Shri Ramdeobaba College of Engineering & Management, Nagpur.

RCOEM
Shri Ramdeobaba College of
Engineering and Management, Nagpur

TOOLS FOR DATA SCIENCE.

IV SEMESTER 2023-24

TA-01

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1. **Data Analysis with Pandas and Matplotlib:**

   - **Objective:** Perform data analysis on a given dataset using Pandas and visualize the results using Matplotlib.
   - **Requirements:**
     Choose a dataset (e.g., CSV, Excel, or any other format) related to a topic of interest (e.g., finance, sports, health).
     Use Pandas to load and clean the data.
     Perform basic statistical analysis (mean, median, standard deviation).
     Create meaningful visualizations using Matplotlib (e.g., bar chart, line plot, scatter plot).
     Provide insights or conclusions based on the analysis.

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

```
In [9]: #Load the dataset
        ds=pd.read_csv('state - state.csv')
```

```
In [10]: #Display Structure of the data
         print(ds.head())
```

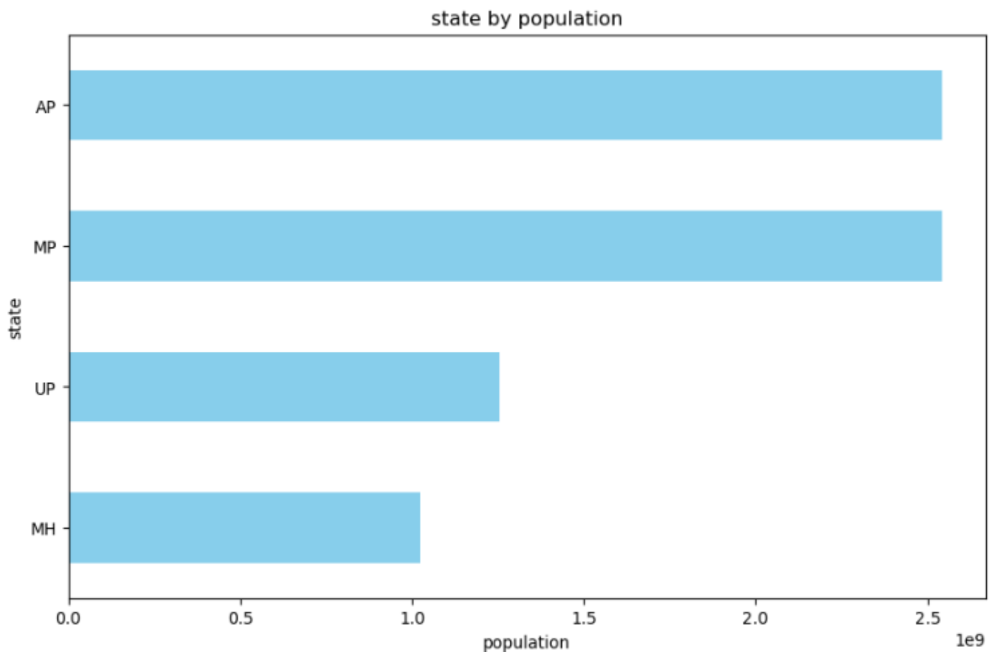
```
  state  population  murder rate
0    MH  1025479666          0.5
1    MP  2541676563          0.4
2    UP  1254789654          0.8
3    AP  2541676783          0.3
```

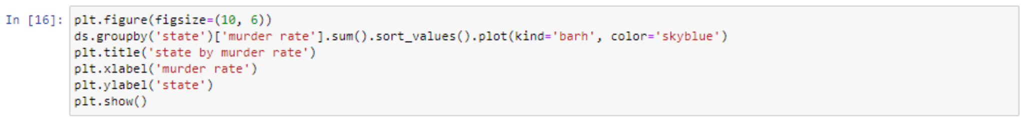
```
In [11]: mean_population = ds['population'].mean()
         median_murderrate = ds['murder rate'].median()
         std_deviation = ds['population'].std()
```

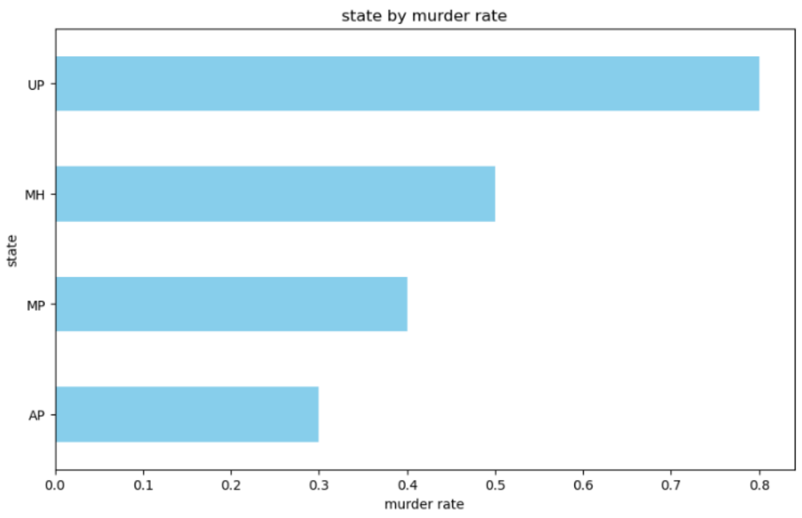
```
In [12]: print(mean_population)
         print(median_murderrate)
         print(std_deviation)
```

```
1840905666.5
0.45
814577917.1862354
```

```
In [15]: # Bar chart
         plt.figure(figsize=(10, 6))
         ds.groupby('state')['population'].sum().sort_values().plot(kind='barh', color='skyblue')
         plt.title('state by population')
         plt.xlabel('population')
         plt.ylabel('state')
         plt.show()
```

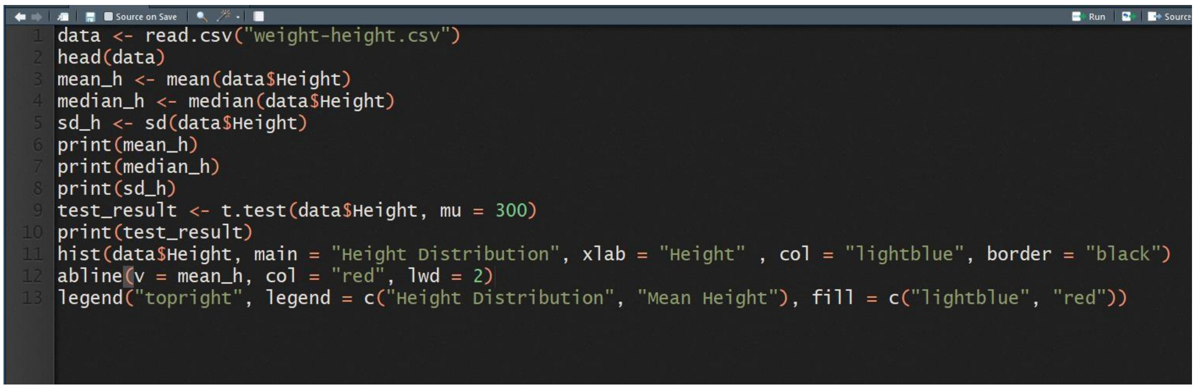



```
In [16]: plt.figure(figsize=(10, 6))
         ds.groupby('state')['murder rate'].sum().sort_values().plot(kind='barh', color='skyblue')
         plt.title('state by murder rate')
         plt.xlabel('murder rate')
         plt.ylabel('state')
         plt.show()
```

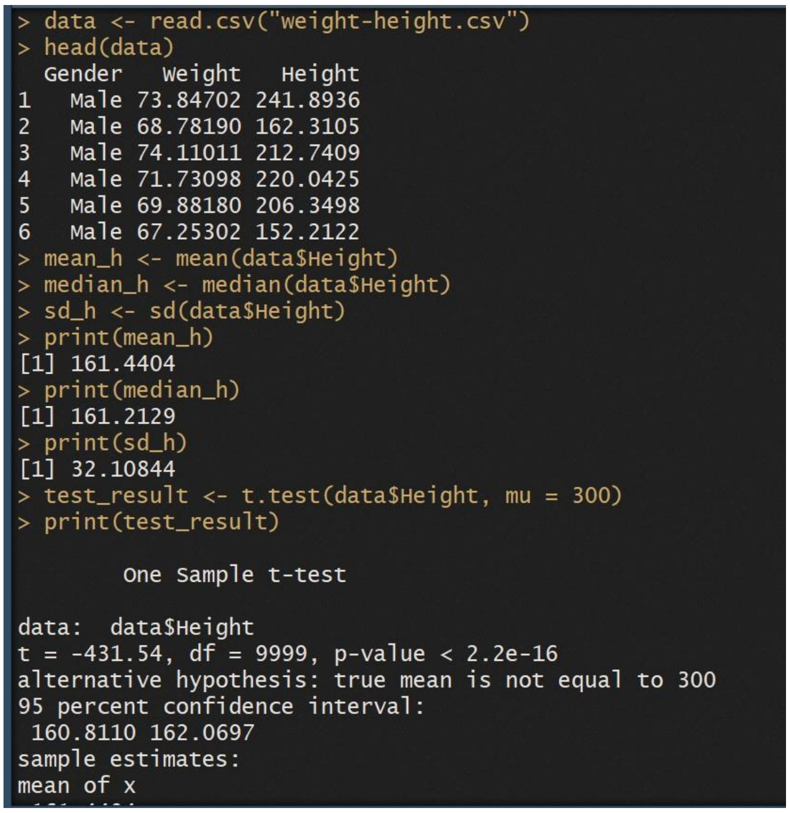


- **Conclusions:**
  - Based on the bar charts, it seems that AP has the highest total population and UP has the highest murder rate.

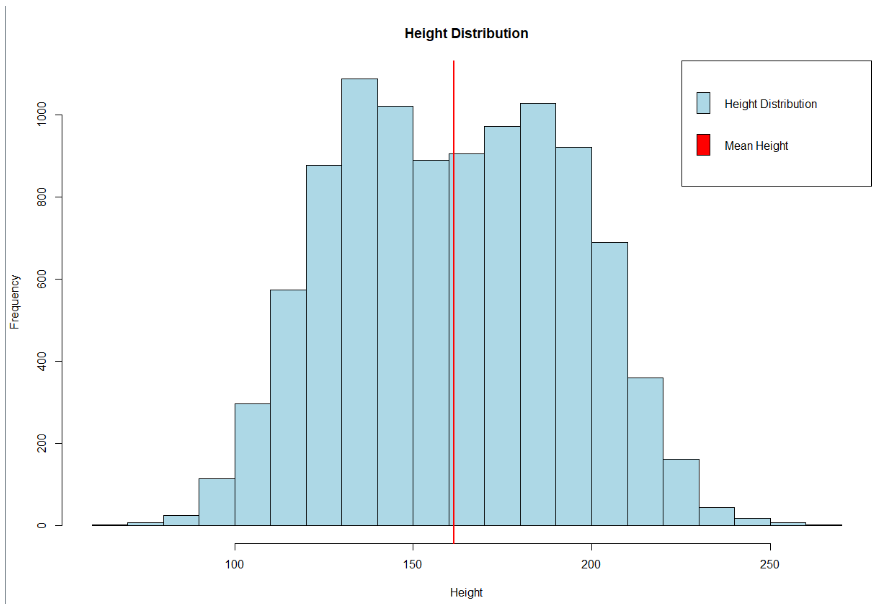
2. **Statistical Analysis with R:**
   - **Objective**: Perform statistical analysis on a dataset using R's built-in statistical functions.
   - **Requirements:**
     Choose a dataset suitable for statistical analysis (e.g., survey data, experiment results).
     Calculate descriptive statistics (mean, median, standard deviation) for relevant variables.
     Conduct hypothesis testing or create confidence intervals for specific hypotheses.
     Visualize the results using appropriate plots (e.g., histograms, violin plots).
     Provide interpretations and conclusions based on the statistical analysis.



```r
data <- read.csv("weight-height.csv")
head(data)
mean_h <- mean(data$Height)
median_h <- median(data$Height)
sd_h <- sd(data$Height)
print(mean_h)
print(median_h)
print(sd_h)
test_result <- t.test(data$Height, mu = 300)
print(test_result)
hist(data$Height, main = "Height Distribution", xlab = "Height" , col = "lightblue", border = "black")
abline(v = mean_h, col = "red", lwd = 2)
legend("topright", legend = c("Height Distribution", "Mean Height"), fill = c("lightblue", "red"))
```



```
> data <- read.csv("weight-height.csv")
> head(data)
  Gender   Weight   Height
1   Male 73.84702 241.8936
2   Male 68.78190 162.3105
3   Male 74.11011 212.7409
4   Male 71.73098 220.0425
5   Male 69.88180 206.3498
6   Male 67.25302 152.2122
> mean_h <- mean(data$Height)
> median_h <- median(data$Height)
> sd_h <- sd(data$Height)
> print(mean_h)
[1] 161.4404
> print(median_h)
[1] 161.2129
> print(sd_h)
[1] 32.10844
> test_result <- t.test(data$Height, mu = 300)
> print(test_result)

	One Sample t-test

data:  data$Height
t = -431.54, df = 9999, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 300
95 percent confidence interval:
 160.8110 162.0697
sample estimates:
mean of x
```



- **Conclusion:**
  - The mean height of the individuals in the dataset is 161.4404 cm.
  - The median height is 161.2126 cm, indicating the central tendency.
  - The standard deviation of height is 32.108 cm, reflecting the spread of the data.

3. **Title: Data Analysis with Pandas and NumPy.**
   - **Problem Statement:**
     You are given a dataset containing information about a fictional company's employees. The dataset (employee_data.csv) has the following columns:
     Employee_ID: Unique identifier for each employee.
     First_Name: First name of the employee.
     Last_Name: Last name of the employee.
     Department: Department in which the employee works.
     Salary: Salary of the employee.
     Joining_Date: Date when the employee joined the company.

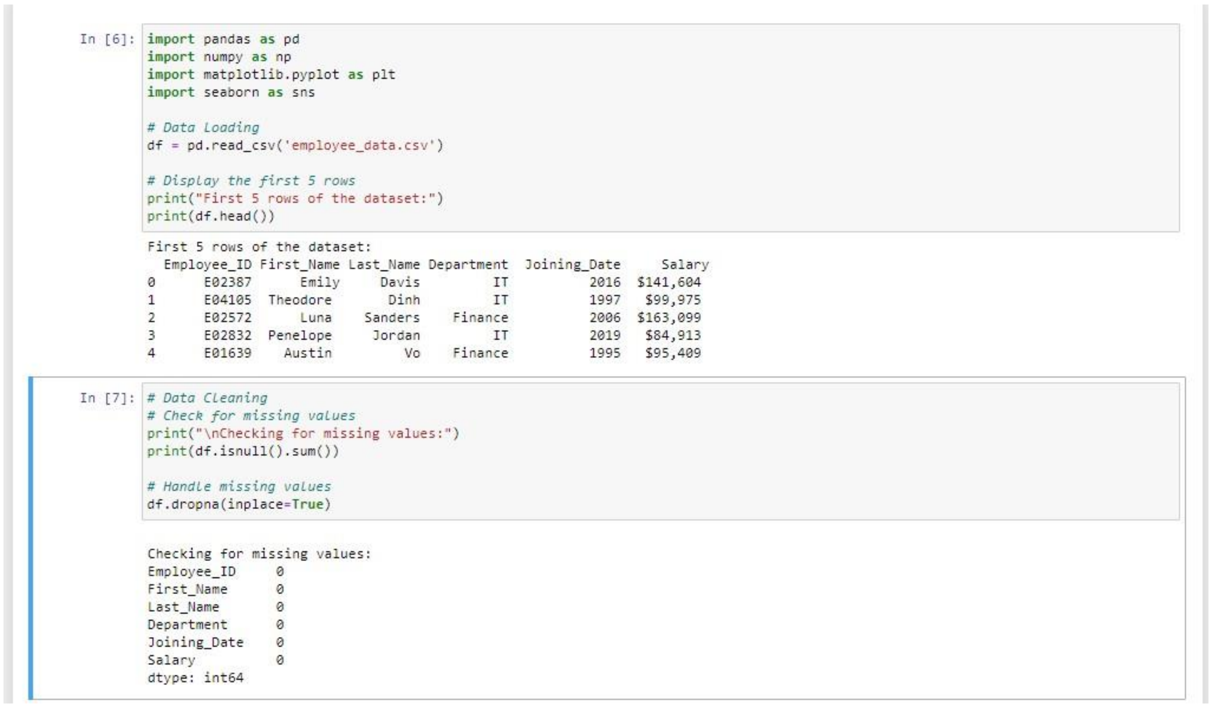
- **Tasks:**
  - **Data Loading:**
    Load the dataset (employee_data.csv) into a Pandas DataFrame.
    Display the first 5 rows to get an overview of the data.

  - **Data Cleaning:**
    Check for and handle any missing values in the dataset.
    Convert the Joining_Date column to a datetime format.

  - **Data Exploration:**
    Calculate and display the average salary of employees in each department.
    Identify the employee with the highest salary and display their information.

  - **Time-based Analysis:**
    Create a new column Years_Worked representing the number of years each employee has worked in the company.
    Calculate the average salary for employees based on the number of years they have worked (grouped by years).

  - **Data Visualization:**
    Use Matplotlib or Seaborn to create a bar chart showing the average salary for each department.
    Create a histogram of the distribution of employee salaries.

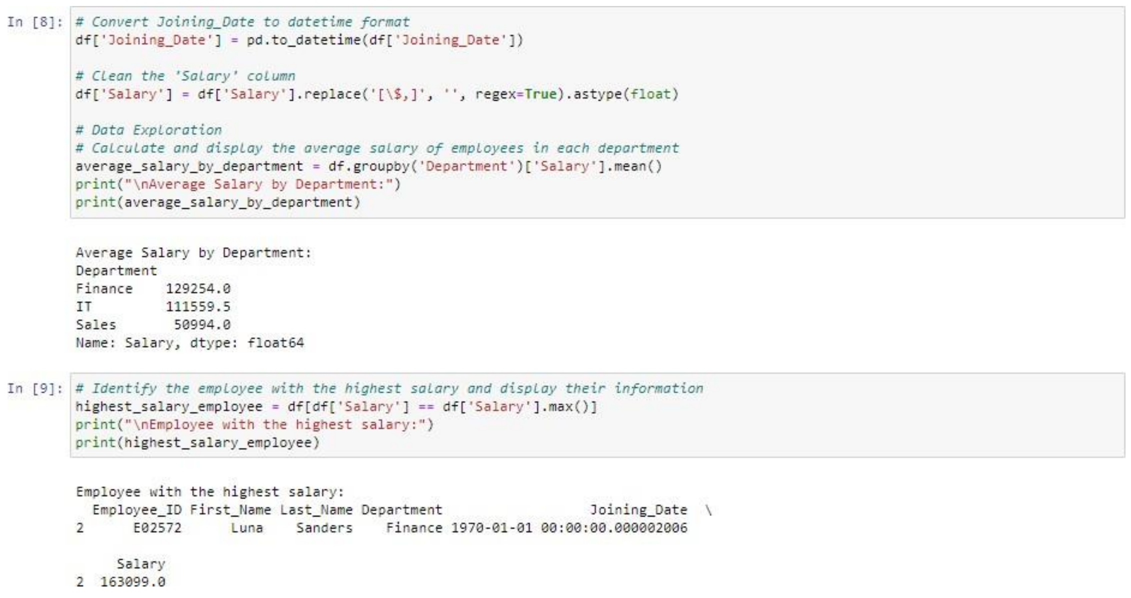


```
In [6]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        import seaborn as sns

        # Data Loading
        df = pd.read_csv('employee_data.csv')

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

```
First 5 rows of the dataset:
  Employee_ID First_Name Last_Name Department  Joining_Date     Salary
0      E02387      Emily     Davis         IT          2016  $141,604
1      E04105   Theodore      Dinh         IT          1997   $99,975
2      E02572       Luna   Sanders    Finance          2006  $163,099
3      E02832   Penelope    Jordan         IT          2019   $84,913
4      E01639     Austin        Vo    Finance          1995   $95,409
```

```
In [7]: # Data Cleaning
        # Check for missing values
        print("\nChecking for missing values:")
        print(df.isnull().sum())

        # Handle missing values
        df.dropna(inplace=True)
```

```

Checking for missing values:
Employee_ID     0
First_Name      0
Last_Name       0
Department      0
Joining_Date    0
Salary          0
dtype: int64
```



```
In [8]: # Convert Joining_Date to datetime format
        df['Joining_Date'] = pd.to_datetime(df['Joining_Date'])

        # Clean the 'Salary' column
        df['Salary'] = df['Salary'].replace('[\$,]', '', regex=True).astype(float)

        # Data Exploration
        # Calculate and display the average salary of employees in each department
        average_salary_by_department = df.groupby('Department')['Salary'].mean()
        print("\nAverage Salary by Department:")
        print(average_salary_by_department)
```

```

Average Salary by Department:
Department
Finance    129254.0
IT         111559.5
Sales       50994.0
Name: Salary, dtype: float64
```

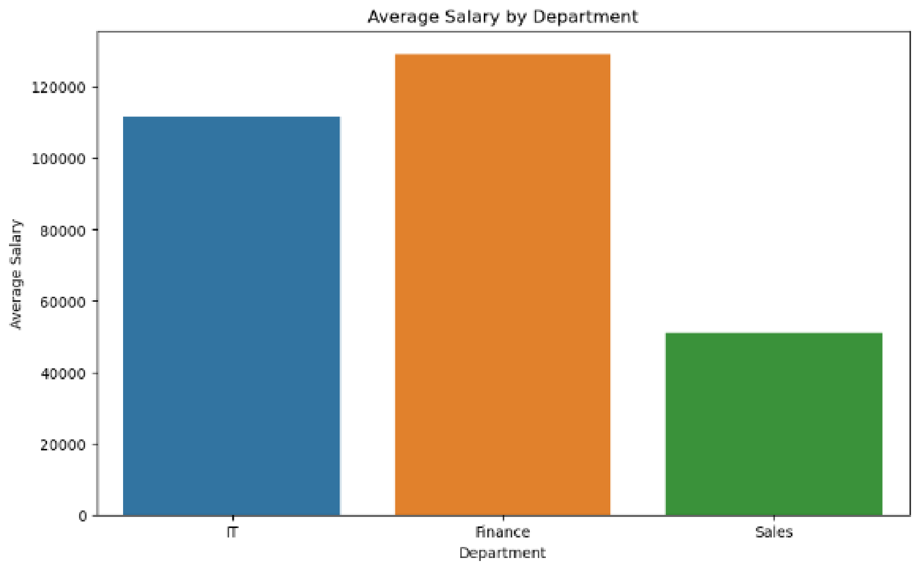
```
In [9]: # Identify the employee with the highest salary and display their information
        highest_salary_employee = df[df['Salary'] == df['Salary'].max()]
        print("\nEmployee with the highest salary:")
        print(highest_salary_employee)
```

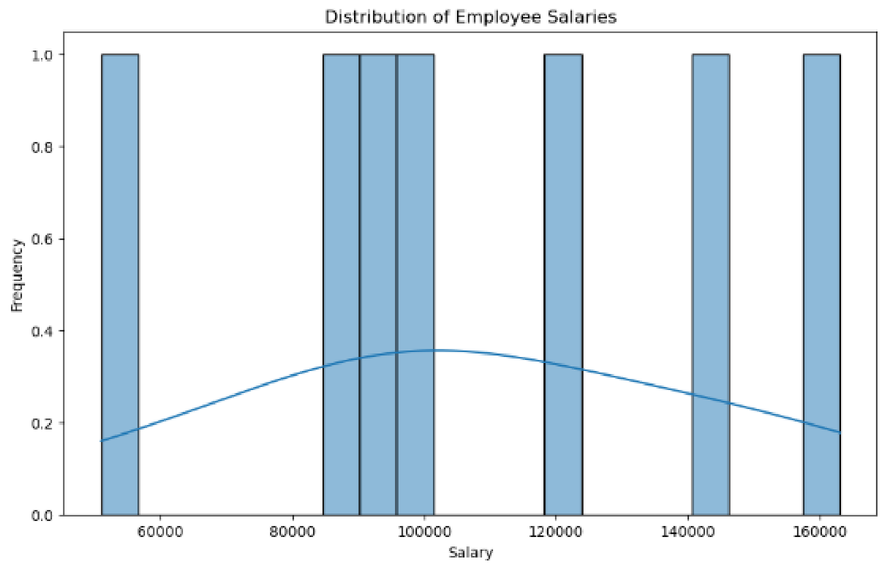
```

Employee with the highest salary:
  Employee_ID First_Name Last_Name Department                  Joining_Date  \
2      E02572       Luna   Sanders    Finance 1970-01-01 00:00:00.000002006

     Salary
2  163099.0
```

```
In [10]: # Time-based Analysis
         # Create a new column Years_Worked
         current_year = pd.to_datetime('now').year
         df['Years_Worked'] = current_year - df['Joining_Date'].dt.year

         # Calculate average salary based on the number of years worked
         average_salary_by_years = df.groupby('Years_Worked')['Salary'].mean()
         print("\nAverage Salary by Years Worked:")
         print(average_salary_by_years)
```

```
Average Salary by Years Worked:
Years_Worked
54    107962.857143
Name: Salary, dtype: float64
```

```
In [11]: # Data Visualization
         # Bar chart showing average salary for each department
         plt.figure(figsize=(10, 6))
         sns.barplot(x='Department', y='Salary', data=df, ci=None)
         plt.title('Average Salary by Department')
         plt.xlabel('Department')
         plt.ylabel('Average Salary')
         plt.show()

         # Histogram of the distribution of employee salaries
         plt.figure(figsize=(10, 6))
         sns.histplot(df['Salary'], bins=20, kde=True)
         plt.title('Distribution of Employee Salaries')
         plt.xlabel('Salary')
         plt.ylabel('Frequency')
         plt.show()
```


Average Salary by Department
Average Salary
IT
Finance
Sales
Department


Distribution of Employee Salaries
Frequency
Salary