  Los Angeles
2  Charlie   35      Chicago
```

In [ ]:
```
Q: Read a CSV file named data.csv into a DataFrame and print the first 5 rows.
```

In [2]:
```
filtered_df = df[df['Age'] > 28]
print(filtered_df)
```

```
      Name  Age         City
1      Bob   30  Los Angeles
2  Charlie   35      Chicago
```

In [ ]:
```
Q: Add a new column Salary with values [50000, 60000, 70000].
```

In [3]:
```
df['Salary'] = [50000, 60000, 70000]
print(df)
```

```
      Name  Age         City  Salary
0    Alice   25     New York   50000
1      Bob   30  Los Angeles   60000
2  Charlie   35      Chicago   70000
```

In [ ]:
```
Q: Given a DataFrame with columns Department and Salary, find the average salary pe
```

In [6]:
```
import pandas as pd
data = {
    'Department': ['HR', 'IT', 'HR', 'Finance', 'IT', 'Finance'],
    'Salary': [50000, 60000, 55000, 70000, 65000, 72000]
}

df = pd.DataFrame(data)
average_salary = df.groupby('Department')['Salary'].mean()

print(average_salary)
```

```
Department
Finance    71000.0
HR         52500.0
IT         62500.0
Name: Salary, dtype: float64
```

In [ ]:
```
Q: Replace all occurrences of 'New York' in City with 'NYC'.
```

In [12]:
```
import pandas as pd


data = {
    'Name': ['Alice', 'Bob', 'Charlie'],
    'Age': [25, 30, 35],
    'City': ['New York', 'Los Angeles', 'Chicago']
}

df = pd.DataFrame(data)


df['City'] = df['City'].replace('New York', 'NYC')
print(df)
```

```
      Name  Age         City
0    Alice   25          NYC
1      Bob   30  Los Angeles
2  Charlie   35      Chicago
```

In [ ]:
```
Q: Drop the Age column from the DataFrame.
```

In [13]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie'],
    'Age': [25, 30, 35],
    'City': ['New York', 'Los Angeles', 'Chicago']
}

df = pd.DataFrame(data)
df = df.drop('Age', axis=1)
print(df)
```

```
      Name         City
0    Alice     New York
1      Bob  Los Angeles
2  Charlie      Chicago
```

In [ ]:
```
Q: Sort the DataFrame by Salary in descending order.
```

In [14]:
```
import pandas as pd
data = {
    'Name': ['Alice', 'Bob', 'Charlie'],
    'Salary': [70000, 85000, 60000],
    'Department': ['HR', 'IT', 'Finance']
}

df = pd.DataFrame(data)
df_sorted = df.sort_values(by='Salary', ascending=False)
print(df_sorted)
```

```
      Name  Salary Department
1      Bob   85000         IT
0    Alice   70000         HR
2  Charlie   60000    Finance
```

In [ ]:
```
Q: Check for missing values in the DataFrame.
```

In [15]:
```
import pandas as pd
import numpy as np
```

```
data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [25, np.nan, 35, 40],
    'City': ['New York', 'Los Angeles', None, 'Chicago'],
    'Salary': [70000, 85000, 60000, None]
}

df = pd.DataFrame(data)


missing_values = df.isnull().sum()
print("Missing values per column:")
print(missing_values)

has_missing = df.isnull().values.any()
print("\nIs there any missing value in the DataFrame?")
print(has_missing)
```

```
Missing values per column:
Name      0
Age       1
City      1
Salary    1
dtype: int64

Is there any missing value in the DataFrame?
True
```

In [ ]:

In [ ]:
```
1. Create a DataFrame from the following data:
data = {
'Name': ['Alice', 'Bob', 'Charlie', 'David'],
'Age': [24, 27, 22, 32],
'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
Write code to:
a) Display the first two rows
```

In [1]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df.head(2))
```

```
    Name  Age         City
0  Alice   24     New York
1    Bob   27  Los Angeles
```

In [ ]:
```
1. Create a DataFrame from the following data:
data = {
'Name': ['Alice', 'Bob', 'Charlie', 'David'],
'Age': [24, 27, 22, 32],
'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
Write code to:
b) Print the column names
```

In [2]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df.columns)
```

```
Index(['Name', 'Age', 'City'], dtype='object')
```

In [ ]:
```
1. Create a DataFrame from the following data:
data = {
'Name': ['Alice', 'Bob', 'Charlie', 'David'],
'Age': [24, 27, 22, 32],
'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
Write code to:
c) Show the shape of the DataFrame
```

In [3]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df.shape)
```

```
(4, 3)
```

In [ ]:
```
1. Create a DataFrame from the following data:
data = {
'Name': ['Alice', 'Bob', 'Charlie', 'David'],
'Age': [24, 27, 22, 32],
'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
Write code to:
d) Display the summary info of the DataFrame
```

In [4]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4 entries, 0 to 3
Data columns (total 3 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   Name    4 non-null      object
 1   Age     4 non-null      int64
 2   City    4 non-null      object
dtypes: int64(1), object(2)
memory usage: 224.0+ bytes
None
```

In [ ]:
```
2.a) Select only the Name column
```

In [5]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df[['Name', 'City']])
```

```
      Name         City
0    Alice     New York
1      Bob  Los Angeles
2  Charlie      Chicago
3    David      Houston
```

In [ ]:
```
2.b) Select both Name and City columns
```

In [6]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df[['Name', 'City']])
```

```
      Name         City
0    Alice     New York
1      Bob  Los Angeles
2  Charlie      Chicago
3    David      Houston
```

In [ ]:
```
2.c) Select the second row using .iloc
```

In [7]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df.iloc[1])
```

```
Name            Bob
Age              27
City    Los Angeles
Name: 1, dtype: object
```

In [ ]:
```
2.d) Select the row where Name is 'Charlie' using .loc
```

In [8]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df.loc[df['Name'] == 'Charlie'])
```

```
      Name  Age     City
2  Charlie   22  Chicago
```

In [ ]:
```
3.a) People older than 25
```

In [9]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df[df['Age'] > 25])
```

```
    Name  Age         City
1    Bob   27  Los Angeles
3  David   32      Houston
```

In [ ]:
```
3.b) People living in 'Chicago' or 'Houston'
```

In [10]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
```

```
df = pd.DataFrame(data)
print(df[df['City'].isin(['Chicago', 'Houston'])])
```

```
      Name  Age     City
2  Charlie   22  Chicago
3    David   32  Houston
```

In [ ]:
```
3.c) People whose age is between 23 and 30
```

In [11]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
print(df[(df['Age'] >= 23) & (df['Age'] <= 30)])
```

```
    Name  Age         City
0  Alice   24     New York
1    Bob   27  Los Angeles
```

In [ ]:
```
4.a) Add a new column Score with values [85, 90, 88, 95]
```

In [12]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
df['Score'] = [85, 90, 88, 95]
print(df)
```

```
      Name  Age         City  Score
0    Alice   24     New York     85
1      Bob   27  Los Angeles     90
2  Charlie   22      Chicago     88
3    David   32      Houston     95
```

In [ ]:
```
4.b) Change Bob's age to 28
```

In [13]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
df.at[1, 'Age'] = 28
print(df)
```

```
      Name  Age         City
0    Alice   24     New York
1      Bob   28  Los Angeles
2  Charlie   22      Chicago
3    David   32      Houston
```

In [ ]:
```
4.c) Remove the City column
```

In [14]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
df = df.drop(columns=['City'])
print(df)
```

```
      Name  Age
0    Alice   24
1      Bob   27
2  Charlie   22
3    David   32
```

In [ ]:
```
4.d) Drop the row of David
```

In [15]:
```
import pandas as pd

data = {
    'Name': ['Alice', 'Bob', 'Charlie', 'David'],
    'Age': [24, 27, 22, 32],
    'City': ['New York', 'Los Angeles', 'Chicago', 'Houston']
}
df = pd.DataFrame(data)
df = df[df['Name'] != 'David']
print(df)
```

```
      Name  Age         City
0    Alice   24     New York
1      Bob   27  Los Angeles
2  Charlie   22      Chicago
```

In [ ]:
```
5. Create a new DataFrame:
data = {
'Department': ['HR', 'IT', 'HR', 'IT'],
'Salary': [30000, 50000, 35000, 55000],
'Experience': [2, 5, 3, 6]
}
Write code to:
a) Group by Department and find average Salary
```

In [16]:
```
import pandas as pd

data = {
    'Department': ['HR', 'IT', 'HR', 'IT'],
    'Salary': [30000, 50000, 35000, 55000],
    'Experience': [2, 5, 3, 6]
}
df = pd.DataFrame(data)
print(df.groupby('Department')['Salary'].mean())
```

```
Department
HR    32500.0
IT    52500.0
Name: Salary, dtype: float64
```

In [ ]:
```
5. Create a new DataFrame:
data = {
'Department': ['HR', 'IT', 'HR', 'IT'],
'Salary': [30000, 50000, 35000, 55000],
```

```
'Experience': [2, 5, 3, 6]
}
Write code to:
b) Find maximum Experience in each Department
```

In [17]:
```
import pandas as pd

data = {
    'Department': ['HR', 'IT', 'HR', 'IT'],
    'Salary': [30000, 50000, 35000, 55000],
    'Experience': [2, 5, 3, 6]
}
df = pd.DataFrame(data)
print(df.groupby('Department')['Experience'].max())
```

```
Department
HR    3
IT    6
Name: Experience, dtype: int64
```

In [ ]:
```
5. Create a new DataFrame:
data = {
'Department': ['HR', 'IT', 'HR', 'IT'],
'Salary': [30000, 50000, 35000, 55000],
'Experience': [2, 5, 3, 6]
}
Write code to:
c) Calculate total Salary paid
```

In [18]:
```
import pandas as pd

data = {
    'Department': ['HR', 'IT', 'HR', 'IT'],
    'Salary': [30000, 50000, 35000, 55000],
    'Experience': [2, 5, 3, 6]
}
df = pd.DataFrame(data)
print(df['Salary'].sum())
```

```
170000
```

In [ ]:
```
6. Given a DataFrame with missing values:
data = {
'Student': ['John', 'Emma', 'Sam', 'Olivia'],
'Marks': [80, None, 75, 90]
}
Write code to:
a) Fill missing marks with 0
```

In [19]:
```
import pandas as pd

data = {
    'Student': ['John', 'Emma', 'Sam', 'Olivia'],
    'Marks': [80, None, 75, 90]
}
df = pd.DataFrame(data)
df['Marks'] = df['Marks'].fillna(0)  # safer than inplace
print(df)
```

```
  Student  Marks
0    John   80.0
1    Emma    0.0
2     Sam   75.0
3  Olivia   90.0
```

In [ ]:
```
6. Given a DataFrame with missing values:
data = {
'Student': ['John', 'Emma', 'Sam', 'Olivia'],
'Marks': [80, None, 75, 90]
}
Write code to:
b) Drop rows with missing values
```

In [20]:
```
import pandas as pd

data = {
    'Student': ['John', 'Emma', 'Sam', 'Olivia'],
    'Marks': [80, None, 75, 90]
}
df = pd.DataFrame(data)
df = df.dropna()
print(df)
```

```
  Student  Marks
0    John   80.0
2     Sam   75.0
3  Olivia   90.0
```

In [ ]:
```
6. Given a DataFrame with missing values:
data = {
'Student': ['John', 'Emma', 'Sam', 'Olivia'],
'Marks': [80, None, 75, 90]
}
Write code to:
c) Sort the DataFrame by Marks in descending order
```

In [21]:
```
import pandas as pd

data = {
    'Student': ['John', 'Emma', 'Sam', 'Olivia'],
    'Marks': [80, None, 75, 90]
}
df = pd.DataFrame(data)
df = df.sort_values(by='Marks', ascending=False)
print(df)
```

```
  Student  Marks
3  Olivia   90.0
0    John   80.0
2     Sam   75.0
1    Emma    NaN
```

In [ ]:
```
7.a) Save it as a CSV file named students.csv
```

In [22]:
```
import pandas as pd


df = pd.DataFrame({
    'Name': ['Alice', 'Bob'],
    'Age': [25, 28]
})
df.to_csv('students.csv', index=False)
```

In [ ]:
```
7.b) Load a CSV file named employees.csv
```

In [23]:
```
import pandas as pd


df = pd.read_csv('students.csv')
print(df)
```

```
    Name  Age
0  Alice   25
1    Bob   28
```

In [ ]:
```
7.c) Set Name as the index
```

In [24]:
```
import pandas as pd

df = pd.DataFrame({
    'Name': ['Alice', 'Bob'],
    'Age': [25, 28]
})

df.set_index('Name', inplace=True)
print(df)
```

```
       Age
Name
Alice   25
Bob     28
```

In [ ]:
```
7.d) Reset the index
```

In [25]:
```
import pandas as pd

df = pd.DataFrame({
    'Name': ['Alice', 'Bob'],
    'Age': [25, 28]
})
df.set_index('Name', inplace=True)

df.reset_index(inplace=True)
print(df)
```

```
    Name  Age
0  Alice   25
1    Bob   28
```

In [ ]:
```
8) You are given the following DataFrame:
import pandas as pd
data = {
'Product': ['Laptop', 'Tablet', 'Smartphone', 'Monitor', 'Keyboard'],
'Price': [70000, 30000, 25000, 15000, 2000],
'Stock': [10, 25, 50, 15, 100]
}
df = pd.DataFrame(data)
Task:
Write a line of code using .loc[] to display the details of the first and
third products in the DataFrame.
Expected Output:
Product Price Stock
0 Laptop 70000 10
2 Smartphone 25000 50
```

In [26]:
```
import pandas as pd

data = {
    'Product': ['Laptop', 'Tablet', 'Smartphone', 'Monitor', 'Keyboard'],
    'Price': [70000, 30000, 25000, 15000, 2000],
    'Stock': [10, 25, 50, 15, 100]
}
df = pd.DataFrame(data)

print(df.loc[[0, 2]])
```

```
      Product  Price  Stock
0      Laptop  70000     10
2  Smartphone  25000     50
```

In [ ]:
```
9) You are given the following data:
import pandas as pd
data = {
'Subject': ['Math', 'Science', 'English'],
'Marks': [88, 92, 85]
}
Task:
Create a DataFrame from the above data and assign custom row labels:
'Student1', 'Student2', and 'Student3' using the index argument.
Then, using .loc[], print the marks obtained by 'Student2'.
Expected Output:
Subject Science
Marks 92
Name: Student2, dtype: object
```

In [27]:
```
import pandas as pd

data = {
    'Subject': ['Math', 'Science', 'English'],
    'Marks': [88, 92, 85]
}
df = pd.DataFrame(data, index=['Student1', 'Student2', 'Student3'])

print(df.loc['Student2'])
```

```
Subject    Science
Marks           92
Name: Student2, dtype: object
```

In [ ]:
```

```

In [ ]:
```
1. You are assigned a data creation task. Based on the field/topic given to you,
Pandas to create a CSV file containing at least 25 entries.
Each record should have relevant columns (fields) suitable for your dataset.
```

In [1]:
```
import pandas as pd

data = {
    'Dish_ID': ['D001', 'D002', 'D003', 'D004', 'D005',
                'D006', 'D007', 'D008', 'D009', 'D010',
                'D011', 'D012', 'D013', 'D014', 'D015',
                'D016', 'D017', 'D018', 'D019', 'D020',
                'D021', 'D022', 'D023', 'D024', 'D025'],

    'Dish_Name': ['Spring Rolls', 'Paneer Tikka', 'Chicken Wings', 'Garlic Bread
                  'Butter Chicken', 'Paneer Butter Masala', 'Veg Biryani', 'Chic
                  'Palak Paneer', 'Mutton Rogan Josh', 'Gulab Jamun', 'Rasgulla'
                  'Chocolate Brownie', 'Cheesecake', 'Masala Chai', 'Cold Coffee
                  'Lemonade', 'Green Tea', 'Paneer Tikka Special 23', 'Veg Birya
                  'Chocolate Brownie Special 25'],

    'Category': ['Starters','Starters','Starters','Starters','Starters',
                 'Main Course','Main Course','Main Course','Main Course','Main C
                 'Main Course','Main Course','Dessert','Dessert','Dessert',
                 'Dessert','Dessert','Beverage','Beverage','Beverage',
                 'Beverage','Beverage','Starters','Main Course','Dessert'],

    'Price': [207,128,106,112,198,
              415,311,480,316,337,
              419,453,157,167,145,
              172,161,78,87,88,
              73,68,248,482,155],

    'Ingredients': [
        'Rice, Onion, Flour, Paneer, Garlic',
        'Herbs, Paneer, Spices, Milk, Onion',
        'Butter, Garlic, Paneer, Onion, Flour',
        'Butter, Onion, Herbs, Spices, Rice',
        'Onion, Garlic, Paneer, Butter, Spices',
        'Mutton, Garlic, Onion, Spices, Butter',
        'Cheese, Spices, Paneer, Onion, Garlic',
        'Rice, Tomato, Onion, Garlic, Spices',
        'Rice, Chicken, Garlic, Spices, Onion',
        'Garlic, Onion, Tomato, Spices, Herbs',
        'Paneer, Onion, Garlic, Herbs, Spices',
        'Mutton, Onion, Tomato, Garlic, Spices',
        'Milk, Flour, Sugar, Butter, Paneer',
        'Sugar, Paneer, Milk, Butter, Cheese',
        'Milk, Chocolate, Sugar, Butter, Paneer',
        'Sugar, Chocolate, Flour, Butter, Milk',
        'Cheese, Milk, Sugar, Butter, Flour',
        'Tea Leaves, Milk, Sugar, Spices, Herbs',
        'Milk, Sugar, Chocolate, Butter, Paneer',
        'Milk, Sugar, Paneer, Butter, Herbs',
        'Sugar, Herbs, Lemon, Water, Ice',
        'Tea Leaves, Water, Herbs, Lemon',
        'Onion, Spices, Paneer, Garlic, Tomato',
        'Rice, Spices, Onion, Garlic, Tomato',
        'Chocolate, Flour, Sugar, Butter, Milk'
```

```
    ],

    'Vegetarian': ['Yes','Yes','No','Yes','Yes',
                   'No','Yes','Yes','No','Yes',
                   'Yes','No','Yes','Yes','Yes',
                   'Yes','Yes','Yes','Yes','Yes',
                   'Yes','Yes','Yes','Yes','Yes'],

    'Preparation_Time (mins)': [20,19,18,18,13,
                                24,25,34,36,37,
                                35,23,14,13,14,
                                13,9,7,9,8,
                                7,6,20,38,12]
}
df = pd.DataFrame(data)
df.to_csv('restaurant_menu.csv', index=False)
print("CSV file 'restaurant_menu.csv' created successfully.")
```

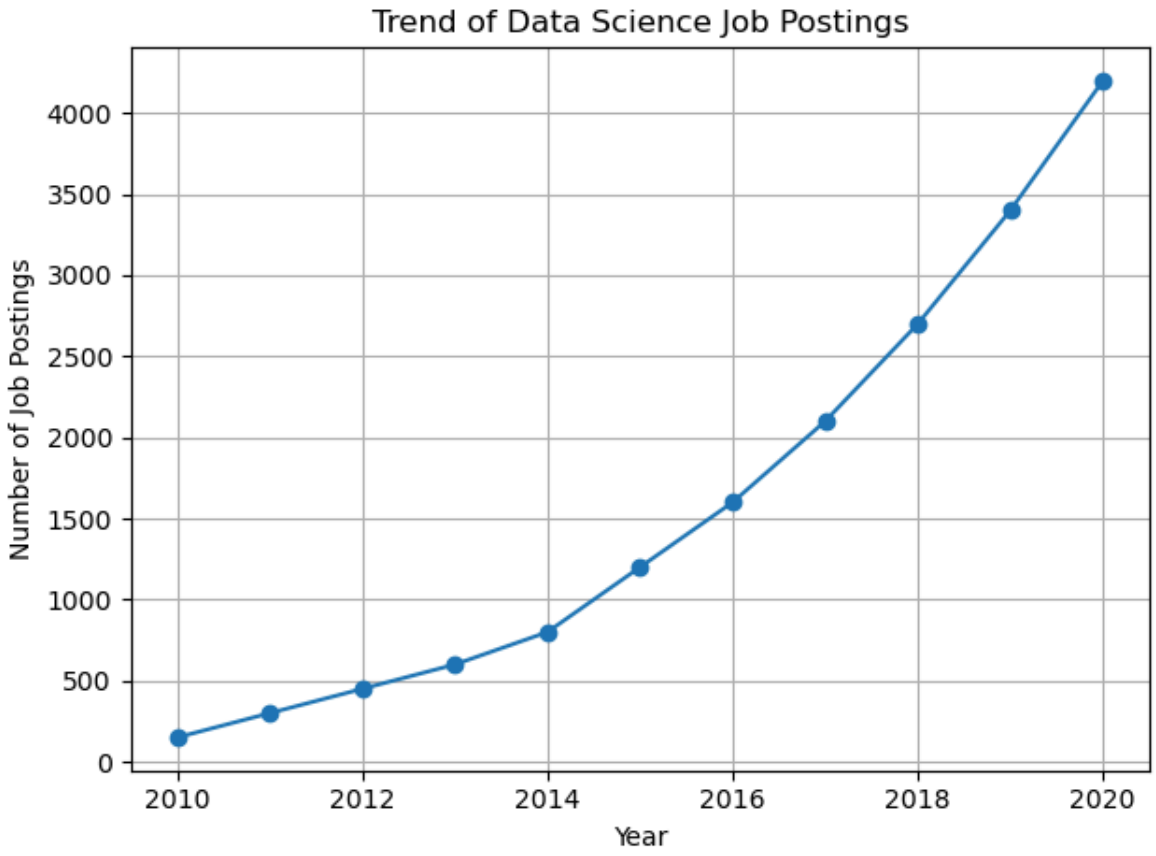
```
CSV file 'restaurant_menu.csv' created successfully.
```

In [ ]:

Dish_ID,Dish_Name,Category,Price,Ingredients,Vegetarian,Preparation_Time (mins)
D001,Spring Rolls,Starters,207,"Rice, Onion, Flour, Paneer, Garlic",Yes,20
D002,Paneer Tikka,Starters,128,"Herbs, Paneer, Spices, Milk, Onion",Yes,19
D003,Chicken Wings,Starters,106,"Butter, Garlic, Paneer, Onion, Flour",No,18
D004,Garlic Bread,Starters,112,"Butter, Onion, Herbs, Spices, Rice",Yes,18
D005,Hummus Platter,Starters,198,"Onion, Garlic, Paneer, Butter, Spices",Yes,13
D006,Butter Chicken,Main Course,415,"Mutton, Garlic, Onion, Spices, Butter",No,24
D007,Paneer Butter Masala,Main Course,311,"Cheese, Spices, Paneer, Onion, Garlic",Yes,25
D008,Veg Biryani,Main Course,480,"Rice, Tomato, Onion, Garlic, Spices",Yes,34
D009,Chicken Biryani,Main Course,316,"Rice, Chicken, Garlic, Spices, Onion",No,36
D010,Dal Tadka,Main Course,337,"Garlic, Onion, Tomato, Spices, Herbs",Yes,37
D011,Palak Paneer,Main Course,419,"Paneer, Onion, Garlic, Herbs, Spices",Yes,35
D012,Mutton Rogan Josh,Main Course,453,"Mutton, Onion, Tomato, Garlic, Spices",No,23
D013,Gulab Jamun,Dessert,157,"Milk, Flour, Sugar, Butter, Paneer",Yes,14
D014,Rasgulla,Dessert,167,"Sugar, Paneer, Milk, Butter, Cheese",Yes,13
D015,Ice Cream Sundae,Dessert,145,"Milk, Chocolate, Sugar, Butter, Paneer",Yes,14
D016,Chocolate Brownie,Dessert,172,"Sugar, Chocolate, Flour, Butter, Milk",Yes,13
D017,Cheesecake,Dessert,161,"Cheese, Milk, Sugar, Butter, Flour",Yes,9
D018,Masala Chai,Beverage,78,"Tea Leaves, Milk, Sugar, Spices, Herbs",Yes,7
D019,Cold Coffee,Beverage,87,"Milk, Sugar, Chocolate, Butter, Paneer",Yes,9
D020,Mango Lassi,Beverage,88,"Milk, Sugar, Paneer, Butter, Herbs",Yes,8
D021,Lemonade,Beverage,73,"Sugar, Herbs, Lemon, Water, Ice",Yes,7
D022,Green Tea,Beverage,68,"Tea Leaves, Water, Herbs, Lemon",Yes,6
D023,Paneer Tikka Special 23,Starters,248,"Onion, Spices, Paneer, Garlic, Tomato",Yes,20
D024,Veg Biryani Special 24,Main Course,482,"Rice, Spices, Onion, Garlic, Tomato",Yes,38
D025,Chocolate Brownie Special 25,Dessert,155,"Chocolate, Flour, Sugar, Butter, Milk",Yes,12

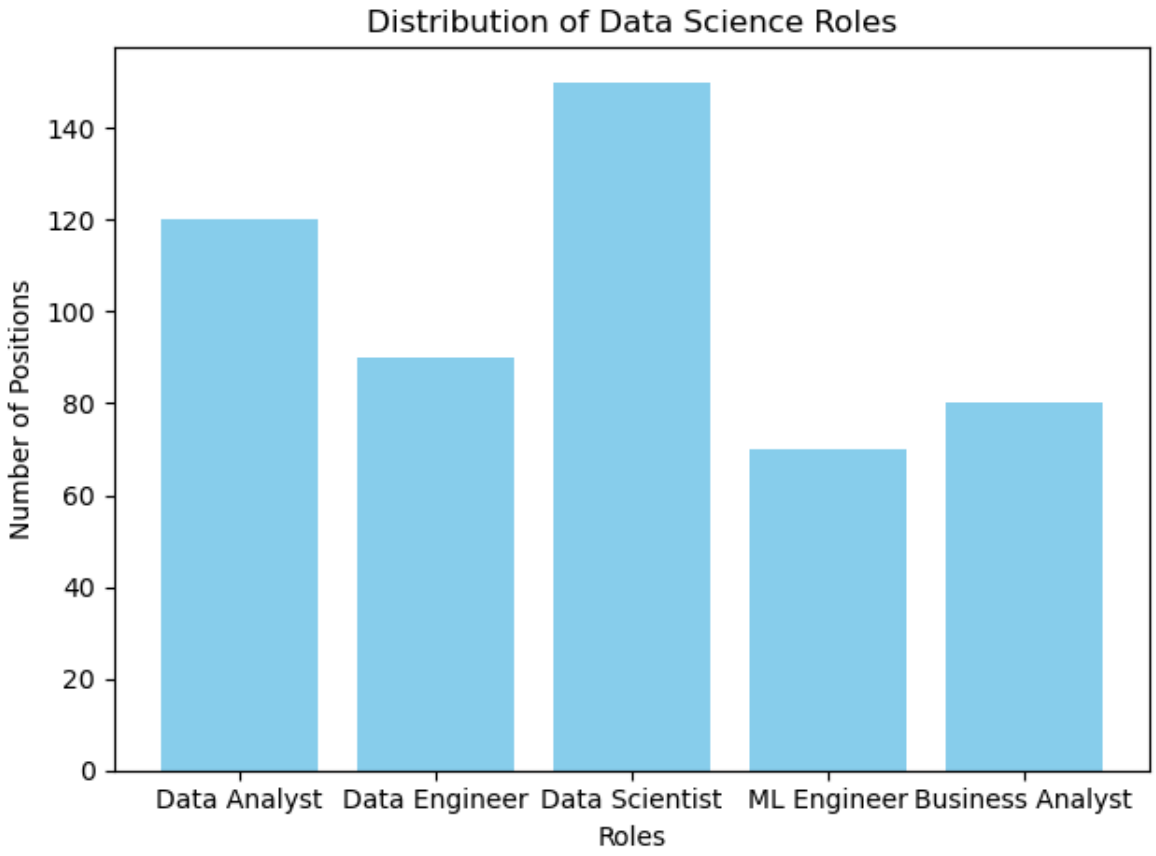
In [ ]:
```
1. The following table shows the number of Data Science job postings recorded ov
to 2020.
Year Job Postings
2010 150
2011 300
2012 450
2013 600
2014 800
2015 1200
2016 1600
2017 2100
2018 2700
2019 3400
2020 4200
Using Python (Pandas and Matplotlib):
1. Create a DataFrame for the given data.
2. Plot a line graph showing the trend of Data Science job postings over the yea
on data points.
3. Add suitable title and axis labels to the graph.
Expected Output: A line chart showing steady growth of job postings from 2010 to
```

In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
data = {
    'Year': list(range(2010, 2021)),
    'Job Postings': [150, 300, 450, 600, 800, 1200, 1600, 2100, 2700, 3400, 4200
}
df = pd.DataFrame(data)
plt.plot(df['Year'], df['Job Postings'], marker='o')
plt.title('Trend of Data Science Job Postings')
plt.xlabel('Year')
plt.ylabel('Number of Job Postings')
plt.grid(True)
plt.tight_layout()
plt.show()
```



In [ ]:
```
2.Write a Python program using Matplotlib to create a bar chart that shows the d
different Data Science roles (Data Analyst, Data Engineer, Data Scientist, ML En

Business Analyst) with their respective counts. Add appropriate axis labels and
chart.
```

In [2]:
```
import matplotlib.pyplot as plt
roles = ['Data Analyst', 'Data Engineer', 'Data Scientist', 'ML Engineer', 'Busi
counts = [120, 90, 150, 70, 80]
plt.bar(roles, counts, color='skyblue')
plt.title('Distribution of Data Science Roles')
plt.xlabel('Roles')
plt.ylabel('Number of Positions')
plt.tight_layout()
plt.show()
```



In [ ]:
```
3.Write a Python program to demonstrate the three main types of data: Structured
Unstructured, and Semi-structured. Use a Pandas DataFrame for structured data, a
for unstructured data, and a dictionary for semi-structured data. Print each typ
clear labels.
```

In [3]:
```
import pandas as pd
a = pd.DataFrame({
    'Name': ['Alice', 'Bob'],
    'Age': [25, 30],
    'Role': ['Data Scientist', 'Data Engineer']
})
b= "This is an example of unstructured data. It could be a paragraph, email, or
c= {'Name': 'Alice',
    'Contact': {
        'Email': 'alice@example.com',
        'Phone': '1234567890'
    },
    'Skills': ['Python', 'ML', 'SQL']
}
print("Structured Data (DataFrame):\n",a, '\n')
print("Unstructured Data (Text):\n",b, '\n')
print("Semi-structured Data (Dictionary):\n", c)
```

```
Structured Data (DataFrame):
     Name  Age            Role
0  Alice   25  Data Scientist
1    Bob   30   Data Engineer

Unstructured Data (Text):
 This is an example of unstructured data. It could be a paragraph, email, or soci
al media post.

Semi-structured Data (Dictionary):
 {'Name': 'Alice', 'Contact': {'Email': 'alice@example.com', 'Phone': '123456789
0'}, 'Skills': ['Python', 'ML', 'SQL']}
```

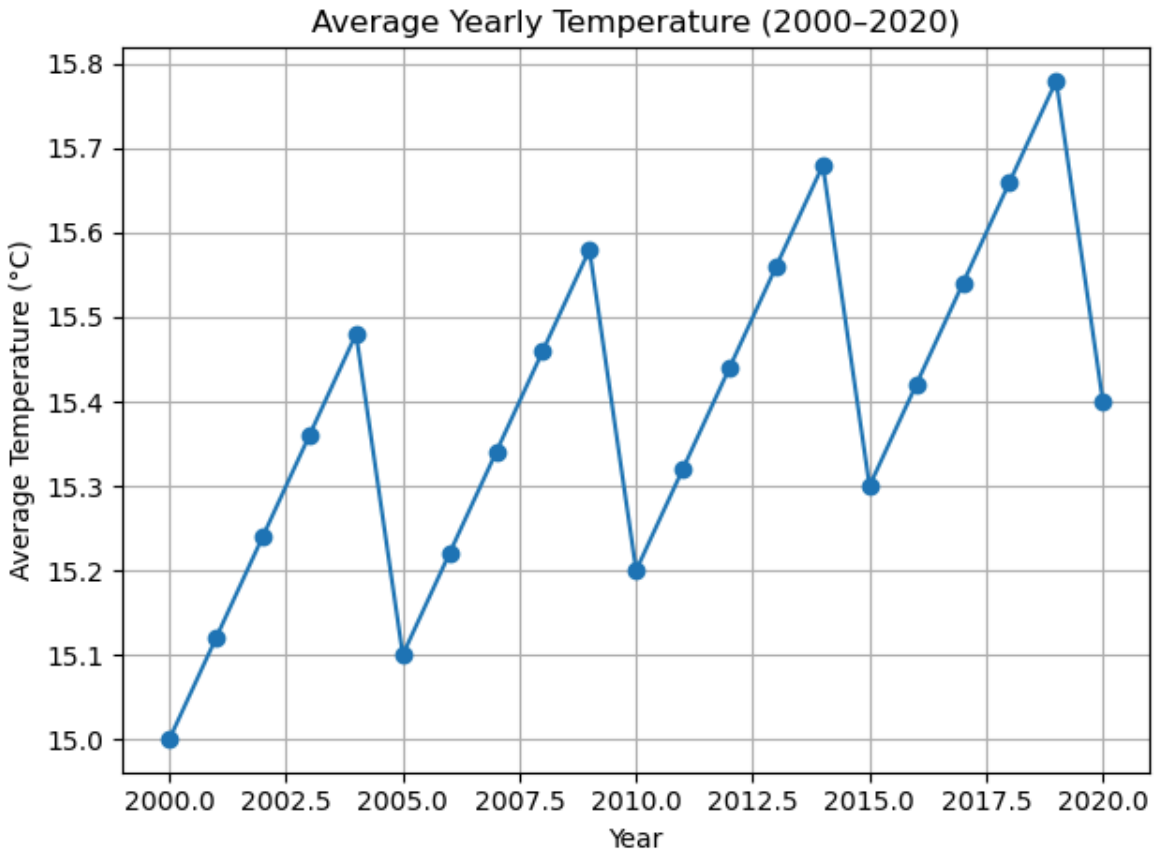
In [ ]:
```
4. Write a Python program using the cryptography.fernet module to demonstrate sy
key encryption and decryption. Encrypt the text 'Rajalakshmi Engineering College
generated key, display the encrypted ciphertext, and then decrypt it back to the
Print the original, encrypted, and decrypted data.
```

In [6]:
```
from cryptography.fernet import Fernet
key = Fernet.generate_key()
f = Fernet(key)
token = f.encrypt(b"Rajalakshmi Engineering College")
token
f.decrypt(token)
key = Fernet.generate_key()
cipher_suite = Fernet(key)
plain_text = b"Rajalakshmi Engineering College."
cipher_text = cipher_suite.encrypt(plain_text)
decrypted_text = cipher_suite.decrypt(cipher_text)
print("Original Data:", plain_text)
print("Encrypted Data:", cipher_text)
print("Decrypted Data:", decrypted_text)
```

```
Original Data: b'Rajalakshmi Engineering College.'
Encrypted Data: b'gAAAAABovnoT2NDFnlvelT4EXmiHKVwqrCwx2ngKagNrPmxqGsTFgK14pWCn9yv
S5qTUc_yBuS7UeM2cUHLT4V_dDPx18MJFbcXTC7wIq3qp408cW-M3gNN2s5jpp-30UOll1VtLP_Bg'
Decrypted Data: b'Rajalakshmi Engineering College.'
```

In [ ]:
```
Q1. Line Plot from CSV (Temperature Trends)
```

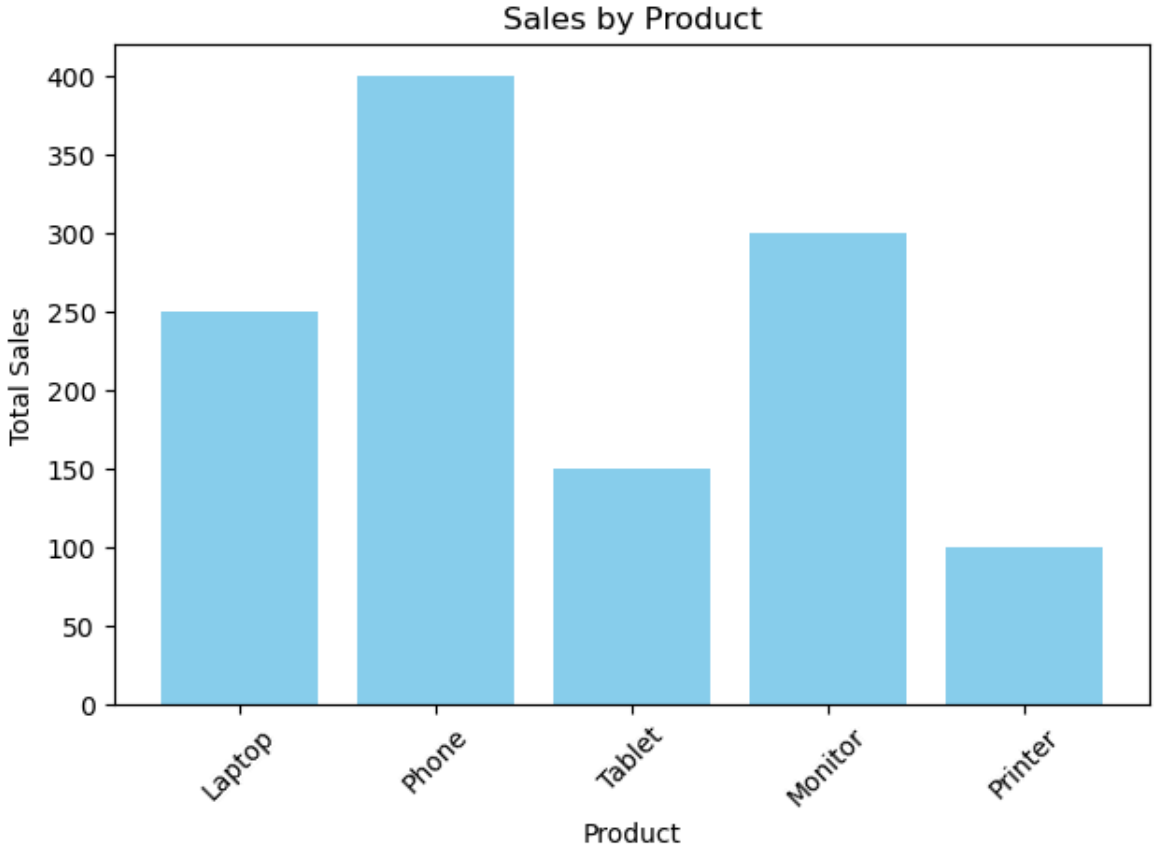
In [2]:
```
import pandas as pd
import matplotlib.pyplot as plt


data = {
    'Year': list(range(2000, 2021)),
    'AvgTemperature': [15 + (i % 5) * 0.1 + i*0.02 for i in range(21)]
}

df = pd.DataFrame(data)
df.to_csv('weather.csv', index=False)


df = pd.read_csv('weather.csv')
plt.plot(df['Year'], df['AvgTemperature'], marker='o')
plt.xlabel('Year')
plt.ylabel('Average Temperature (°C)')
plt.title('Average Yearly Temperature (2000-2020)')
plt.grid(True)
plt.tight_layout()
plt.show()
```



In [ ]:
```
Q2. Bar Chart from CSV (Sales Data)
```

In [3]:
```
import pandas as pd
import matplotlib.pyplot as plt


data = {
```

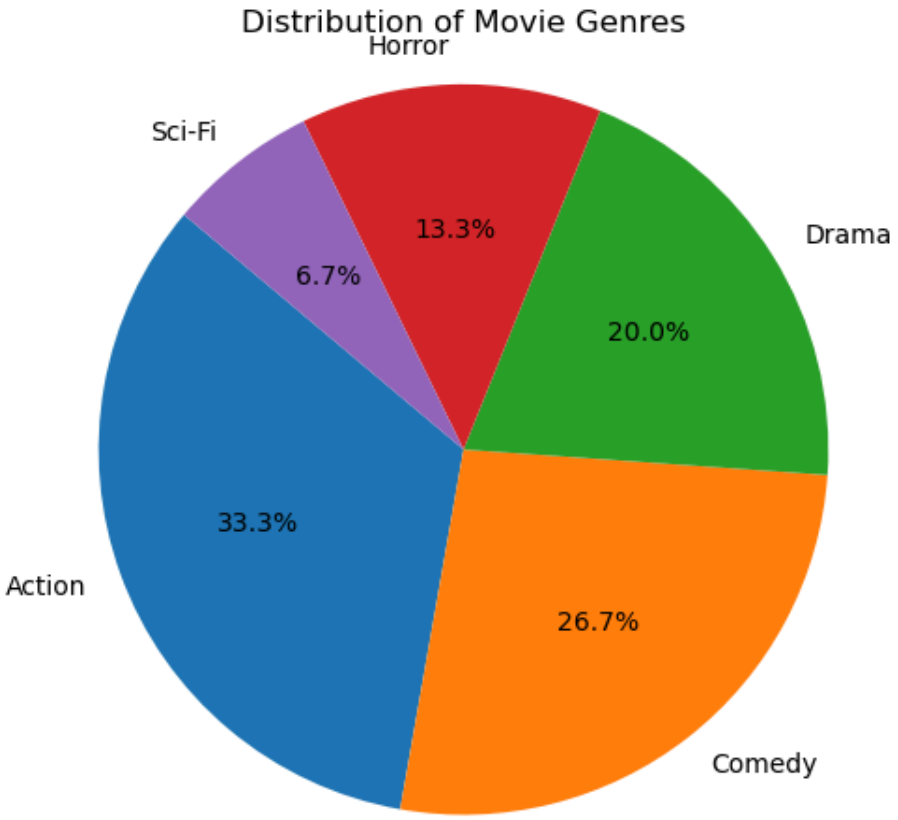
```
    'Product': ['Laptop', 'Phone', 'Tablet', 'Monitor', 'Printer'],
    'Sales': [250, 400, 150, 300, 100]
}
df = pd.DataFrame(data)
df.to_csv('sales.csv', index=False)


df = pd.read_csv('sales.csv')
plt.bar(df['Product'], df['Sales'], color='skyblue')
plt.xlabel('Product')
plt.ylabel('Total Sales')
plt.title('Sales by Product')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [ ]:
```
Q3. Pie Chart (Movie Genres Distribution)
```

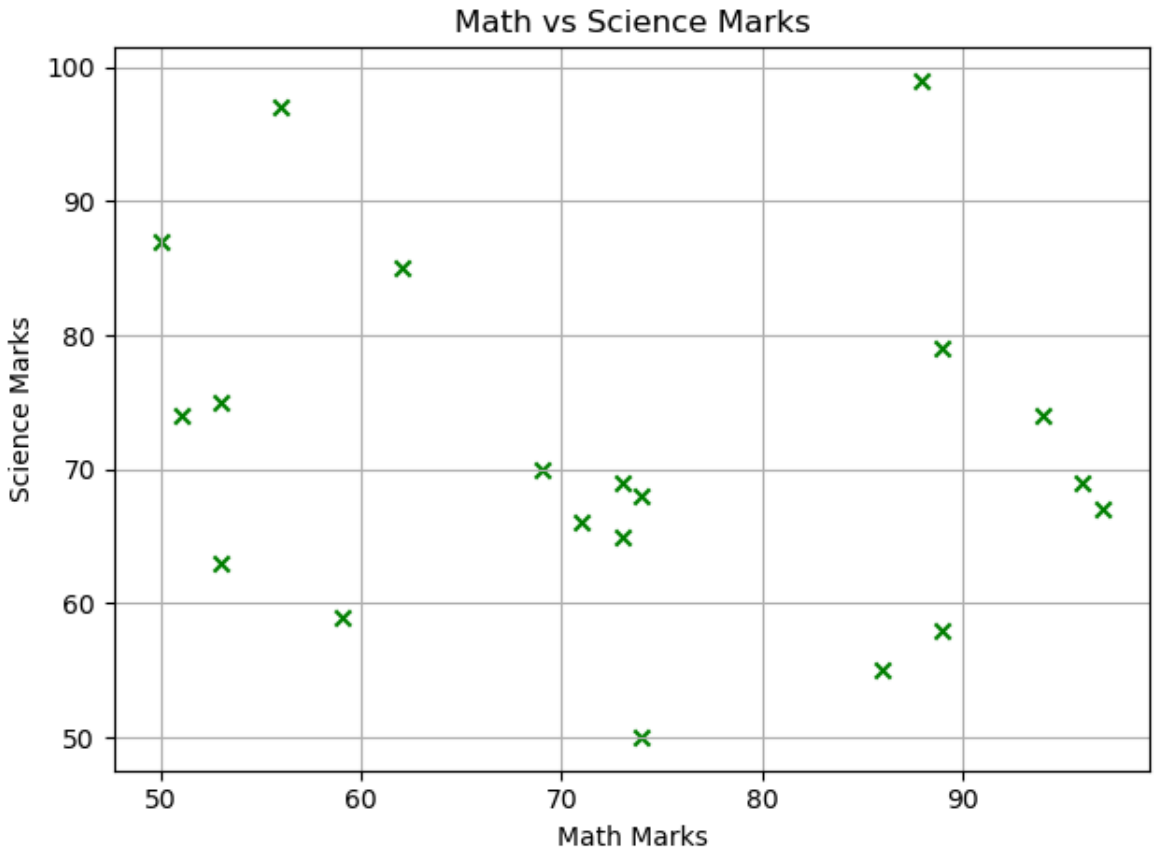
In [4]:
```
import pandas as pd
import matplotlib.pyplot as plt


data = {
    'Genre': ['Action', 'Comedy', 'Drama', 'Horror', 'Sci-Fi'],
    'Count': [50, 40, 30, 20, 10]
}
df = pd.DataFrame(data)
df.to_csv('movies.csv', index=False)


df = pd.read_csv('movies.csv')
plt.pie(df['Count'], labels=df['Genre'], autopct='%1.1f%%', startangle=140)
plt.title('Distribution of Movie Genres')
```

```
plt.axis('equal')
plt.tight_layout()
plt.show()
```



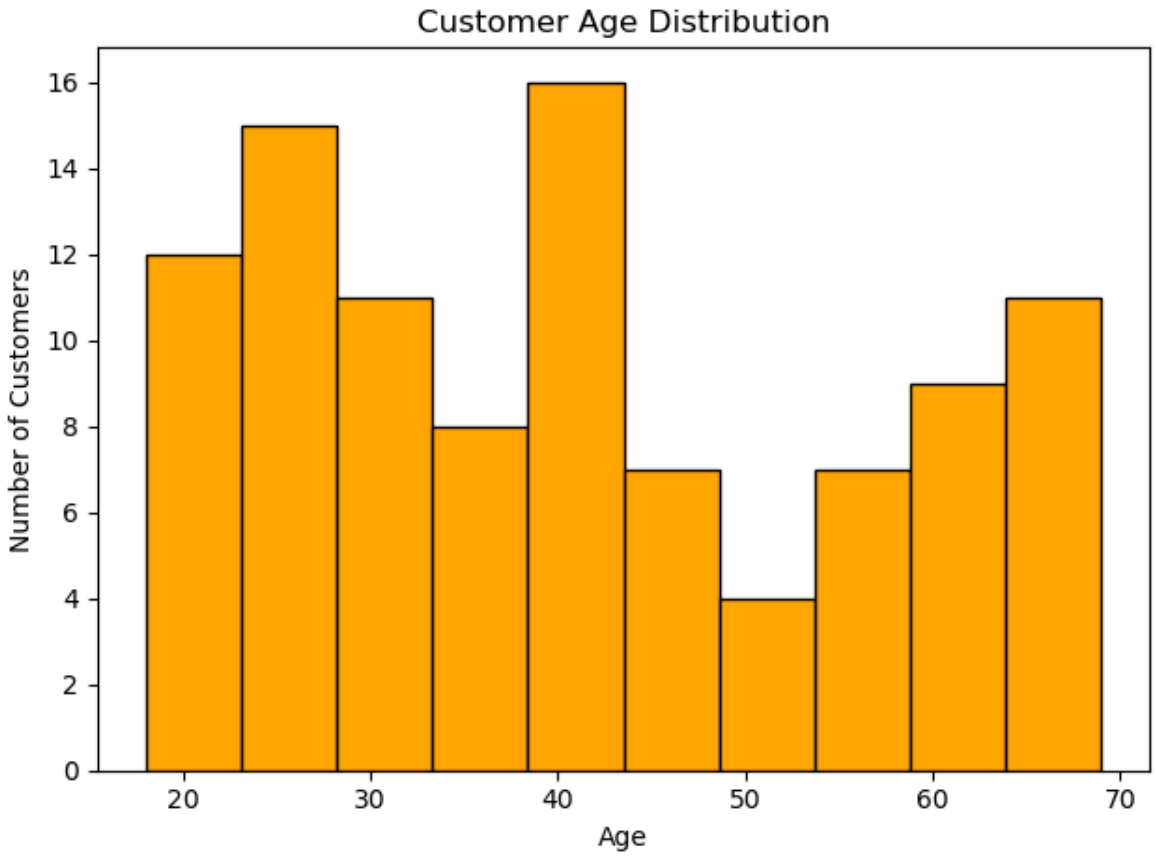
In [ ]:
```
Q4. Scatter Plot (Students' Marks)
```

In [5]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np


np.random.seed(0)
data = {
    'MathMarks': np.random.randint(50, 100, 20),
    'ScienceMarks': np.random.randint(50, 100, 20)
}
df = pd.DataFrame(data)
df.to_csv('students.csv', index=False)

df = pd.read_csv('students.csv')
plt.scatter(df['MathMarks'], df['ScienceMarks'], color='green', marker='x')
plt.xlabel('Math Marks')
plt.ylabel('Science Marks')
plt.title('Math vs Science Marks')
plt.grid(True)
plt.tight_layout()
plt.show()
```



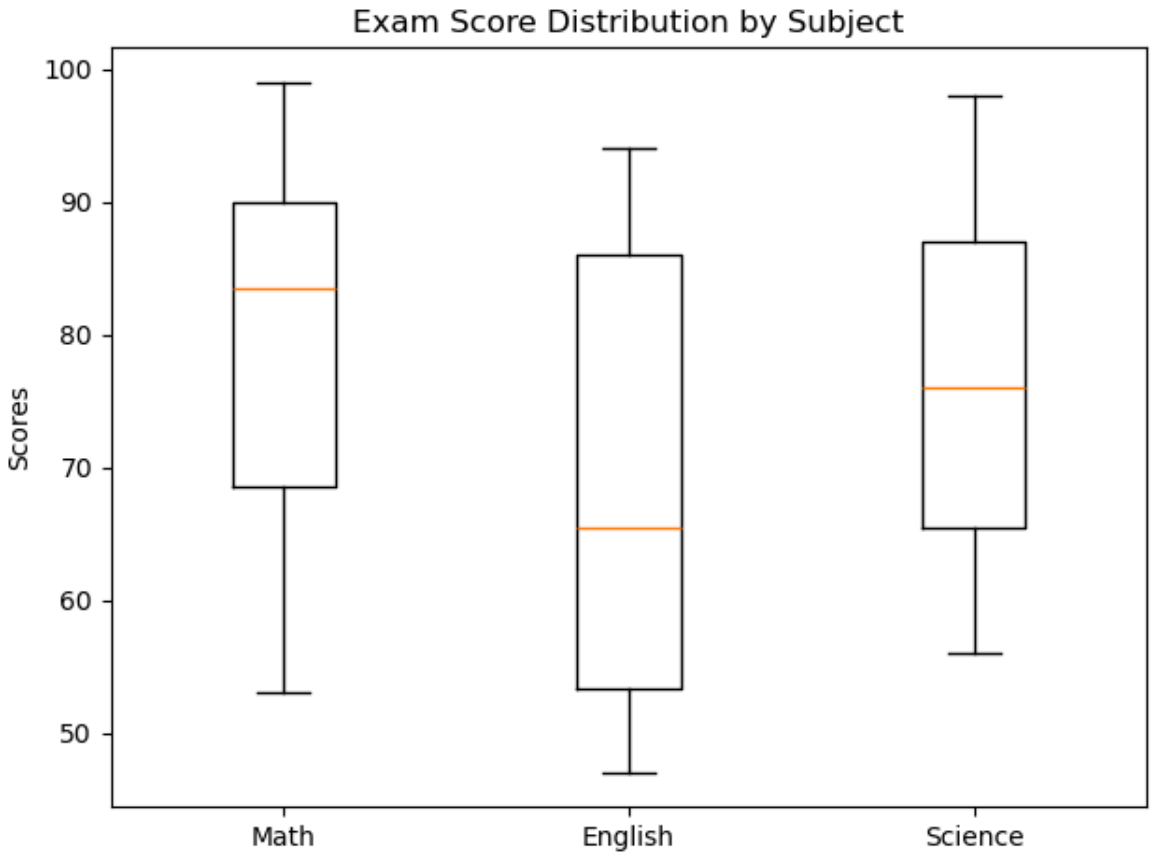
In [ ]:
```
Q5. Histogram (Customer Ages)
```

In [6]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np


np.random.seed(1)
df = pd.DataFrame({'Age': np.random.randint(18, 70, 100)})
df.to_csv('customers.csv', index=False)


df = pd.read_csv('customers.csv')
plt.hist(df['Age'], bins=10, color='orange', edgecolor='black')
plt.xlabel('Age')
plt.ylabel('Number of Customers')
plt.title('Customer Age Distribution')
plt.tight_layout()
plt.show()
```



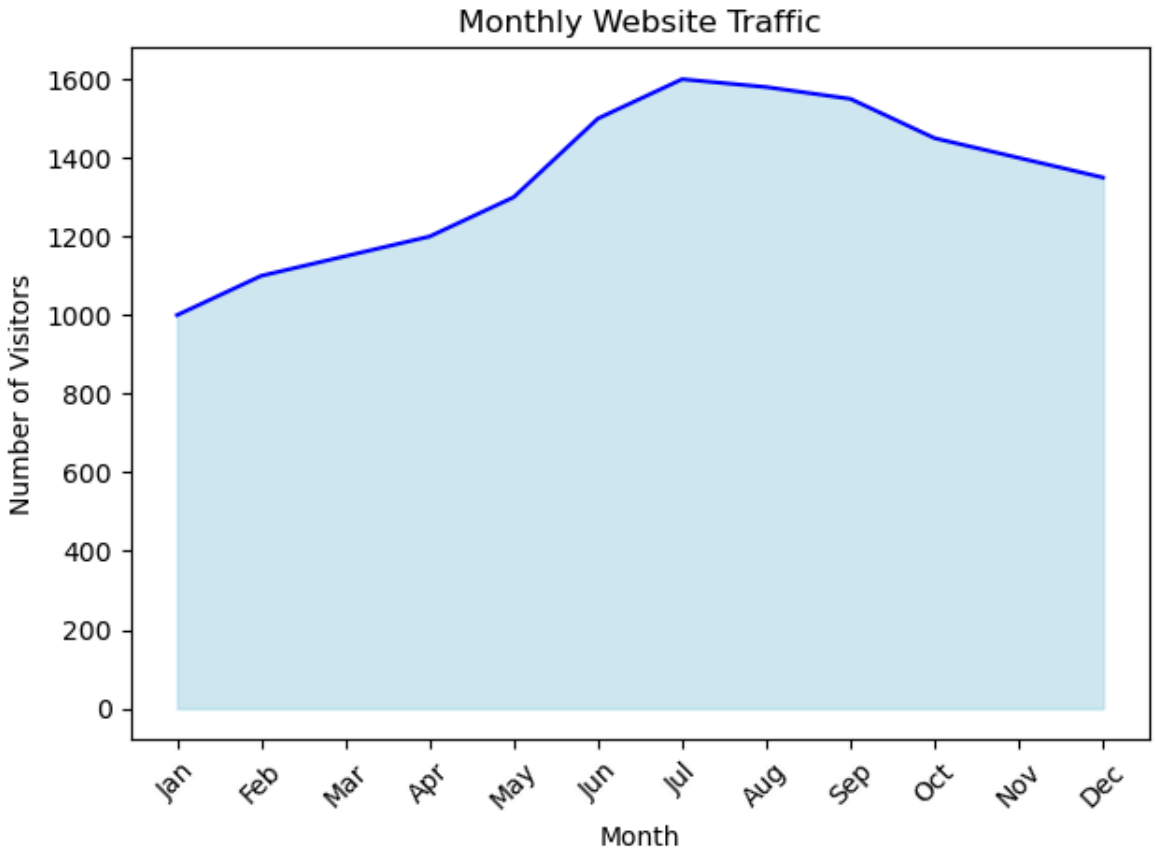
In [ ]:
```
Q6. Boxplot (Exam Scores Comparison)
```

In [9]:
```
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np


np.random.seed(2)
df = pd.DataFrame({
    'Math': np.random.randint(50, 100, 30),
    'English': np.random.randint(45, 95, 30),
    'Science': np.random.randint(55, 100, 30)
})
df.to_csv('exam_scores.csv', index=False)


df = pd.read_csv('exam_scores.csv')
plt.boxplot(
    [df['Math'], df['English'], df['Science']],
    tick_labels=['Math', 'English', 'Science']
)
plt.ylabel('Scores')
plt.title('Exam Score Distribution by Subject')
plt.tight_layout()
plt.show()
```



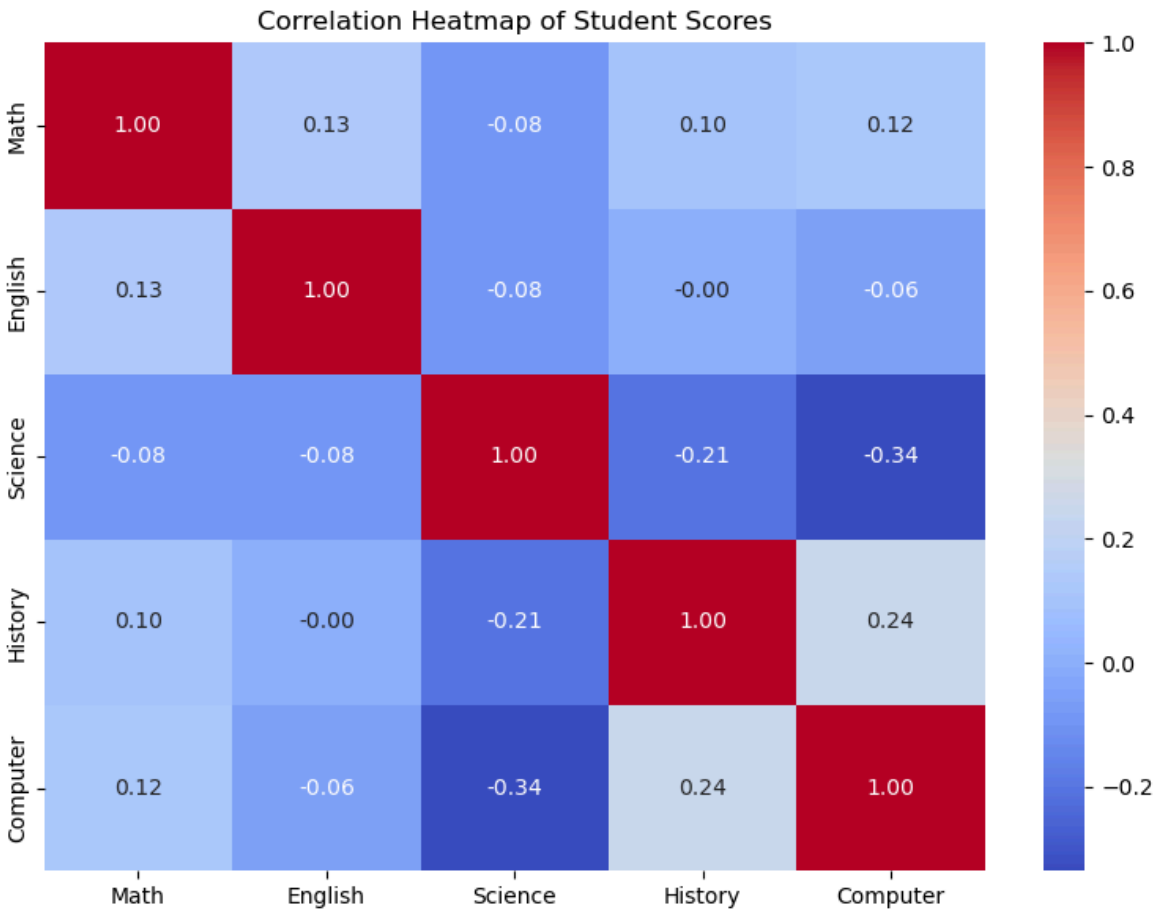
In [ ]:
```
Q7. Area Chart (Website Traffic)
```

In [10]:
```
import pandas as pd
import matplotlib.pyplot as plt


data = {
    'Month': ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oc
    'Visitors': [1000, 1100, 1150, 1200, 1300, 1500, 1600, 1580, 1550, 1450, 140
}
df = pd.DataFrame(data)
df.to_csv('traffic.csv', index=False)


df = pd.read_csv('traffic.csv')
plt.fill_between(df['Month'], df['Visitors'], color='lightblue', alpha=0.6)
plt.plot(df['Month'], df['Visitors'], color='blue')
plt.xlabel('Month')
plt.ylabel('Number of Visitors')
plt.title('Monthly Website Traffic')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [ ]:
```
Q8. Heatmap (Correlation Matrix)
```

In [11]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np


np.random.seed(3)
df = pd.DataFrame({
    'Math': np.random.randint(60, 100, 30),
    'English': np.random.randint(55, 95, 30),
    'Science': np.random.randint(65, 100, 30),
    'History': np.random.randint(50, 90, 30),
    'Computer': np.random.randint(70, 100, 30)
})
df.to_csv('students_scores.csv', index=False)


df = pd.read_csv('students_scores.csv')
corr = df.corr()

plt.figure(figsize=(8, 6))
sns.heatmap(corr, annot=True, cmap='coolwarm', fmt=".2f")
plt.title('Correlation Heatmap of Student Scores')
plt.tight_layout()
plt.show()
```

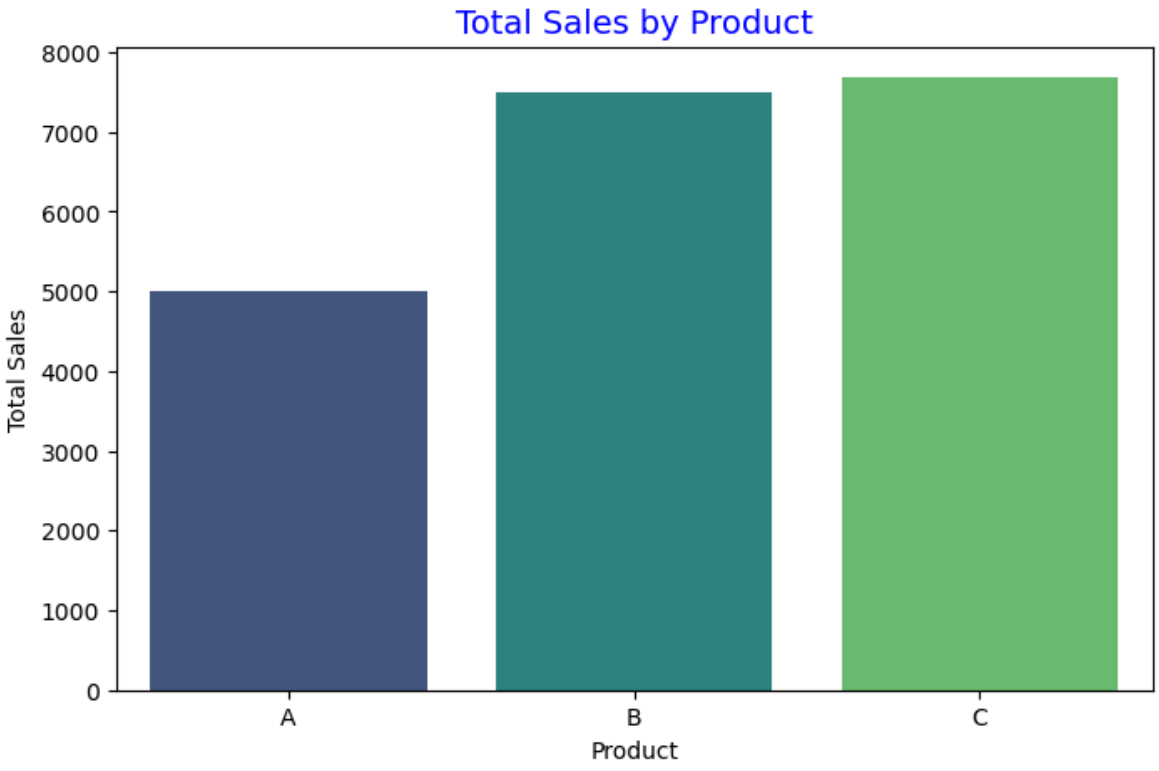

Correlation Heatmap of Student Scores
Math
English
Science
History
Computer
1.00 0.13 -0.08 0.10 0.12
0.13 1.00 -0.08 -0.00 -0.06
-0.08 -0.08 1.00 -0.21 -0.34
0.10 -0.00 -0.21 1.00 0.24
0.12 -0.06 -0.34 0.24 1.00
Math
English
Science
History
Computer
1.0
0.8
0.6
0.4
0.2
0.0
−0.2

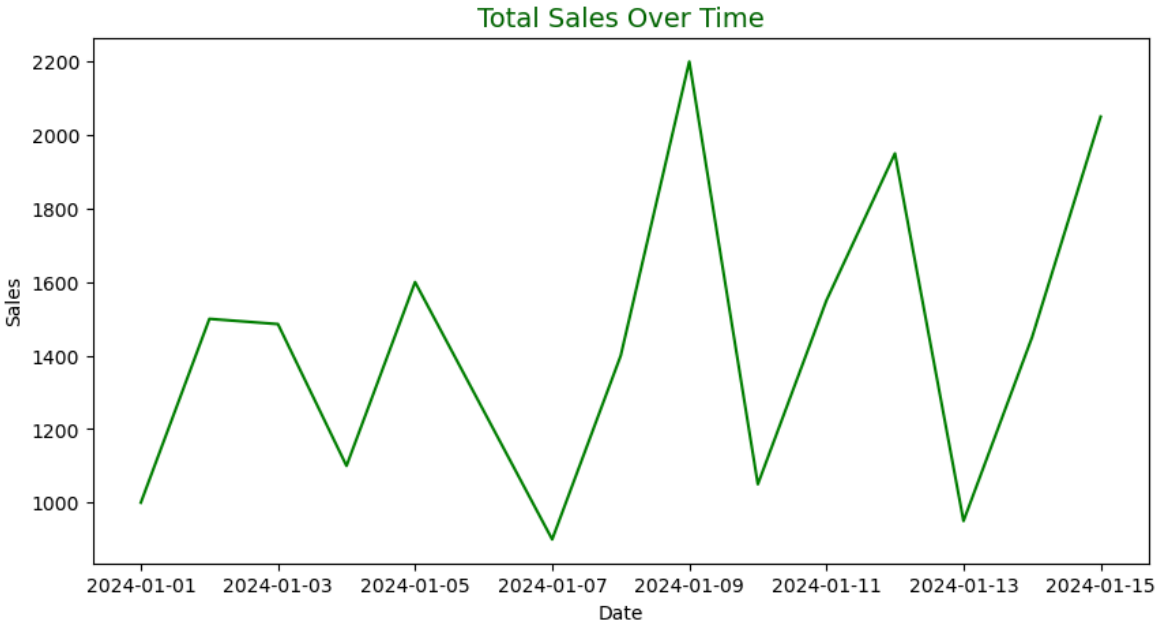
In [ ]:
```
1) A retail company has provided a CSV file (sales_data.csv) containing sales tr
with the following columns: Date, Product, Quantity, Sales, and Region. As a Dat
perform an Exploratory Data Analysis (EDA) using Python (Pandas, NumPy, Matplotl
Seaborn) with the following tasks:
1. Load the dataset into a Pandas DataFrame and display the first few records.
2. Identify and handle missing values (replace missing Sales values with the mea
rows with missing Product, Quantity, or Region).
3. Generate summary statistics of the numerical columns.
4. Group the data by Product and compute the total Sales and Quantity sold.
5. Create a bar chart showing the total sales for each product.
6. Convert the Date column to datetime and plot a line chart of total sales over
7. Construct a pivot table to analyze sales by Region and Product.
8. Compute the correlation matrix of numerical variables and visualize it using
Discuss the insights obtained from each step.
```

In [2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

data = {
    'Date': pd.date_range(start='2024-01-01', periods=15, freq='D'),
    'Product': ['A','B','C','A','B','C','A','B','C','A','B','C','A','B','C'],
    'Quantity': [10,15,20,12,18,25,8,14,22,11,16,19,9,13,21],
    'Sales': [1000,1500,2000,1100,1600,2100,900,1400,2200,1050,1550,1950,950,145
    'Region': ['North','South','East','West','North','South','East','West','Nort
}
df = pd.DataFrame(data)

df.loc[2,'Sales'] = np.nan
df.loc[5,'Product'] = np.nan

df['Sales'] = df['Sales'].fillna(df['Sales'].mean())
df = df.dropna(subset=['Product','Quantity','Region'])
print(df.isnull().sum())

print(df.describe())

product_summary = df.groupby('Product', as_index=False).agg({'Sales':'sum','Quan
print(product_summary)

plt.figure(figsize=(8,5))
sns.barplot(data=product_summary, x='Product', y='Sales', hue='Product', palette
plt.title('Total Sales by Product', fontsize=14, color='blue')
plt.xlabel('Product')
plt.ylabel('Total Sales')
plt.show()

df['Date'] = pd.to_datetime(df['Date'])
sales_over_time = df.groupby('Date', as_index=False)['Sales'].sum()

plt.figure(figsize=(10,5))
sns.lineplot(data=sales_over_time, x='Date', y='Sales', color='green')
plt.title('Total Sales Over Time', fontsize=14, color='darkgreen')
plt.xlabel('Date')
plt.ylabel('Sales')
plt.show()
```

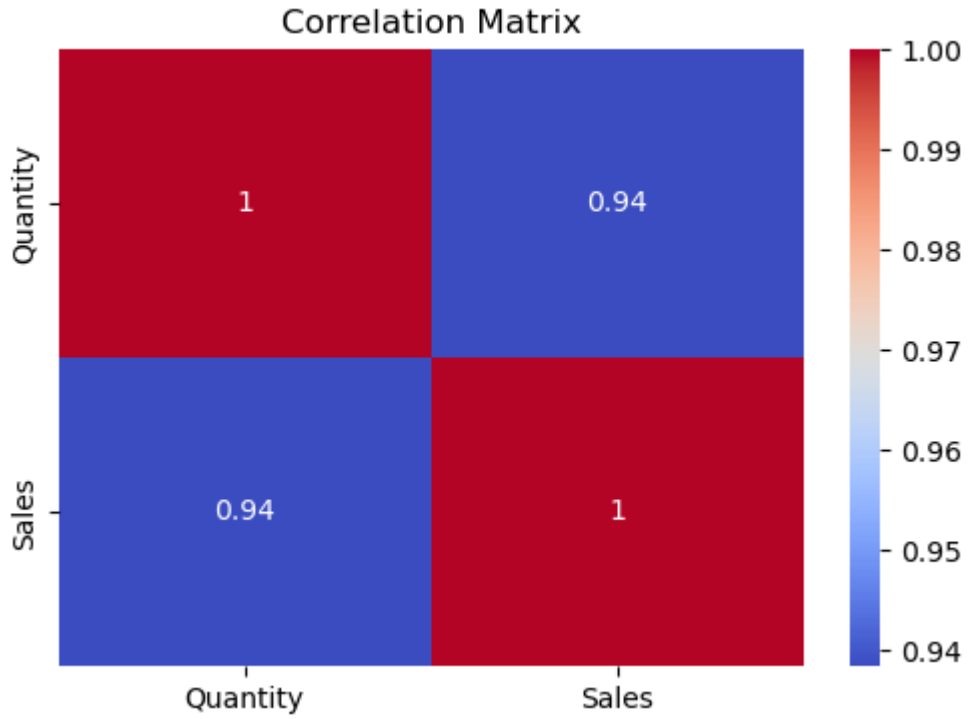
```
pivot_table = pd.pivot_table(df, values='Sales', index='Region', columns='Produc
print(pivot_table)

plt.figure(figsize=(6,4))
sns.heatmap(df.corr(numeric_only=True), annot=True, cmap='coolwarm')
plt.title('Correlation Matrix')
plt.show()
```

```
Date        0
Product     0
Quantity    0
Sales       0
Region      0
dtype: int64
                                Date   Quantity        Sales
count                             14  14.000000    14.000000
mean   2024-01-08 03:25:42.857142784  14.857143  1441.836735
min              2024-01-01 00:00:00   8.000000   900.000000
25%              2024-01-04 06:00:00  11.250000  1062.500000
50%              2024-01-08 12:00:00  14.500000  1467.857143
75%              2024-01-11 18:00:00  18.750000  1587.500000
max              2024-01-15 00:00:00  22.000000  2200.000000
std                              NaN   4.605300   415.825644
  Product        Sales  Quantity
0       A  5000.000000        50
1       B  7500.000000        76
2       C  7685.714286        82
```



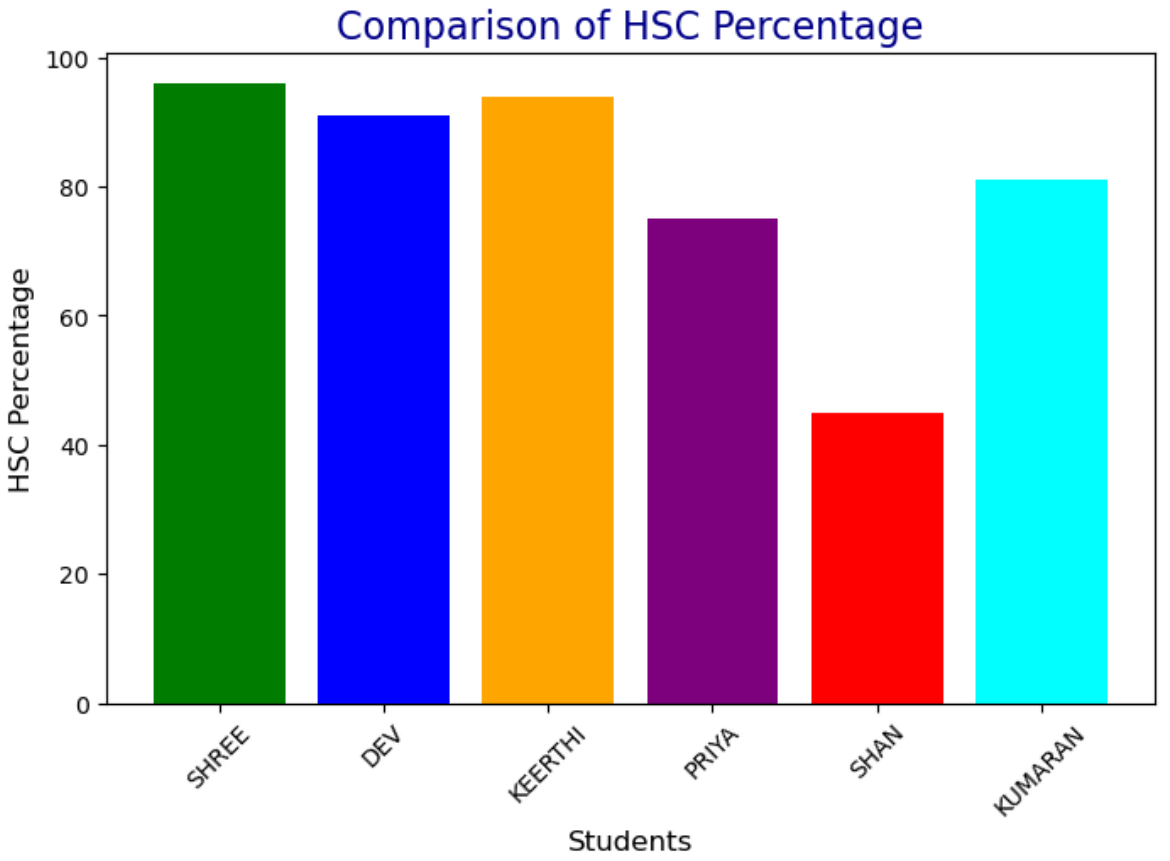


Product	A	B	C
Region			
East	900.0	1550.0	3535.714286
North	1950.0	1600.0	2200.000000
South	1050.0	2950.0	0.000000
West	1100.0	1400.0	1950.000000



In [ ]:
```
2) A dataset contains the names of six students (SHREE, DEV, KEERTHI, PRIYA, SHA
along with their Higher Secondary Certificate (HSC) exam percentages: 96, 91, 94
Using Matplotlib and NumPy in Python:
Plot a bar chart comparing the HSC percentages of the students.
Set appropriate labels for the x-axis and y-axis.
Rotate the x-axis tick labels for better readability.
Add a title ("Comparison of HSC Percentage") with customized font size and color
Display the chart using show().
Also, interpret the chart to identify the student with the highest and lowest pe
```

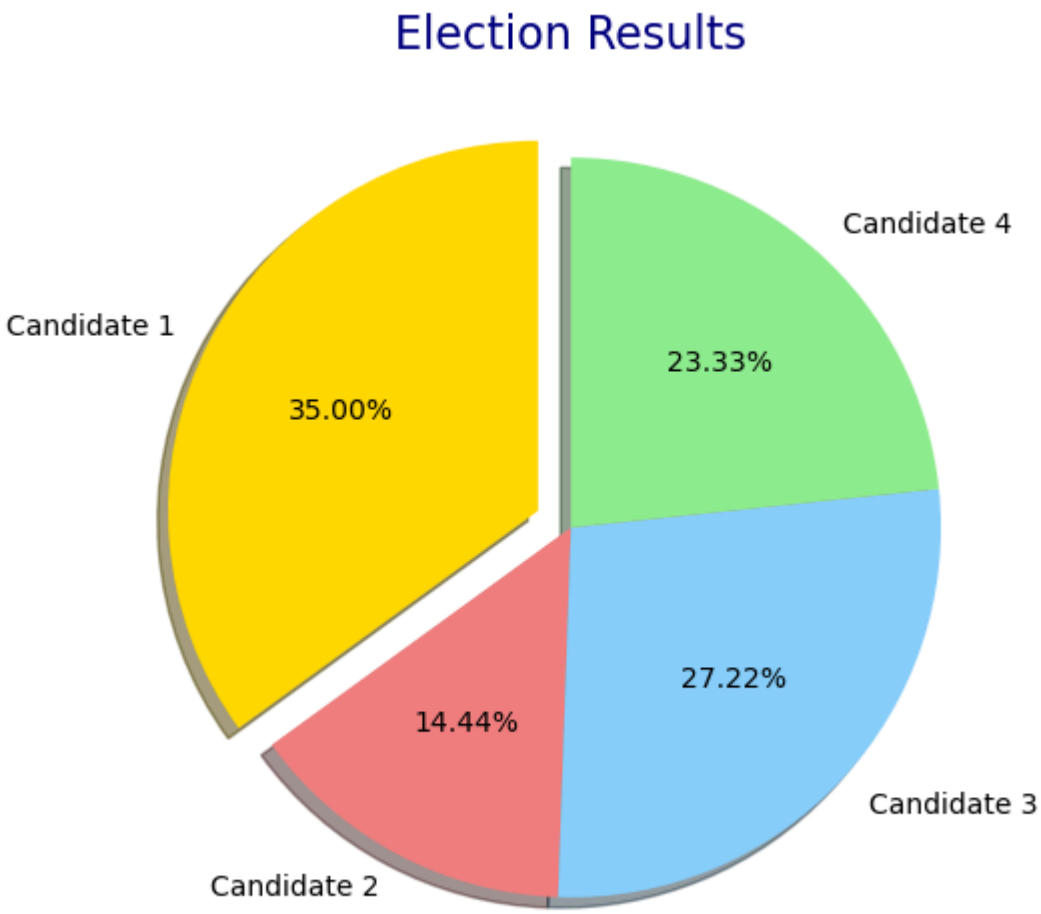
In [3]:
```
import numpy as np
import matplotlib.pyplot as plt

students = ['SHREE', 'DEV', 'KEERTHI', 'PRIYA', 'SHAN', 'KUMARAN']
percentages = [96, 91, 94, 75, 45, 81]

plt.figure(figsize=(8,5))
plt.bar(students, percentages, color=['green','blue','orange','purple','red','cy
plt.xlabel('Students', fontsize=12)
plt.ylabel('HSC Percentage', fontsize=12)
plt.title('Comparison of HSC Percentage', fontsize=16, color='darkblue')
plt.xticks(rotation=45)
plt.show()
```



In [ ]:
```
3) The following table shows the number of votes received by four candidates in
Candidate Votes
Candidate 1 315
Candidate 2 130

Candidate Votes
Candidate 3 245
Candidate 4 210

Using Matplotlib in Python, write a program to:
1. Plot a pie chart to represent the election results.
2. Highlight Candidate 1 using the explode parameter.
3. Use different colors for each candidate.
4. Display percentage values on the chart up to two decimal places.
5. Add a suitable title ("Election Results").
```

In [4]:
```
import matplotlib.pyplot as plt
```

```
candidates = ['Candidate 1', 'Candidate 2', 'Candidate 3', 'Candidate 4']
votes = [315, 130, 245, 210]
colors = ['gold', 'lightcoral', 'lightskyblue', 'lightgreen']
explode = [0.1, 0, 0, 0]

plt.figure(figsize=(6,6))
plt.pie(votes, labels=candidates, autopct='%1.2f%%', startangle=90, colors=color
plt.title('Election Results', fontsize=16, color='navy')
plt.show()
```



In [ ]:
```
4) To Count the frequency of occurrence of a word in a body of text is often nee
processing.
Description: Import the word_tokenize function and gutenberg.
```

In [6]:
```
import nltk
nltk.download('gutenberg')
nltk.download('punkt')
```

```
[nltk_data] Downloading package gutenberg to
[nltk_data]     C:\Users\RISHASRI\AppData\Roaming\nltk_data...
[nltk_data]   Package gutenberg is already up-to-date!
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\RISHASRI\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
```

Out[6]: True

In [8]:
```
import nltk
nltk.download('punkt_tab')
```

```
[nltk_data] Downloading package punkt_tab to
[nltk_data]     C:\Users\RISHASRI\AppData\Roaming\nltk_data...
[nltk_data]   Unzipping tokenizers\punkt_tab.zip.
```

Out[8]: True

In [9]:
```
from nltk.tokenize import word_tokenize
from nltk.corpus import gutenberg

sample = gutenberg.raw("austen-emma.txt")
token = word_tokenize(sample)
wlist = [token[i] for i in range(50)]
wordfreq = [wlist.count(w) for w in wlist]
print("Pairs\n" + str(list(zip(wlist, wordfreq))))
```

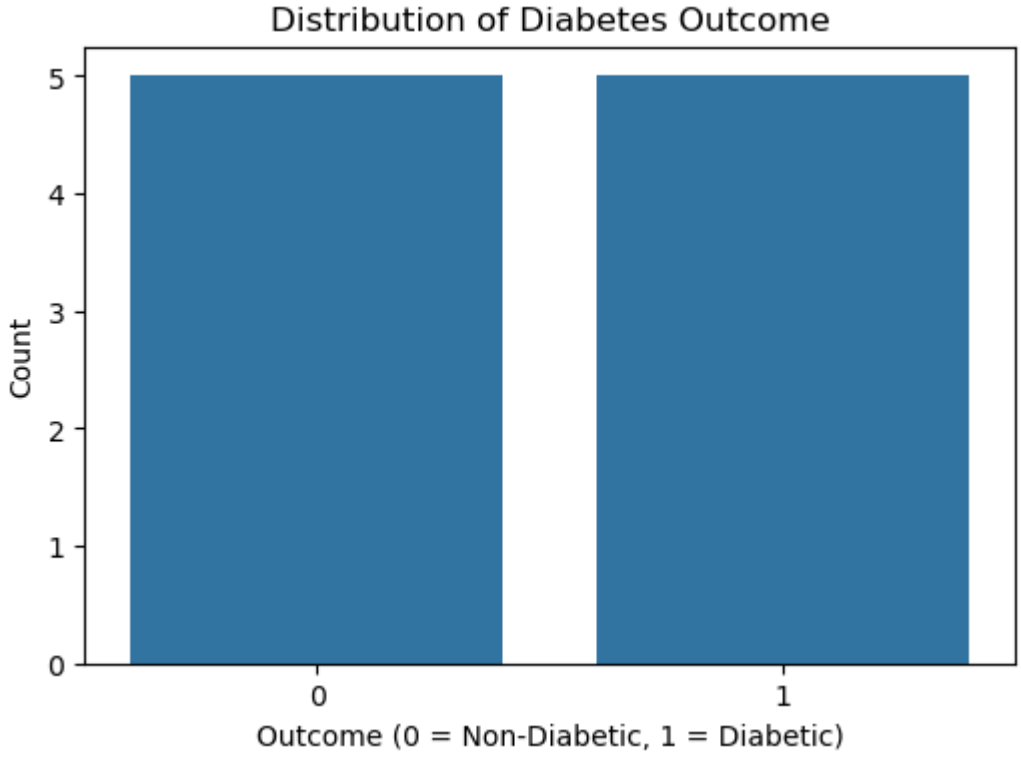
```
Pairs
[('[', 1), ('Emma', 2), ('by', 1), ('Jane', 1), ('Austen', 1), ('1816', 1), (']',
1), ('VOLUME', 1), ('I', 2), ('CHAPTER', 1), ('I', 2), ('Emma', 2), ('Woodhouse',
1), (',', 5), ('handsome', 1), (',', 5), ('clever', 1), (',', 5), ('and', 3), ('r
ich', 1), (',', 5), ('with', 2), ('a', 1), ('comfortable', 1), ('home', 1), ('an
d', 3), ('happy', 1), ('disposition', 1), (',', 5), ('seemed', 1), ('to', 1), ('u
nite', 1), ('some', 1), ('of', 2), ('the', 2), ('best', 1), ('blessings', 1), ('o
f', 2), ('existence', 1), (';', 1), ('and', 3), ('had', 1), ('lived', 1), ('nearl
y', 1), ('twenty-one', 1), ('years', 1), ('in', 1), ('the', 2), ('world', 1), ('w
ith', 2)]
```

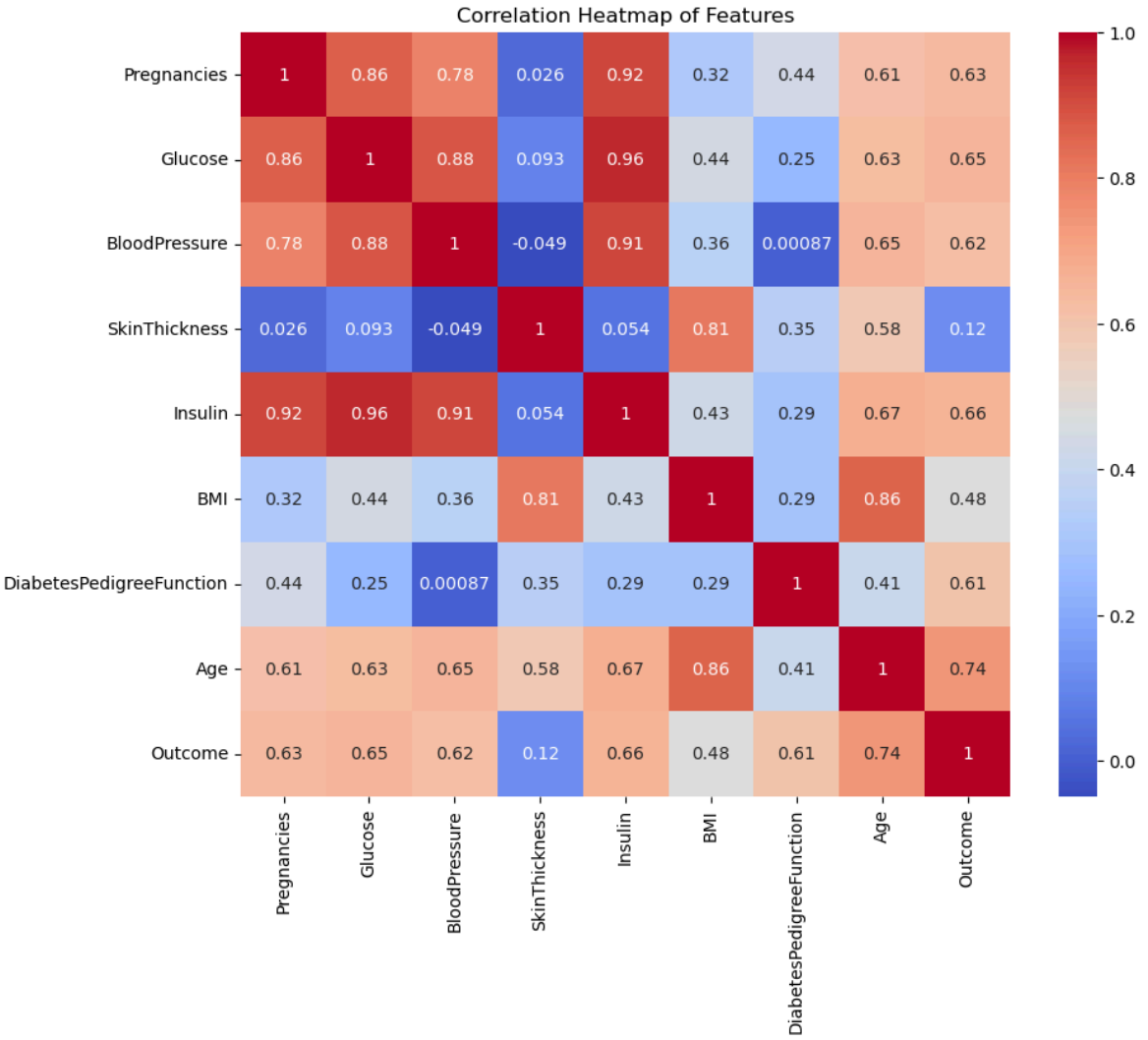
In [ ]:
```
1) Write a Python program to collect, load, and perform initial exploration of t
dataset using Pandas. Display the first few records of the dataset and summarize
structure and contents.
```

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

data = {
    "Pregnancies": [2, 5, 3, 1, 4, 6, 8, 0, 2, 7],
    "Glucose": [120, 150, 85, 95, 130, 140, 155, 100, 110, 160],
    "BloodPressure": [70, 80, 60, 75, 78, 85, 90, 72, 68, 88],
    "SkinThickness": [35, 29, 30, 32, 28, 25, 31, 27, 33, 36],
    "Insulin": [100, 130, 85, 90, 120, 140, 150, 95, 105, 160],
    "BMI": [33.6, 28.1, 26.2, 30.5, 27.8, 29.4, 31.1, 25.7, 32.3, 34.8],
    "DiabetesPedigreeFunction": [0.627, 0.351, 0.672, 0.245, 0.587, 0.478, 0.513
    "Age": [50, 31, 29, 41, 35, 45, 55, 28, 38, 60],
    "Outcome": [1, 0, 0, 0, 1, 1, 1, 0, 0, 1]
}

df = pd.DataFrame(data)
df.to_csv("diabetes.csv", index=False)
print("diabetes.csv created successfully!\n")

diabetes_df = pd.read_csv("diabetes.csv")

print("First 5 rows of the dataset:")
print(diabetes_df.head())

print("\nDataset Information:")
print(diabetes_df.info())

print("\nStatistical Summary:")
print(diabetes_df.describe())

print("\nMissing Values in Each Column:")
print(diabetes_df.isnull().sum())

plt.figure(figsize=(6,4))
sns.countplot(x='Outcome', data=diabetes_df)
plt.title('Distribution of Diabetes Outcome')
plt.xlabel('Outcome (0 = Non-Diabetic, 1 = Diabetic)')
plt.ylabel('Count')
plt.show()

plt.figure(figsize=(10,8))
sns.heatmap(diabetes_df.corr(), annot=True, cmap='coolwarm')
plt.title('Correlation Heatmap of Features')
plt.show()
```

```
diabetes.csv created successfully!

First 5 rows of the dataset:
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  \
0            2      120             70             35      100  33.6
1            5      150             80             29      130  28.1
2            3       85             60             30       85  26.2
3            1       95             75             32       90  30.5
4            4      130             78             28      120  27.8

   DiabetesPedigreeFunction  Age  Outcome
0                     0.627   50        1
1                     0.351   31        0
2                     0.672   29        0
3                     0.245   41        0
4                     0.587   35        1

Dataset Information:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9
Data columns (total 9 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   Pregnancies               10 non-null     int64
 1   Glucose                   10 non-null     int64
 2   BloodPressure             10 non-null     int64
 3   SkinThickness             10 non-null     int64
 4   Insulin                   10 non-null     int64
 5   BMI                       10 non-null     float64
 6   DiabetesPedigreeFunction  10 non-null     float64
 7   Age                       10 non-null     int64
 8   Outcome                   10 non-null     int64
dtypes: float64(2), int64(7)
memory usage: 852.0 bytes
None

Statistical Summary:
       Pregnancies     Glucose  BloodPressure  SkinThickness     Insulin  \
count     10.00000   10.000000      10.000000       10.00000   10.000000
mean       3.80000  124.500000      76.600000       30.60000  117.500000
std        2.65832   26.609313       9.489175        3.50238   26.483748
min        0.00000   85.000000      60.000000       25.00000   85.000000
25%        2.00000  102.500000      70.500000       28.25000   96.250000
50%        3.50000  125.000000      76.500000       30.50000  112.500000
75%        5.75000  147.500000      83.750000       32.75000  137.500000
max        8.00000  160.000000      90.000000       36.00000  160.000000

             BMI  DiabetesPedigreeFunction        Age    Outcome
count  10.000000                 10.000000  10.000000  10.000000
mean   29.950000                  0.490600  41.200000   0.500000
std     3.063495                  0.153845  11.113555   0.527046
min    25.700000                  0.245000  28.000000   0.000000
25%    27.875000                  0.366750  32.000000   0.000000
50%    29.950000                  0.495500  39.500000   0.500000
75%    32.000000                  0.617000  48.750000   1.000000
max    34.800000                  0.690000  60.000000   1.000000

Missing Values in Each Column:
Pregnancies                 0
Glucose                     0
```

```
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```



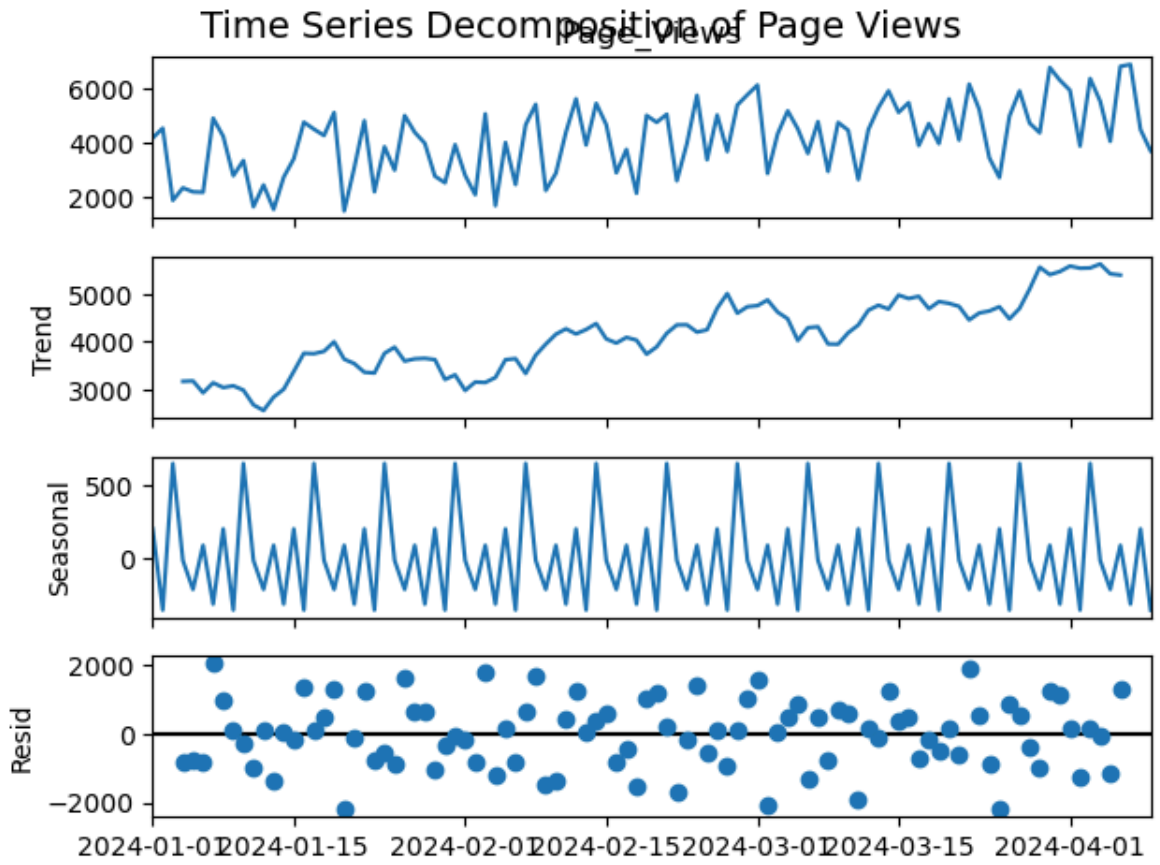


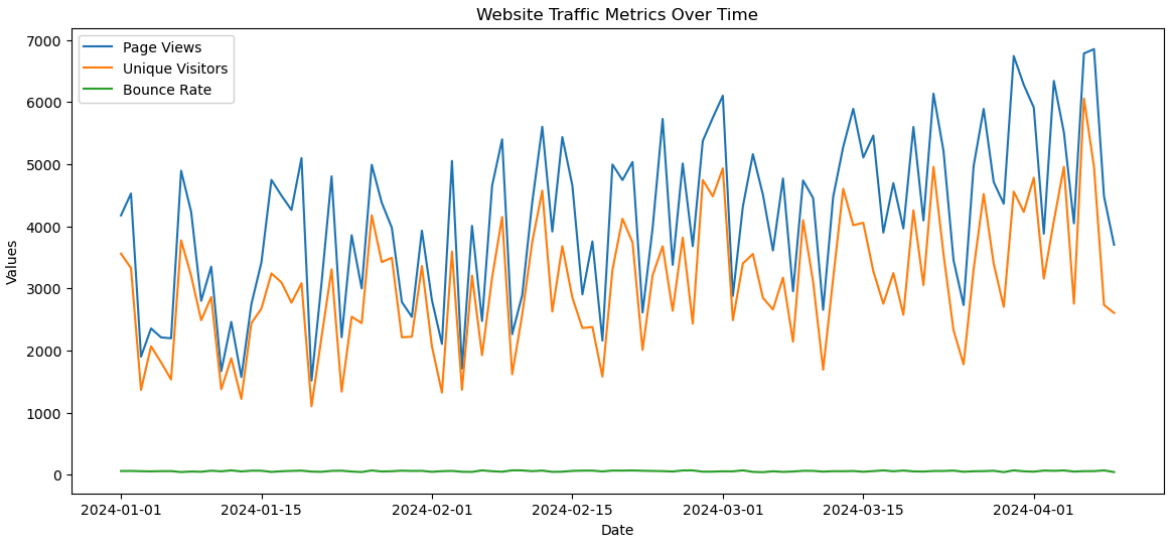
In [ ]:
```
2) Write a Python program to perform Time Series Analysis on a website traffic d
program should load and clean the dataset, decompose the time series to identify
and seasonality, visualize key metrics using moving averages and seasonal plots,
anomalies using statistical methods.
```

In [2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from statsmodels.tsa.seasonal import seasonal_decompose
from scipy import stats

dates = pd.date_range(start='2024-01-01', periods=100, freq='D')
np.random.seed(42)
page_views = np.random.randint(1000, 5000, size=100) + np.linspace(0, 2000, 100)
unique_visitors = page_views * np.random.uniform(0.6, 0.9, size=100)
bounce_rate = np.random.uniform(40, 70, size=100)

df = pd.DataFrame({
    'Date': dates,
    'Page_Views': page_views,
    'Unique_Visitors': unique_visitors,
    'Bounce_Rate': bounce_rate
})

df = df.sort_values('Date')
df.set_index('Date', inplace=True)
```

```
df = df.interpolate()

print("First few rows of the dataset:")
print(df.head())

print("\nDataset Information:")
print(df.info())

decomposition = seasonal_decompose(df['Page_Views'], model='additive', period=7)
plt.figure(figsize=(12, 8))
decomposition.plot()
plt.suptitle('Time Series Decomposition of Page Views', fontsize=14)
plt.show()

plt.figure(figsize=(14, 6))
plt.plot(df.index, df['Page_Views'], label='Page Views')
plt.plot(df.index, df['Unique_Visitors'], label='Unique Visitors')
plt.plot(df.index, df['Bounce_Rate'], label='Bounce Rate')
plt.title('Website Traffic Metrics Over Time')
plt.xlabel('Date')
plt.ylabel('Values')
plt.legend()
plt.show()
```

```
First few rows of the dataset:
             Page_Views  Unique_Visitors  Bounce_Rate
Date
2024-01-01  4174.000000      3559.108995    59.030540
2024-01-02  4527.202020      3327.159558    60.421164
2024-01-03  1900.404040      1365.525956    55.928037
2024-01-04  2354.606061      2067.338611    53.433495
2024-01-05  2210.808081      1808.842490    56.586793

Dataset Information:
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 100 entries, 2024-01-01 to 2024-04-09
Data columns (total 3 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   Page_Views       100 non-null    float64
 1   Unique_Visitors  100 non-null    float64
 2   Bounce_Rate      100 non-null    float64
dtypes: float64(3)
memory usage: 3.1 KB
None
<Figure size 1200x800 with 0 Axes>
```





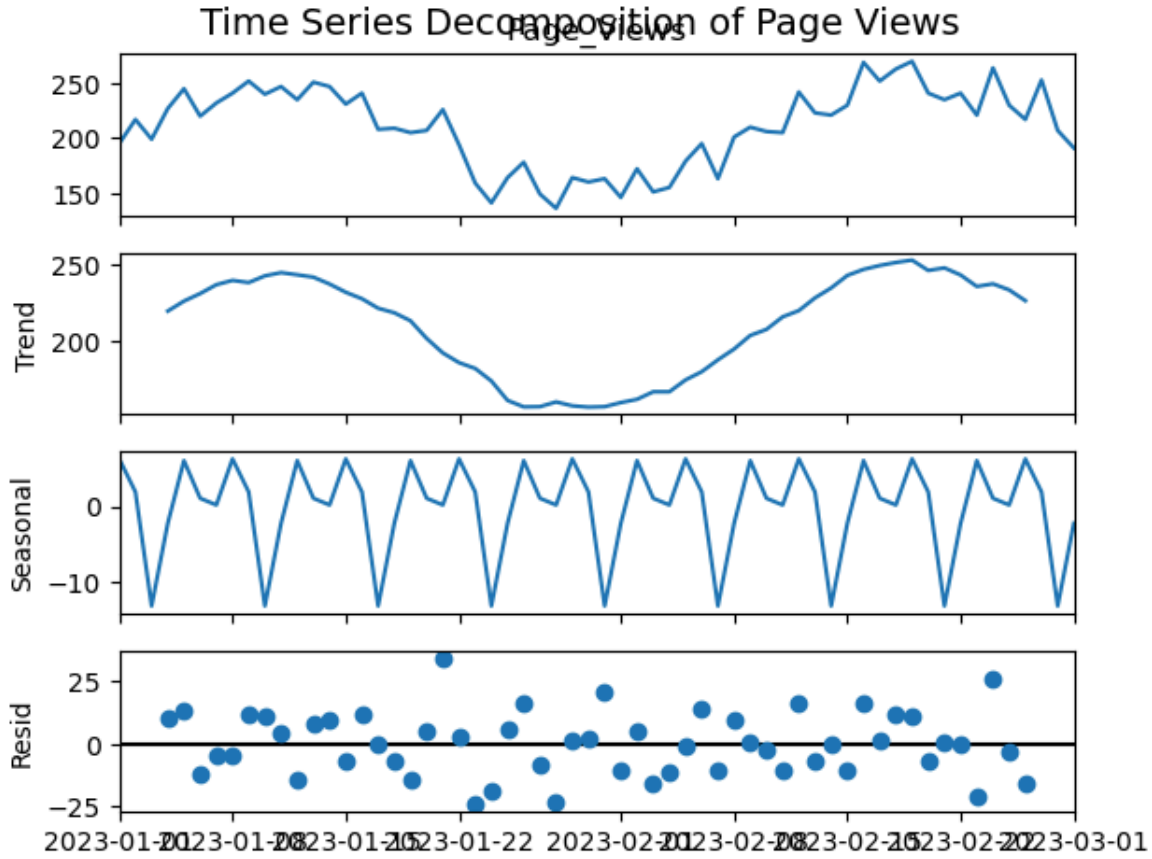
In [ ]:
```
2) Write a Python program to perform Time Series Analysis on a website traffic d
program should load and clean the dataset, decompose the time series to identify
and seasonality, visualize key metrics using moving averages and seasonal plots,
anomalies using statistical methods.
```

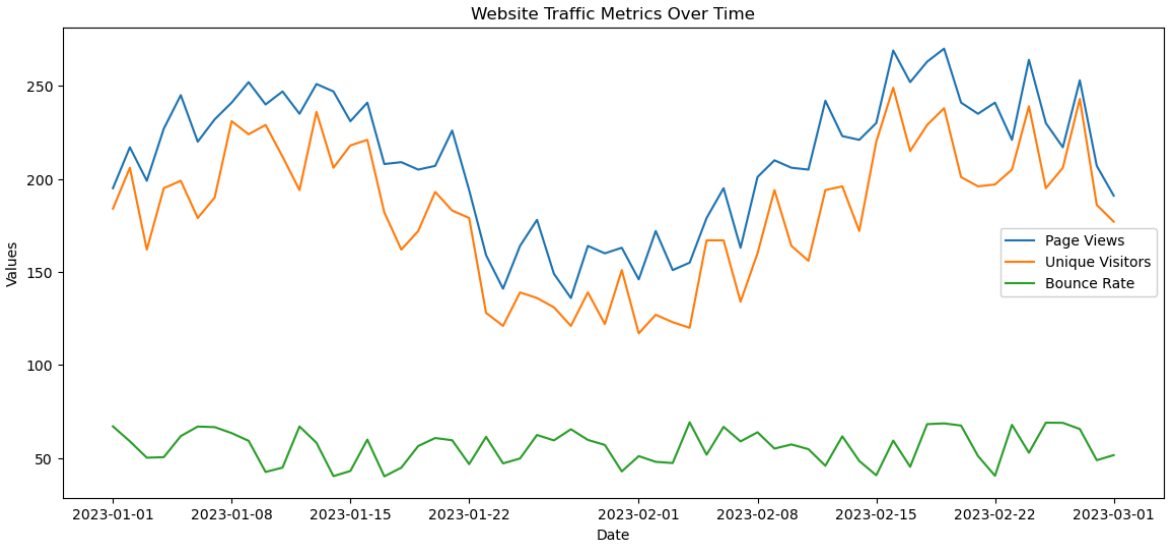
In [4]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from statsmodels.tsa.seasonal import seasonal_decompose
from scipy import stats

dates = pd.date_range(start='2023-01-01', periods=60, freq='D')
np.random.seed(42)
page_views = np.random.poisson(lam=200, size=60) + (np.sin(np.linspace(0, 3*np.p
unique_visitors = page_views - np.random.randint(10, 50, size=60)
```

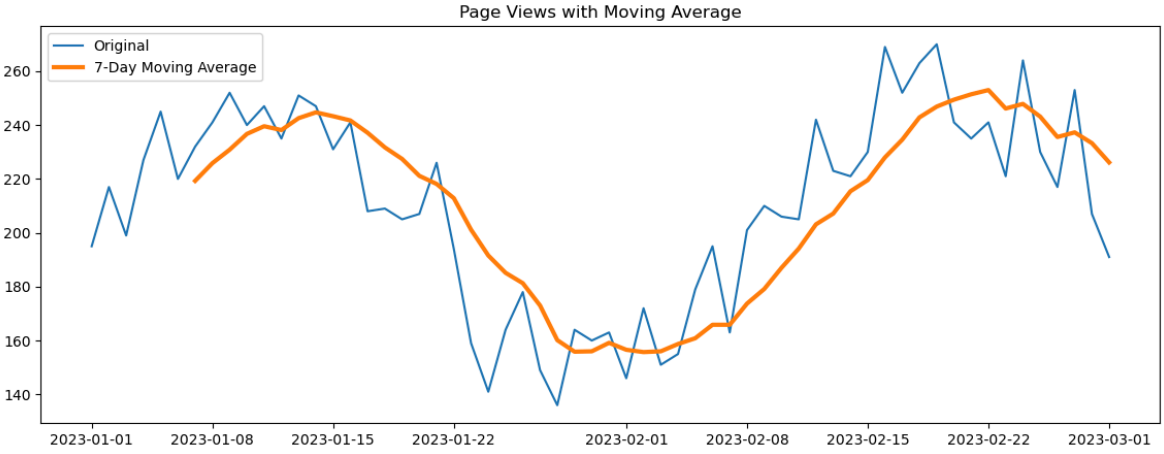
```
bounce_rate = np.random.uniform(40, 70, size=60)

data = {
    'Date': dates,
    'Page_Views': page_views,
    'Unique_Visitors': unique_visitors,
    'Bounce_Rate': bounce_rate
}

df_sample = pd.DataFrame(data)
df_sample.to_csv('website_traffic.csv', index=False)

df = pd.read_csv('website_traffic.csv', parse_dates=['Date'])
df = df.sort_values('Date')
df.set_index('Date', inplace=True)
df = df.interpolate()

decomposition = seasonal_decompose(df['Page_Views'], model='additive', period=7)

plt.figure(figsize=(12, 8))
decomposition.plot()
plt.suptitle('Time Series Decomposition of Page Views', fontsize=14)
plt.show()

plt.figure(figsize=(14, 6))
plt.plot(df.index, df['Page_Views'], label='Page Views')
plt.plot(df.index, df['Unique_Visitors'], label='Unique Visitors')
plt.plot(df.index, df['Bounce_Rate'], label='Bounce Rate')
plt.title('Website Traffic Metrics Over Time')
plt.xlabel('Date')
plt.ylabel('Values')
plt.legend()
plt.show()

df['PageViews_MA7'] = df['Page_Views'].rolling(window=7).mean()

plt.figure(figsize=(14, 5))
plt.plot(df.index, df['Page_Views'], label='Original')
plt.plot(df.index, df['PageViews_MA7'], label='7-Day Moving Average', linewidth=
plt.title('Page Views with Moving Average')
plt.legend()
plt.show()

df['DayOfWeek'] = df.index.day_name()

plt.figure(figsize=(10, 5))
sns.boxplot(x='DayOfWeek', y='Page_Views', data=df.reset_index(),
            order=['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Satu
plt.title('Seasonal Pattern by Day of Week')
plt.xticks(rotation=45)
plt.show()

df['Z_Score'] = np.abs(stats.zscore(df['Page_Views']))
anomalies = df[df['Z_Score'] > 3]

plt.figure(figsize=(14, 5))
plt.plot(df.index, df['Page_Views'], label='Page Views')
plt.scatter(anomalies.index, anomalies['Page_Views'], color='red', label='Anomal
plt.title('Anomaly Detection in Page Views')
plt.legend()
```

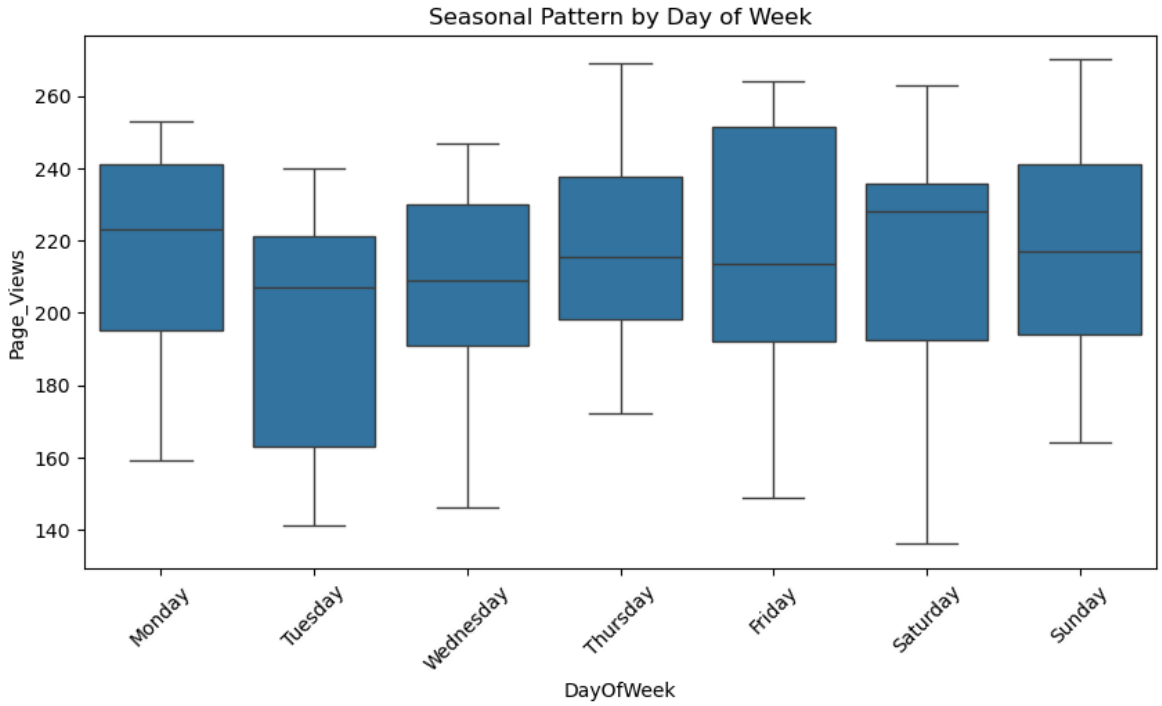
```
plt.show()

print("\nDetected Anomalies:")
print(anomalies[['Page_Views', 'Z_Score']])
```

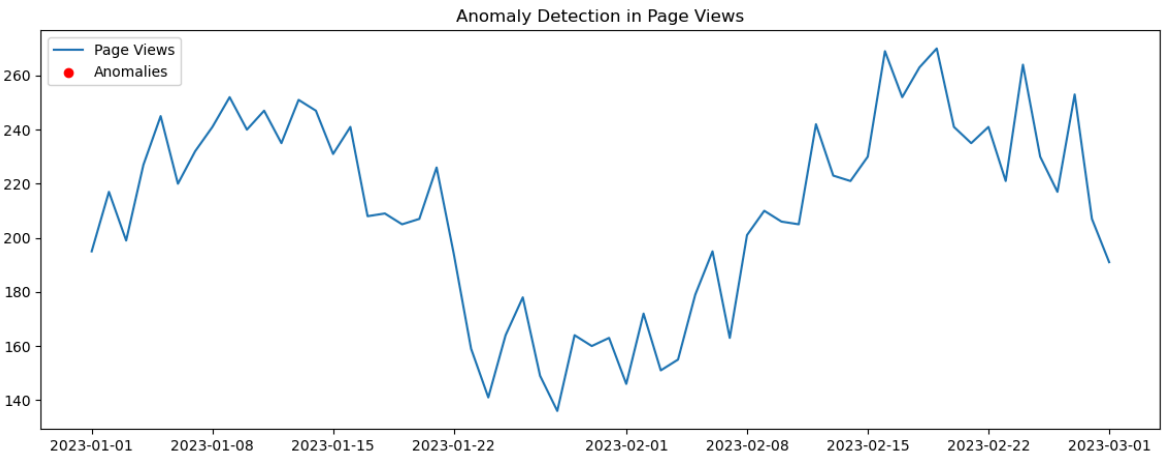
```
<Figure size 1200x800 with 0 Axes>
```









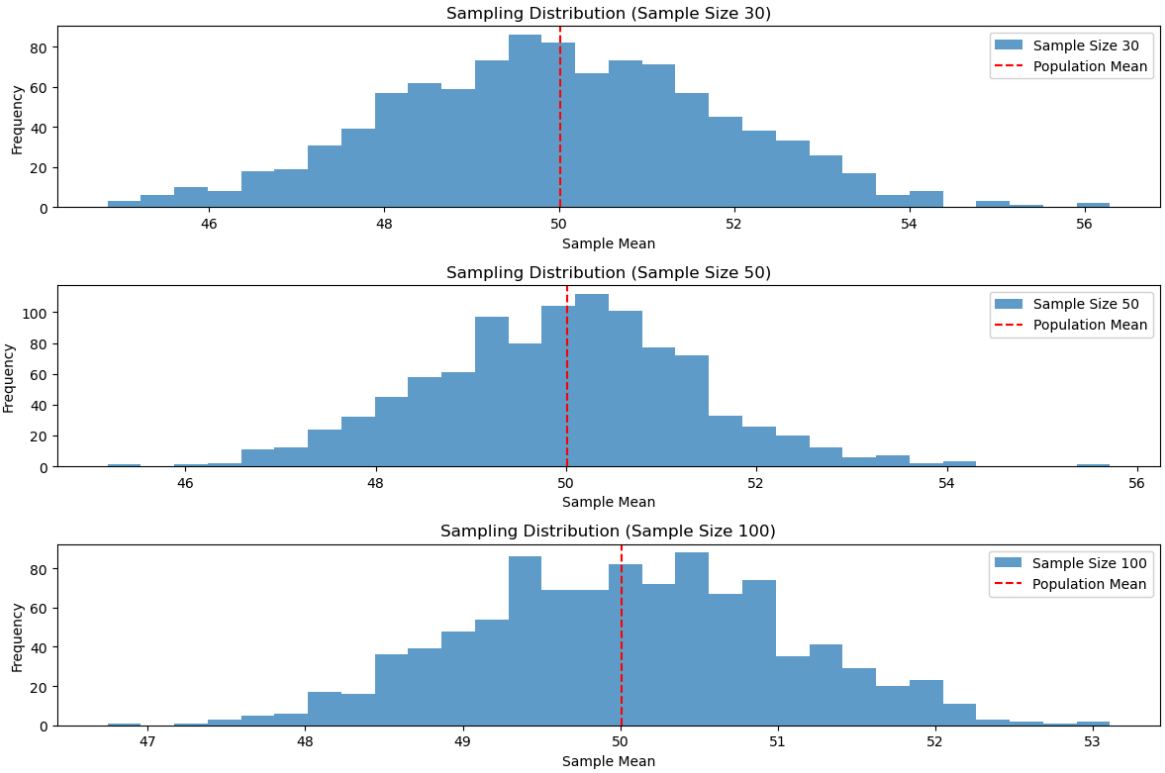



```
Detected Anomalies:
Empty DataFrame
Columns: [Page_Views, Z_Score]
Index: []
```

In [ ]:
```
3) Random Sampling and Sampling Distribution
 To explore random sampling from a population and understand the concept of samp
distribution using Python in Jupyter Notebook.
```

In [5]:
```
import numpy as np
import matplotlib.pyplot as plt
```

```
population_mean = 50
population_std = 10
population_size = 100000
population = np.random.normal(population_mean, population_std, population_size)

sample_sizes = [30, 50, 100]
num_samples = 1000
sample_means = {}

for size in sample_sizes:
    sample_means[size] = []
    for _ in range(num_samples):
        sample = np.random.choice(population, size=size, replace=False)
        sample_means[size].append(np.mean(sample))

plt.figure(figsize=(12, 8))
for i, size in enumerate(sample_sizes):
    plt.subplot(len(sample_sizes), 1, i+1)
    plt.hist(sample_means[size], bins=30, alpha=0.7, label=f'Sample Size {size}'
    plt.axvline(np.mean(population), color='red', linestyle='dashed', linewidth=
    plt.title(f'Sampling Distribution (Sample Size {size})')
    plt.xlabel('Sample Mean')
    plt.ylabel('Frequency')
    plt.legend()
plt.tight_layout()
plt.show()
```



In [ ]:
```
Lab Experiment 8: Conduct Z test for the Data Given using Python Objective:
To test whether the average weight of a species of birds differs from 150 grams.
```

In [1]:
```
import numpy as np
import scipy.stats as stats

sample_data = np.array([152,148,151,149,147,153,150,148,152,149,
                        151,150,149,152,151,148,150,152,149,150,
                        148,153,151,150,149,152,148,151,150,153])

population_mean = 150
sample_mean = np.mean(sample_data)
sample_std = np.std(sample_data, ddof=1)
n = len(sample_data)
z_statistic = (sample_mean - population_mean) / (sample_std / np.sqrt(n))
p_value = 2 * (1 - stats.norm.cdf(abs(z_statistic)))
alpha = 0.05

print(f"Sample Mean: {sample_mean:.2f}")
print(f"Z-Statistic: {z_statistic:.4f}")
print(f"P-Value: {p_value:.4f}")

if p_value < alpha:
    print("Reject the null hypothesis")
else:
    print("Fail to reject the null hypothesis")
```

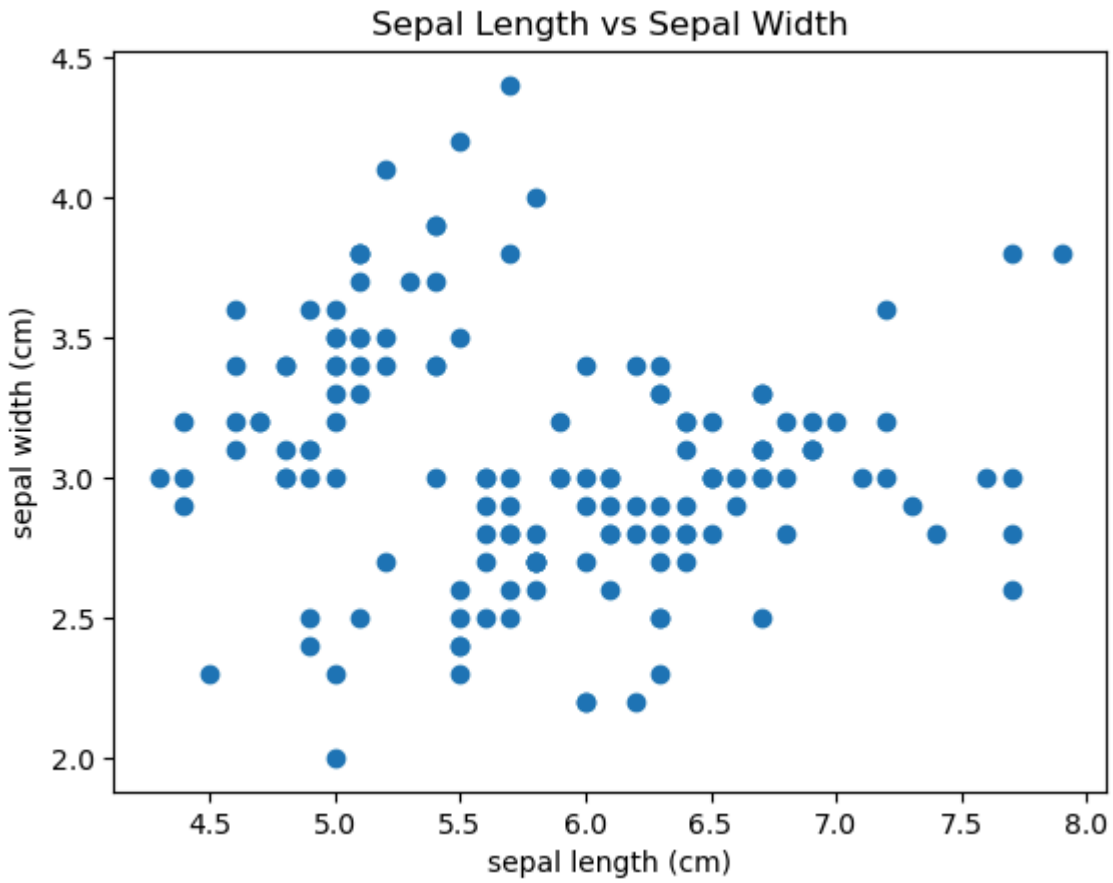
```
Sample Mean: 150.20
Z-Statistic: 0.6406
P-Value: 0.5218
Fail to reject the null hypothesis
```

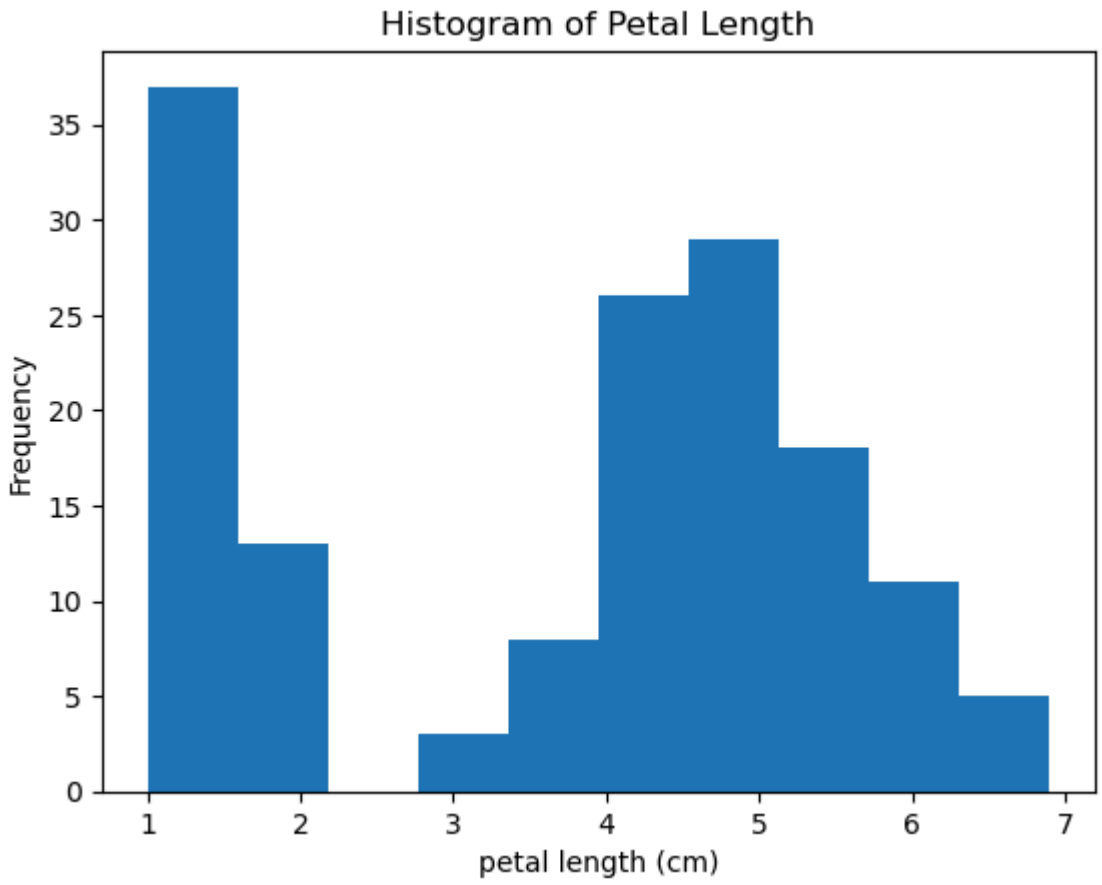
In [ ]:
```
Exp No:9 Experiment to understand Matplotlib library use cases in Data Science
through visualization

Description: Use Iris data set to understand the Matplot lib library
```

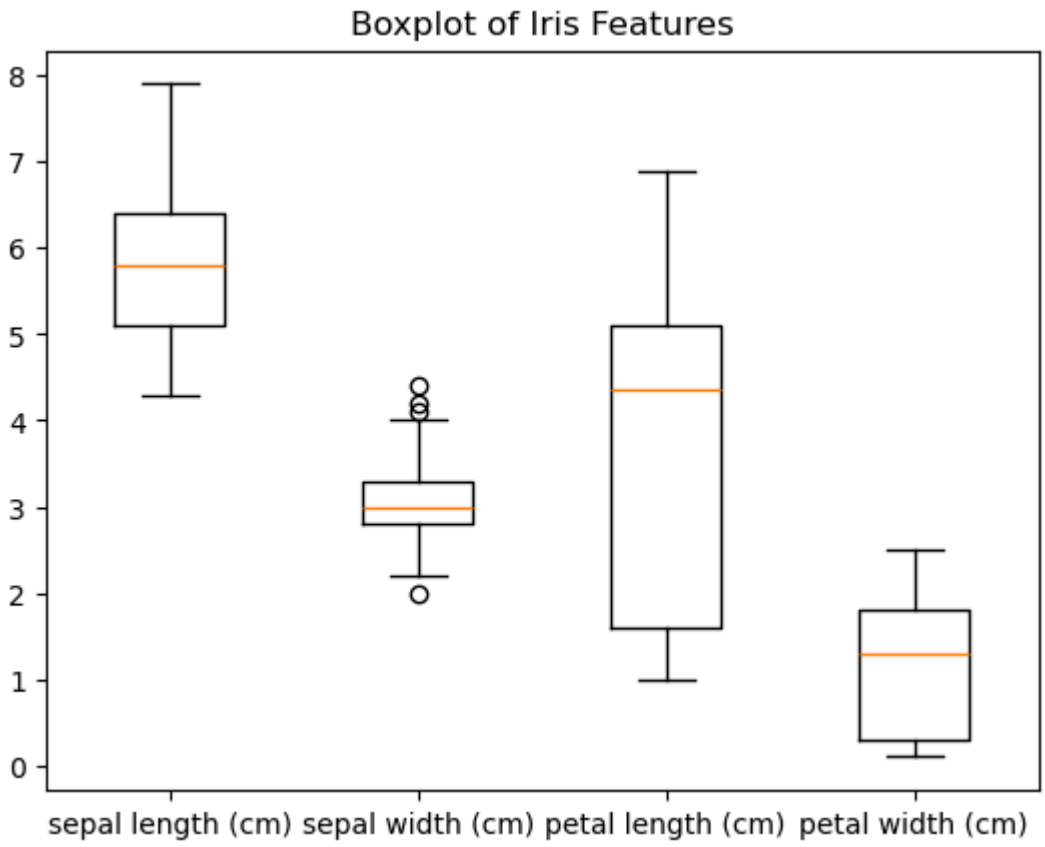
In [7]:
```
import pandas as pd
from sklearn import datasets
import matplotlib.pyplot as plt

iris = datasets.load_iris()
iris_df = pd.DataFrame(iris.data, columns=iris.feature_names)
iris_df['species'] = pd.Categorical.from_codes(iris.target, iris.target_names)

print(iris_df.head())

plt.scatter(iris_df['sepal length (cm)'], iris_df['sepal width (cm)'])
plt.title('Sepal Length vs Sepal Width')
plt.xlabel('sepal length (cm)')
plt.ylabel('sepal width (cm)')
plt.show()

plt.hist(iris_df['petal length (cm)'])
plt.title('Histogram of Petal Length')
plt.xlabel('petal length (cm)')
plt.ylabel('Frequency')
plt.show()
```

```
plt.boxplot([iris_df[col] for col in iris.feature_names], tick_labels=iris.featu
plt.title('Boxplot of Iris Features')
plt.show()
```

```
   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

  species
0  setosa
1  setosa
2  setosa
3  setosa
4  setosa
```







In [ ]:
```
Exp No:10 Experiment to understand array function in Data science.
Description: Understand array function using Numpy library
```

In [3]:
```
import numpy as np

arr = np.arange(1,13)
```

```
print("Original array:", arr)
reshaped = arr.reshape(3,4)
print("Reshaped (3x4):\n", reshaped)
print("Transpose:\n", reshaped.T)
print("Mean:", arr.mean())
print("Standard Deviation:", arr.std(ddof=1))
print("Sliced array (2:8):", arr[2:8])
concat = np.concatenate([arr, arr])
print("Concatenated length:", len(concat))
```

```
Original array: [ 1  2  3  4  5  6  7  8  9 10 11 12]
Reshaped (3x4):
 [[ 1  2  3  4]
 [ 5  6  7  8]
 [ 9 10 11 12]]
Transpose:
 [[ 1  5  9]
 [ 2  6 10]
 [ 3  7 11]
 [ 4  8 12]]
Mean: 6.5
Standard Deviation: 3.605551275463989
Sliced array (2:8): [3 4 5 6 7 8]
Concatenated length: 24
```

In [ ]:
```
Exp No:11 Experiment to understand pandas library use cases in Data science.
Description: Understand data frame use cases using pandas library
```

In [5]:
```
import pandas as pd
from sklearn import datasets

iris = datasets.load_iris()
df = pd.DataFrame(iris.data, columns=iris.feature_names)
df['species'] = pd.Categorical.from_codes(iris.target, iris.target_names)

print(df.head())
print("\nSummary Statistics:\n", df.describe())

grouped = df.groupby('species', observed=False).mean()
print("\nGroup Mean by Species:\n", grouped)

other = pd.DataFrame({'species': ['setosa','versicolor','virginica'],
                      'group_code': [1,2,3]})
merged = pd.merge(df, other, on='species', how='left')
print("\nMerged DataFrame (first 5 rows):\n", merged.head())
```

```
   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

  species
0  setosa
1  setosa
2  setosa
3  setosa
4  setosa

Summary Statistics:
        sepal length (cm)  sepal width (cm)  petal length (cm)  \
count         150.000000        150.000000         150.000000
mean            5.843333          3.057333           3.758000
std             0.828066          0.435866           1.765298
min             4.300000          2.000000           1.000000
25%             5.100000          2.800000           1.600000
50%             5.800000          3.000000           4.350000
75%             6.400000          3.300000           5.100000
max             7.900000          4.400000           6.900000

       petal width (cm)
count        150.000000
mean           1.199333
std            0.762238
min            0.100000
25%            0.300000
50%            1.300000
75%            1.800000
max            2.500000

Group Mean by Species:
             sepal length (cm)  sepal width (cm)  petal length (cm)  \
species
setosa                   5.006             3.428              1.462
versicolor               5.936             2.770              4.260
virginica                6.588             2.974              5.552

            petal width (cm)
species
setosa                0.246
versicolor            1.326
virginica             2.026

Merged DataFrame (first 5 rows):
    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

  species  group_code
0  setosa           1
1  setosa           1
2  setosa           1
```

```
3  setosa           1
4  setosa           1
```

In [ ]:
```
Exp No:12 Experiment to detect outliers in a given data set.
Description: Understand the procedure to identify the outliers in a given datase
```

In [6]:
```
import pandas as pd
import numpy as np
from sklearn import datasets
from scipy import stats

sample_data = pd.Series([152,148,151,149,147,153,150,148,152,149,
                         151,150,149,152,151,148,150,152,149,150,
                         148,153,151,150,149,152,148,151,150,153])

def iqr_outliers(series):
    q1 = series.quantile(0.25)
    q3 = series.quantile(0.75)
    iqr = q3 - q1
    lower = q1 - 1.5 * iqr
    upper = q3 + 1.5 * iqr
    return series[(series < lower) | (series > upper)]

iqr_out = iqr_outliers(sample_data)
print("IQR Outliers:", iqr_out.values)

iris = datasets.load_iris()
iris_df = pd.DataFrame(iris.data, columns=iris.feature_names)
z_scores = stats.zscore(iris_df)
outliers = {}
for i, col in enumerate(iris.feature_names):
    mask = np.abs(z_scores[:, i]) > 3
    if mask.any():
        outliers[col] = iris_df[col][mask].tolist()
print("Z-score Outliers:", outliers)
```

```
IQR Outliers: []
Z-score Outliers: {'sepal width (cm)': [4.4]}
```

In [ ]:
```
Experiment 6: Handling Missing and Inappropriate Data
```

In [1]:
```
import pandas as pd
import numpy as np

data = {
    'CustomerID':[1,2,3,4,5,6,7,8,9,9,10],
    'Age_Group':['20-25','30-35','25-30','20-25','35+','35+','35+','20-25','25-3
    'Rating(1-5)':[4,5,6,-1,3,3,4,7,2,2,5],
    'Hotel':['Ibis','LemonTree','RedFox','LemonTree','Ibis','Ibys','RedFox','Lem
    'FoodPreference':['veg','Non-Veg','Veg','Veg','Vegetarian','Non-Veg','Vegeta
    'Bill':[1300,2000,1322,1234,989,1909,1000,2999,3456,3456,-6755],
    'NoOfPax':[2,3,2,2,2,2,-1,-10,3,3,4],
    'EstimatedSalary':[40000,59000,30000,120000,45000,122220,21122,345673,-99999
    'Age_Group.1':['20-25','30-35','25-30','20-25','35+','35+','35+','20-25','25
}
df=pd.DataFrame(data)
df.to_csv("Hotel_Dataset.csv",index=False)
df=pd.read_csv("Hotel_Dataset.csv")
df=df.drop_duplicates()
df=df.drop(['Age_Group.1'],axis=1)
df.loc[df['Bill']<0,'Bill']=np.nan
df.loc[df['EstimatedSalary']<0,'EstimatedSalary']=np.nan
df.loc[(df['NoOfPax']<1)|(df['NoOfPax']>20),'NoOfPax']=np.nan
df['Hotel']=df['Hotel'].replace({'Ibys':'Ibis'})
df['FoodPreference']=df['FoodPreference'].replace({'veg':'Veg','Vegetarian':'Veg
df['EstimatedSalary']=df['EstimatedSalary'].fillna(round(df['EstimatedSalary'].m
df['NoOfPax']=df['NoOfPax'].fillna(round(df['NoOfPax'].median()))
df['Bill']=df['Bill'].fillna(round(df['Bill'].mean()))
df['Rating(1-5)']=df['Rating(1-5)'].fillna(round(df['Rating(1-5)'].median()))
print(df)
```

```
    CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference    Bill  \
0            1     20-25            4       Ibis            Veg  1300.0
1            2     30-35            5  LemonTree        Non-Veg  2000.0
2            3     25-30            6     RedFox            Veg  1322.0
3            4     20-25           -1  LemonTree            Veg  1234.0
4            5       35+            3       Ibis            Veg   989.0
5            6       35+            3       Ibis        Non-Veg  1909.0
6            7       35+            4     RedFox            Veg  1000.0
7            8     20-25            7  LemonTree            Veg  2999.0
8            9     25-30            2       Ibis        Non-Veg  3456.0
10          10     30-35            5     RedFox        Non-Veg  1801.0

    NoOfPax  EstimatedSalary
0       2.0         40000.0
1       3.0         59000.0
2       2.0         30000.0
3       2.0        120000.0
4       2.0         45000.0
5       2.0        122220.0
6       2.0         21122.0
7       2.0        345673.0
8       3.0         96755.0
10      4.0         87777.0
```

In [ ]:
```
Experiment 14: Feature Scaling
```

In [2]:
```
import pandas as pd
from sklearn.preprocessing import MinMaxScaler,StandardScaler

data={'Age':[20,25,30,35,40],'Salary':[20000,30000,40000,50000,60000]}
df=pd.DataFrame(data)
scaler=MinMaxScaler()
df['Normalized_Salary']=scaler.fit_transform(df[['Salary']])
std_scaler=StandardScaler()
df['Standardized_Salary']=std_scaler.fit_transform(df[['Salary']])
print(df)
```

```
   Age  Salary  Normalized_Salary  Standardized_Salary
0   20   20000               0.00            -1.414214
1   25   30000               0.25            -0.707107
2   30   40000               0.50             0.000000
3   35   50000               0.75             0.707107
4   40   60000               1.00             1.414214
```

In [ ]:
```
Experiment 15: Data Preprocessing in Data Science
```

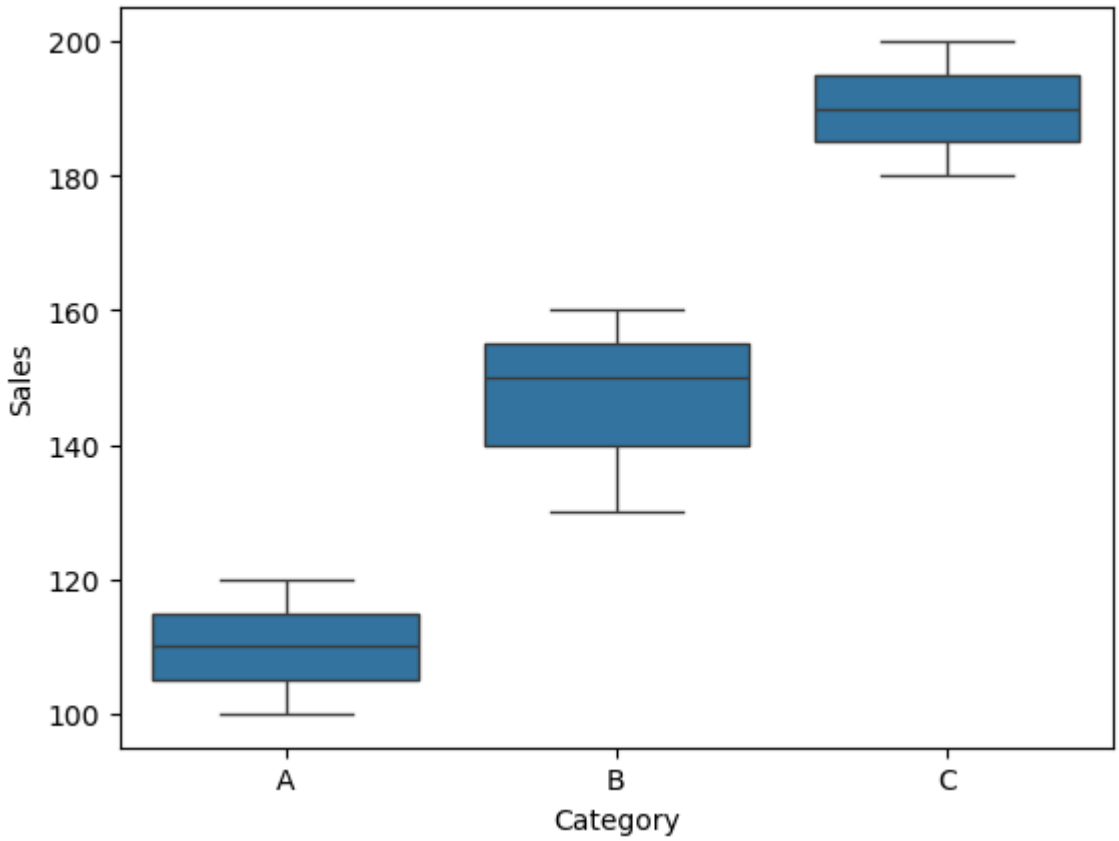
In [3]:
```
import pandas as pd
from sklearn.preprocessing import LabelEncoder

data={'Name':['A','B','C','D','E'],'Gender':['Male','Female','Male','Female','Fe
df=pd.DataFrame(data)
df.to_csv("data.csv",index=False)
df=pd.read_csv("data.csv")
df.fillna(df.mean(numeric_only=True),inplace=True)
encoder=LabelEncoder()
df['Gender']=encoder.fit_transform(df['Gender'])
print(df)
```

```
  Name  Gender  Age  Salary
0    A       1   22   35000
1    B       0   25   40000
2    C       1   28   50000
3    D       0   26   42000
4    E       0   23   38000
```

In [ ]:
```
Experiment 16: EDA – Quantitative and Qualitative Analysis
```

In [4]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

data={'Category':['A','B','A','C','B','C','A','B'],'Sales':[100,150,120,200,130,
df=pd.DataFrame(data)
df.to_csv("dataset.csv",index=False)
df=pd.read_csv("dataset.csv")
print(df.describe())
print(df['Category'].value_counts())
sns.boxplot(data=df,x='Category',y='Sales')
plt.show()
```

```
            Sales
count    8.000000
mean   143.750000
std     35.025501
min    100.000000
25%    117.500000
50%    140.000000
75%    165.000000
max    200.000000
Category
A    3
B    3
C    2
Name: count, dtype: int64
```



In [ ]:
```
Experiment 17: Linear Regression
```

In [5]:
```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression

data={'YearsExperience':[1.1,1.5,2.0,2.2,2.9,3.0,3.2,3.7,3.9,4.0,4.5,4.9,5.1,5.3
      'Salary':[39343,46205,37731,43525,39891,56642,60150,54445,63218,55794,5695
df=pd.DataFrame(data)
df.to_csv("Salary_Data.csv",index=False)
df=pd.read_csv("Salary_Data.csv")
X=df[['YearsExperience']]
y=df['Salary']
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=0)
model=LinearRegression()
model.fit(X_train,y_train)
y_pred=model.predict(X_test)
print(y_pred)
```

```
[90474.58768564 36770.69366503 92991.95771786 56909.65392276]
```

In [ ]:
```
Experiment 18: K-Nearest Neighbors (KNN) Algorithm
```

In [6]:
```
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import accuracy_score

iris=load_iris()
X,y=iris.data,iris.target
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2)
knn=KNeighborsClassifier(n_neighbors=3)
knn.fit(X_train,y_train)
y_pred=knn.predict(X_test)
print("Accuracy:",accuracy_score(y_test,y_pred))
```

```
Accuracy: 0.9333333333333333
```

In [ ]:
```
Experiment 19: Logistic Regression
```

In [7]:
```
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score

iris=load_iris()
X,y=iris.data,(iris.target!=0)*1
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2)
model=LogisticRegression()
model.fit(X_train,y_train)
y_pred=model.predict(X_test)
print("Accuracy:",accuracy_score(y_test,y_pred))
```

```
Accuracy: 1.0
```

In [ ]:
```
Experiment 20: K-Means Clustering
```

In [9]:
```
import os
os.environ["OMP_NUM_THREADS"] = "1"

from sklearn.cluster import KMeans
from sklearn.datasets import load_iris
import pandas as pd

iris = load_iris()
X = iris.data
kmeans = KMeans(n_clusters=3, random_state=42)
kmeans.fit(X)
print("Cluster Centers:\n", kmeans.cluster_centers_)
print("Labels:\n", kmeans.labels_)
```

```
Cluster Centers:
 [[6.85384615 3.07692308 5.71538462 2.05384615]
 [5.006      3.428      1.462      0.246     ]
 [5.88360656 2.74098361 4.38852459 1.43442623]]
Labels:
 [1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 1 1 1 1 1 1 1 1 1 1 1 1 1 0 2 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
 2 2 2 0 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 2 0 0 0 0 2 0 0 0 0
 0 0 2 2 0 0 0 0 2 0 2 0 2 0 0 2 2 0 0 0 0 0 2 0 0 0 0 2 0 0 0 2 0 0 0 2 0
 0 2]
```

```
C:\Users\RISHASRI\anaconda3\Lib\site-packages\sklearn\cluster\_kmeans.py:1419: UserWarning: KMeans is known to have a memory leak on Windows with MKL, when there are less chunks than available threads. You can avoid it by setting the environment variable OMP_NUM_THREADS=1.
  warnings.warn(
```