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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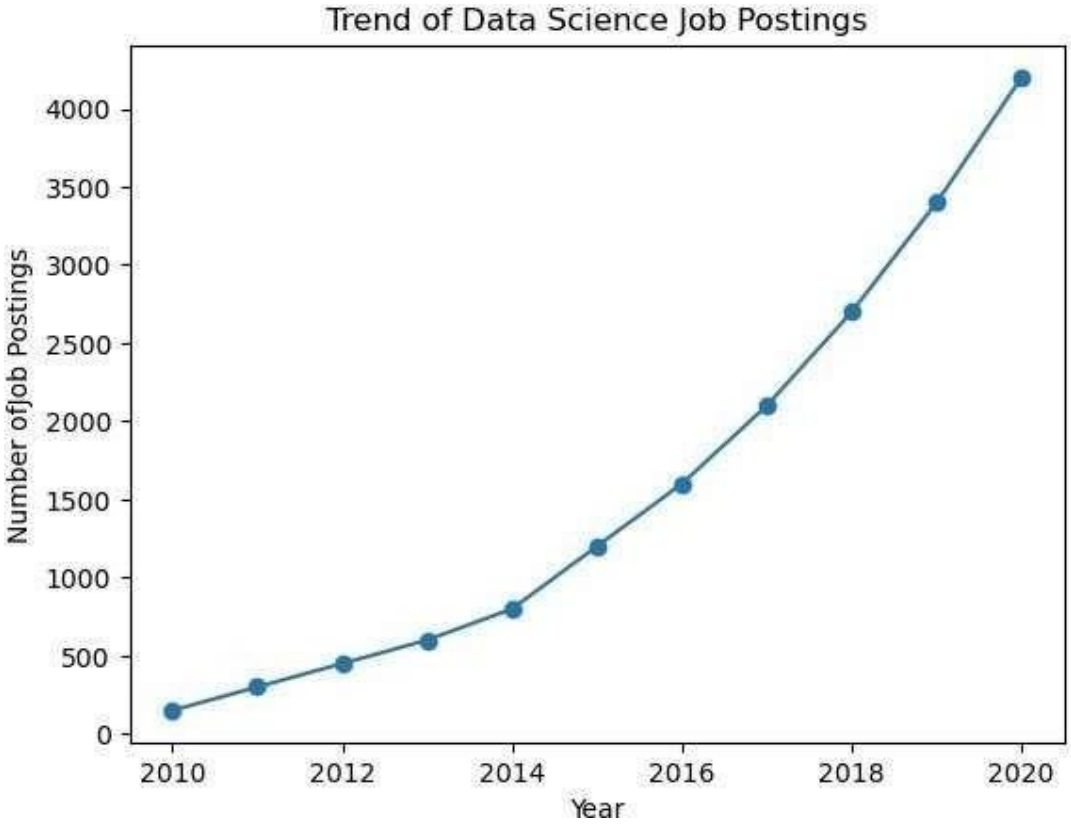
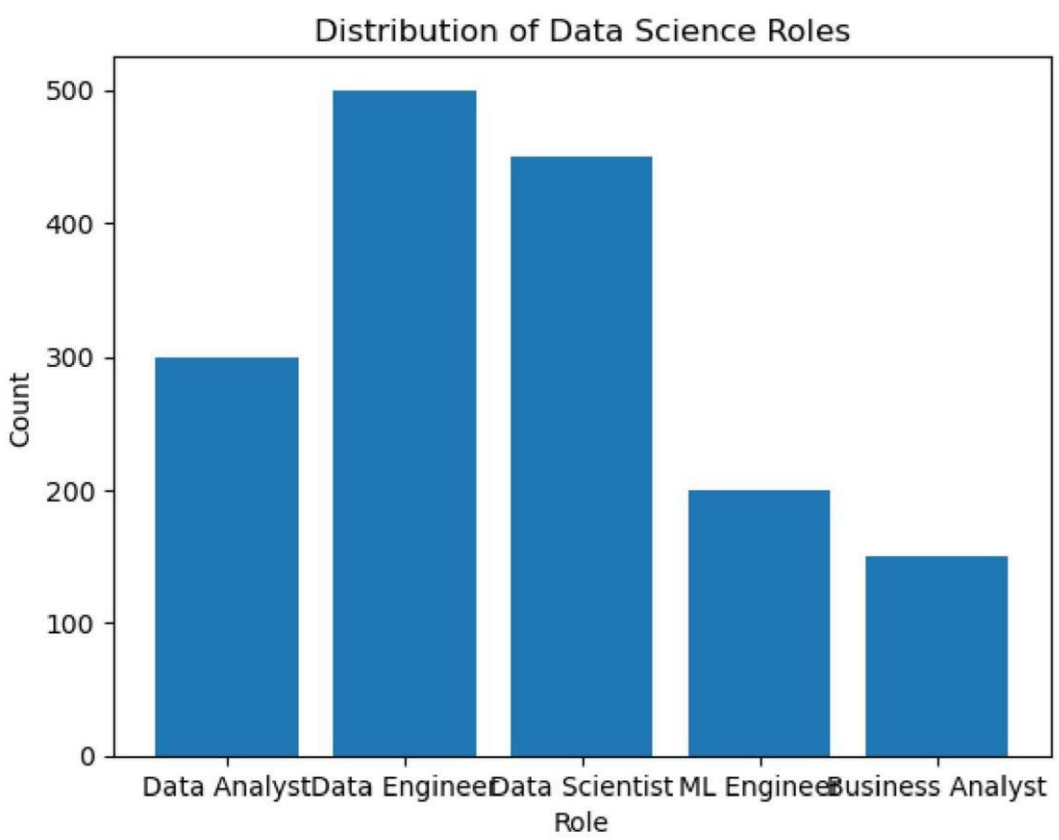
Exercise 1: A]

```
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 ofJob Postings') plt.show()
```



B]

```
roles = ['Data Analyst', 'Data Engineer', 'Data Scientist', 'ML
Engineer',
'Business Analyst'] counts = [300, 500, 450, 200,
150] plt.bar(roles, counts)
plt.title('Distribution of Data Science Roles') plt.xlabel('Role')
plt.ylabel('Count') plt.show()
```




```
structured_data = pd.DataFrame({
'ID': [1, 2, 3],
'Name': ['Alice', 'Bob', 'Charlie'],
'Age': [25, 30, 35]
})
print("Structured Data:\n", structured_data)
unstructured_data ="This is an example of unstructured data. It can be
a piece of text, an image,or a video file."
print("\nUnstructured Data:\n", unstructured_data)
semi_structured_data = {'ID': 1, 'Name': 'Alice', 'Attributes':
{'Height': 165, 'Weight': 68}}
print("\nSemi-structured Data:\n", semi_structured_data)
```

```
Structured Data:
    ID     Name  Age
0   1    Alice   25
1   2      Bob   30
2   3  Charlie   35

Unstructured Data:
 This is an example of unstructured data. It can be a piece of text,
an image,or a video file.
```

```
emi-structured Data:        {'ID': 1, 'Name': 'Alice', 'Attributes':
'Height': 165, 'Weight':
```

{8}}

]

```
rom cryptography.fernet import Fernet key =
 ernet.generate_key() f = Fernet(key)
oken = f.encrypt(b"Rajalakshmi Engineering College") token b'...'
 decrypt(token) b'Rajalakshmi Engineering College' key =
 ernet.generate_key() cipher_suite = Fernet(key) plain_text =
 "Rajalakshmi Engineering College." cipher_text =
 ipher_suite.encrypt(plain_text) decrypted_text =
 ipher_suite.decrypt(cipher_text) print("Original Data:", plain_text)
 rint("Encrypted Data:", cipher_text) print("Decrypted Data:",
 ecrypted_text)
```

```
 riginal Data: b'Rajalakshmi Engineering College.'
 ncrypted Data: b'gAAAAABolBkq8QPVjqIo662CR3sV8YryaRBeq-6ysuG-
 yeHltJZePo_537_IUtW3ALng5dvaGzFo5uW23q- hDEwDOVwlrwzrGBiOC_CleO6dyfujpyEn-
 QnKRvI0mwCCiVnEghUdgV' Decrypted Data: b'Rajalakshmi Engineering College.'
```

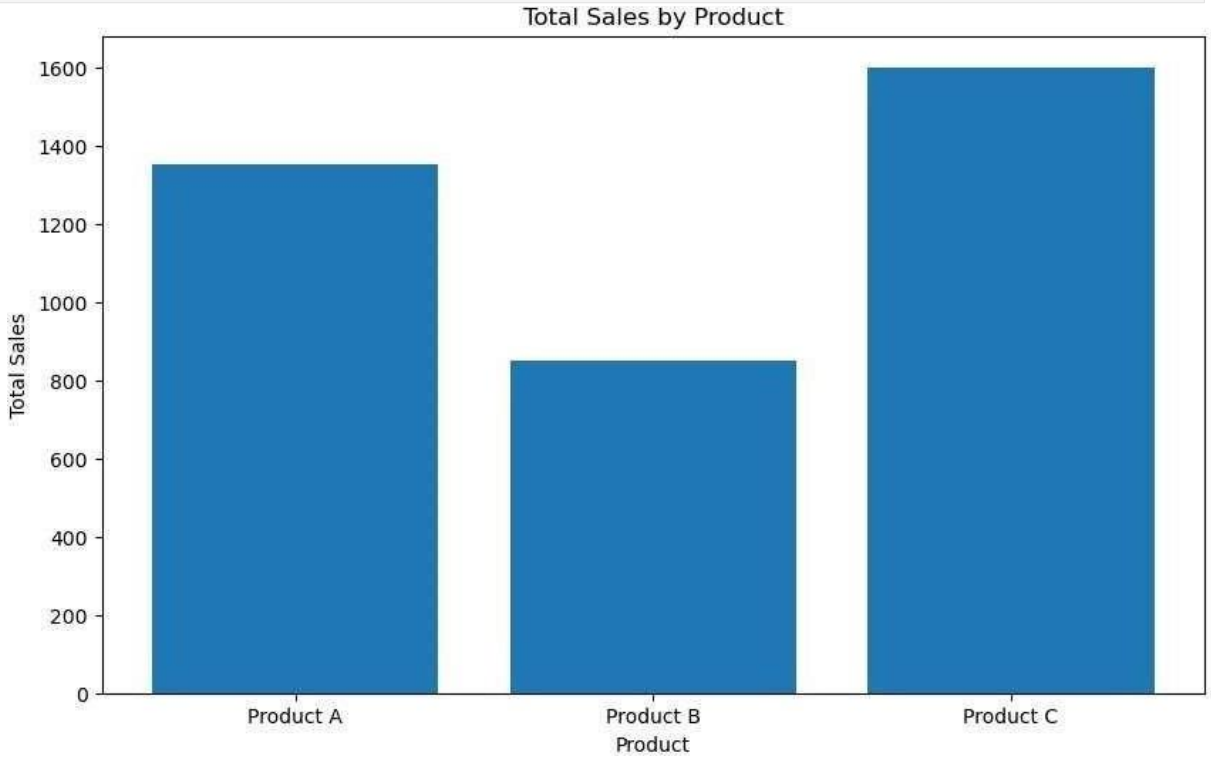
xercise 2

```
import pandas as pd import numpy as np import
matplotlib.pyplot as plt df =
pd.read_csv('E:/sales_data.csv') print(df.head())
print(df.isnull().sum())
df['Sales'].fillna(df['Sales'].mean(), inplace=True)
df.dropna(subset=['Product', 'Quantity', 'Region'], inplace=True) print(df.describe())
product_summary = df.groupby('Product').agg({
    'Sales': 'sum',
    'Quantity': 'sum' }).reset_index()
print(product_summary)
```

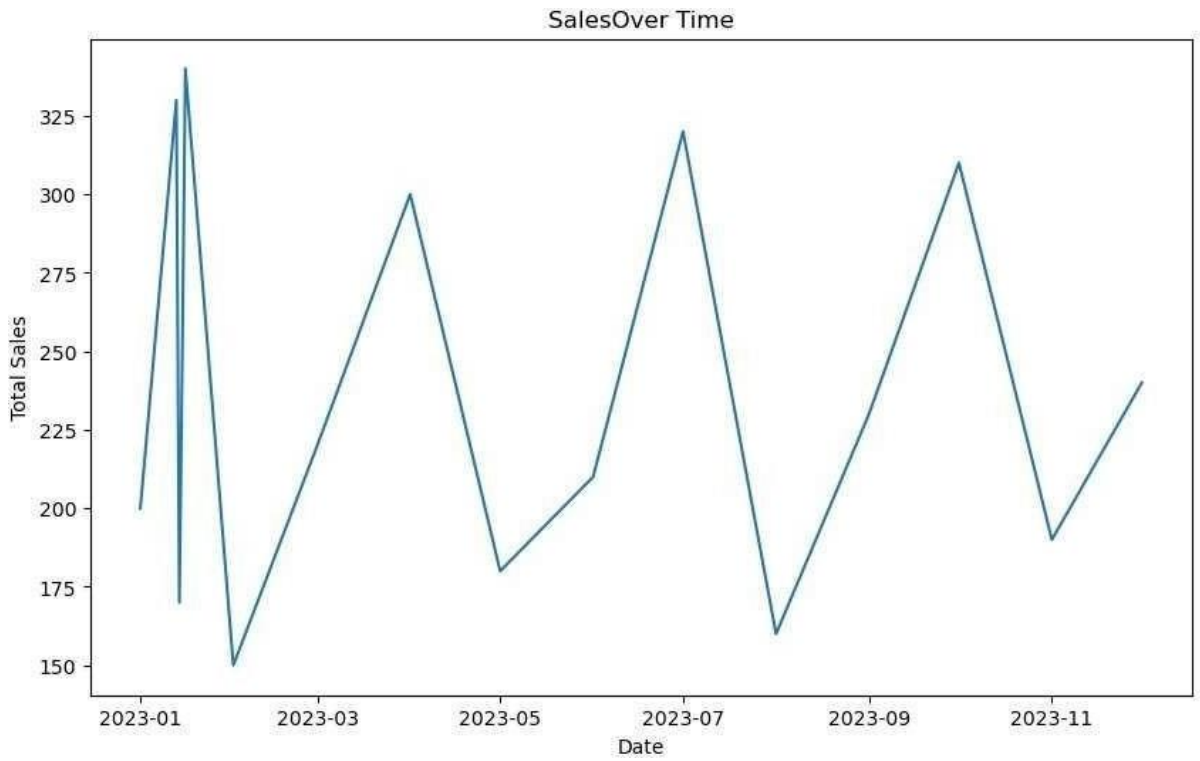
```
         Date    Product  Sales  Quantity Region
0  01-01-2023  Product A    200         4  North
1  02-01-2023  Product B    150         3  South
2  03-01-2023  Product A    220         5  North
```

```
3     04-01-2023  Product C    300         6   East
4     05-01-2023  Product B    180         4   West
Date         0
Product      0
Sales        0
Quantity     0 Region       0
dtype: int64
            Sales   Quantity count   16.000000
16.000000 mean     237.500000     5.375000
std              64.031242         1.746425   min
150.000000   3.000000
25%     187.500000   4.000000
50%     225.000000   5.500000 75%
302.500000   7.000000 max     340.000000
8.000000
Product  Sales  Quantity
0     Product A   1350        33
1     Product B    850        17 2  Product C   1600        36

plt.figure(figsize=(10, 6)) plt.bar(product_summary['Product'], product_summary['Sales'])
plt.xlabel('Product') plt.ylabel('Total Sales') plt.title('Total Sales by Product') plt.show()
df['Date'] = pd.to_datetime(df['Date'])
sales_over_time = df.groupby('Date').agg({'Sales':
'sum'}).reset_index()
```

```
plt.figure(figsize=(10, 6)) plt.plot(sales_over_time['Date'],sales_over_time['Sales'])
plt.xlabel('Date') plt.ylabel('Total Sales') plt.title('SalesOver Time') plt.show()
pivot_table = df.pivot_table(values='Sales', index='Region', columns='Product',
aggfunc=np.sum, fill_value=0) print(pivot_table)
correlation_matrix = df.corr() print(correlation_matrix) import seaborn as sns
plt.figure(figsize=(8, 6)) sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm')
plt.title('Correlation Matrix') plt.show()
```




```
C:\Users\REC\AppData\Local\Temp\ipykernel_7888\2790720894.py:7:
UserWarning: Parsing dates in DD/MM/YYYY format when dayfirst=False
(the default) was specified. This may lead to inconsistently parsed
dates! Specify a format to ensure consistent parsing.
  df['Date'] = pd.to_datetime(df['Date'])
```

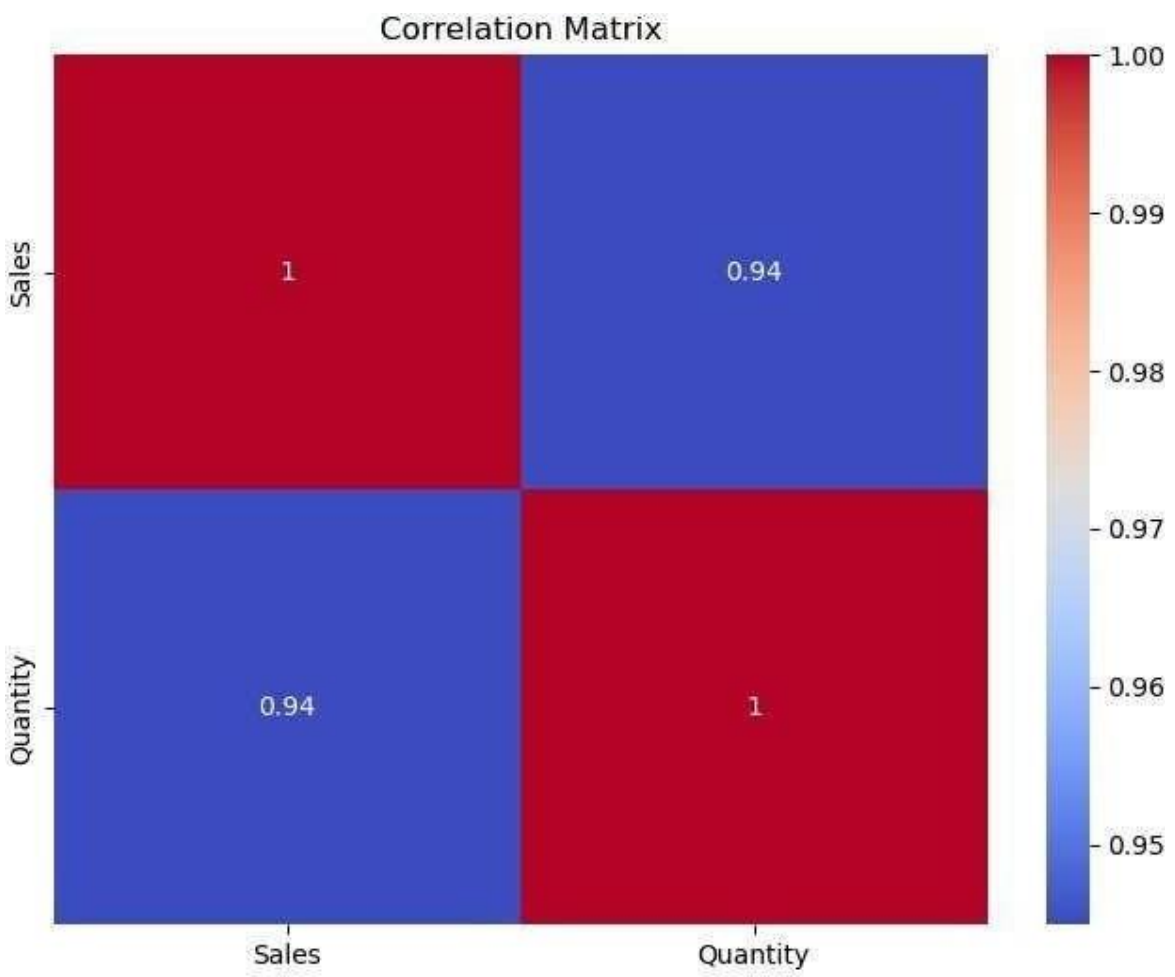


Product	Product A	Product B	Product C
Region			
East	0	0	160
North	1350	0	0
South	0	480	0
West	0	370	0

	Sales	Quantity
Sales	1.000000	0.944922
Quantity	0.944922	1.000000

C:\Users\REC\AppData\Local\Temp\ipykernel_7888\240701101.py:18: FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only valid columns or specify the value of numeric_only to silence this warning.

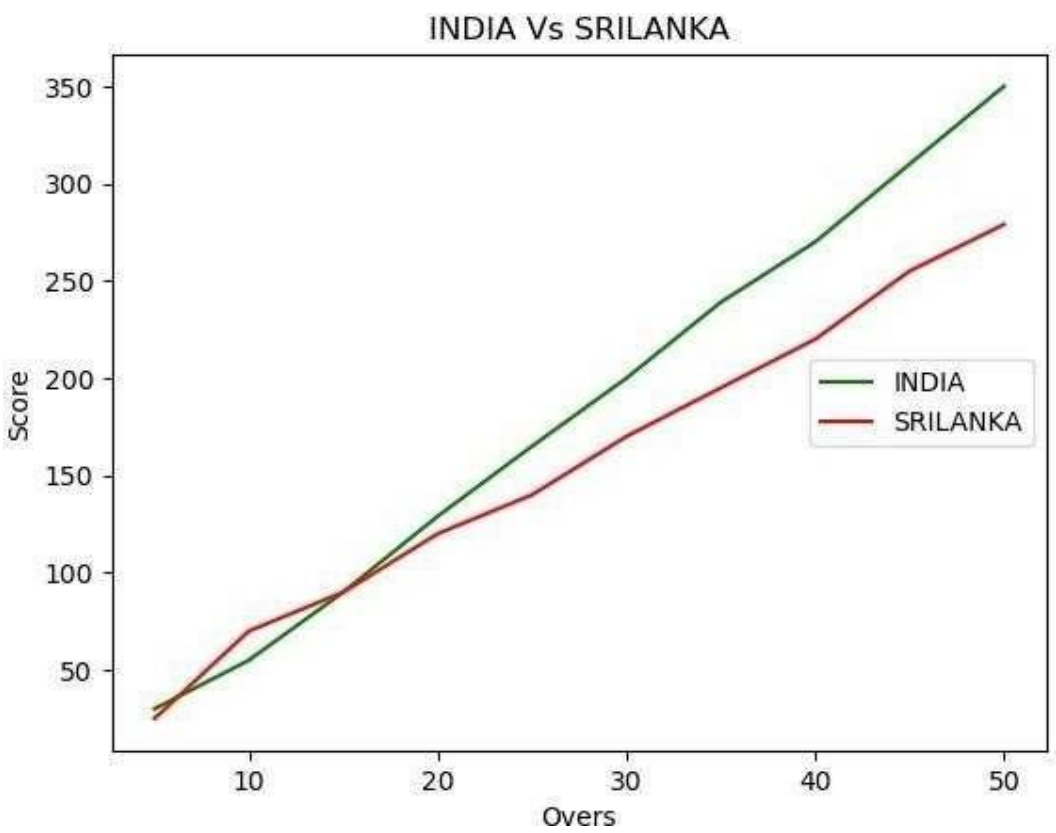
```
  correlation_matrix = df.corr()
```



Exercise 3:

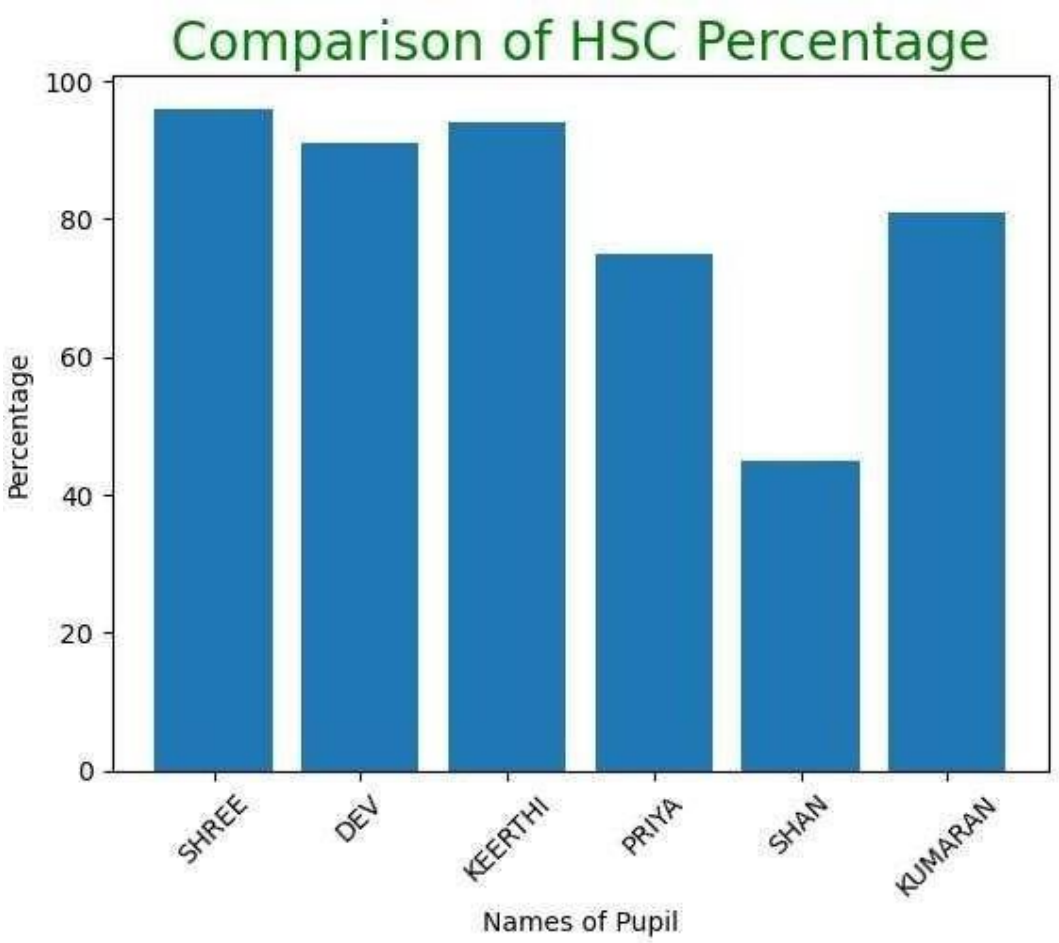
A]

```
import matplotlib.pyplot as cricket
Overs=list(range(5,51,5))
Indian_Score=[30,55,90,129,165,200,239,270,310,350]
Srilankan_Score=[25,70,90,120,140,170,195,220,255,279]  cricket.title("INDIA Vs
SRILANKA") cricket.xlabel("Overs") cricket.ylabel("Score") cricket.legend()
cricket.plot(Overs,Indian_Score,color="green",label="INDIA")
cricket.plot(Overs,Srilankan_Score,color="red",label="SRILANKA") cricket.legend(loc="center
right")
```



B]

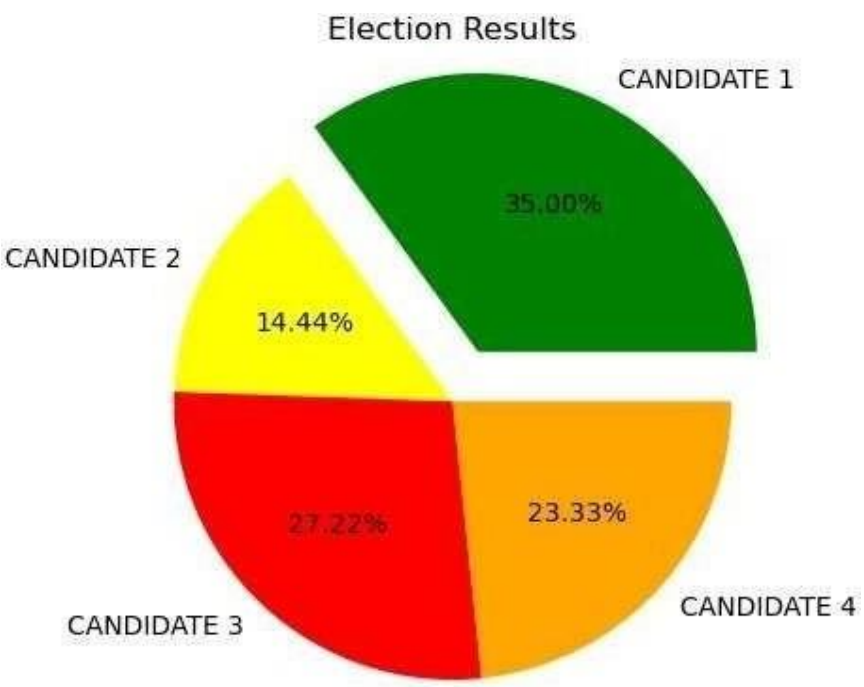
```
Names = ['SHREE', 'DEV', 'KEERTHI', 'PRIYA', 'SHAN', 'KUMARAN'] xaxis = np.arange(len(Names))
Percentage_hsc = [96, 91, 94, 75, 45, 81] hscmark.bar(Names, Percentage_hsc)
hscmark.xticks(xaxis, Names, rotation=45) hscmark.xlabel("Names of Pupil")
hscmark.ylabel("Percentage")
hscmark.title("Comparison of HSC Percentage", fontsize=20, color="green") hscmark.show()
```



C]

```
import matplotlib.pyplot as election labels = ['CANDIDATE 1', 'CANDIDATE 2', 'CANDIDATE 3', 'CANDIDATE 4'] Votes = [315, 130, 245, 210]
colors = ['green', 'yellow', 'red', 'orange'] explode = (0.2, 0, 0, 0) election.pie(Votes, labels=labels, colors=colors, explode=explode, autopct='%0.2f%%')
```

```
election.title('Election Results') election.show()
```


Election Results
CANDIDATE 1
35.00%
CANDIDATE 2
14.44%
27.22%
23.33%
CANDIDATE 3
CANDIDATE 4

```
import nltk
from nltk.tokenize import word_tokenize
from nltk.corpus import gutenberg nltk.download('gutenberg')
nltk.download('punkt')
sample = gutenberg.raw("austen-emma.txt") token =
word_tokenize(sample) wlist = [] for i in range(50):
    wlist.append(token[i]) wordfreq = [wlist.count(w) for w in
wlist]
print("Pairs\n" + str(list(zip(wlist, wordfreq))))
```

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

```
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), ('rich', 1), (',',
5),
('with', 2), ('a', 1), ('comfortable', 1), ('home', 1), ('and', 3),
('happy', 1), ('disposition', 1), (',', 5), ('seemed', 1), ('to', 1),
('unite', 1), ('some', 1), ('of', 2), ('the', 2), ('best', 1),
('blessings', 1), ('of', 2), ('existence', 1), (';', 1), ('and', 3),
('had', 1), ('lived', 1), ('nearly', 1), ('twenty-one', 1), ('years',  1), ('in', 1), ('the', 2), ('world', 1), ('with', 2)]
```

Exercise 5:

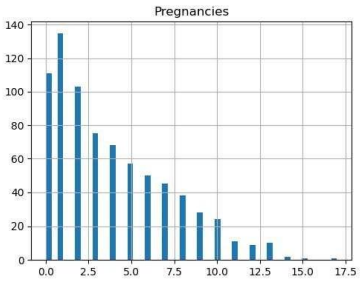
```
import pandas as pd df=pd.read_csv("E:\diabetes.csv")
print(df.head()) print(df.info()) print(df.describe()) import
matplotlib.pyplot as plt import seaborn as sns
df.hist(bins=50, figsize=(20,15)) plt.show() sns.pairplot(df)
plt.show()
```

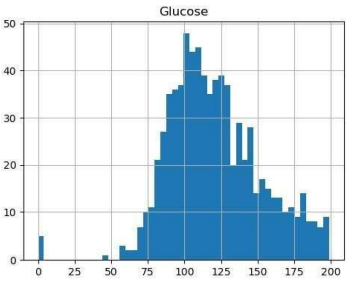
```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin   BMI  \
1            1       85             66             29        0  26.6
6            6      148             72             35        0  33.
```

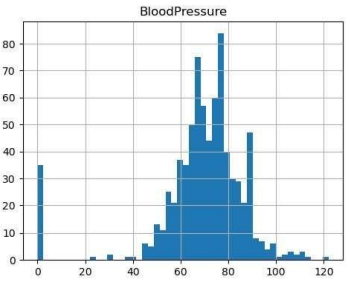
Exercise 4:

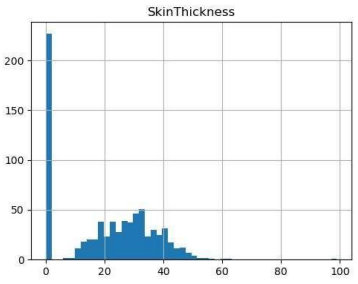
```
2                  8     183          64           0       0  23.3

3                  1      89          66          23      94  28.1

4                  0     137          40          35

                   168  43.1


   DiabetesPedigreeFunction  Age  Outcome
0                                 0.627   50        1
1                                 0.351   31        0
2                                 0.672   32        1
3                                 0.167   21        0
4                                 2.288   33        1
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 768 entries, 0 to 767
Data columns (total 9 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
0       Pregnancies               768 non-null    int64
1       Glucose                   768 non-null    int64
2       BloodPressure             768 non-null    int64   3 SkinThickness             768 non-null    int64   4 Insulin
        768 non-null    int64
5       BMI                       768 non-null    float64
6       DiabetesPedigreeFunction  768 non-null    float64
7       Age                       768 non-null    int64   8   Outcome
        768 non-null    int64   dtypes: float64(2),
int64(7)
memory usage: 54.1 KB
None
       Pregnancies     Glucose  BloodPressure  SkinThickness      Insulin \ count
768.000000  768.000000     768.000000     768.000000
768.000000
mean       3.845052  120.894531      69.105469      20.536458
79.799479    std       3.369578   31.972618      19.355807      15.952218
115.244002    min       0.000000    0.000000       0.000000       0.000000    0.000000
25%        1.000000   99.000000      62.000000       0.000000    0.000000
50%        3.000000  117.000000      72.000000      23.000000    30.500000
75%        6.000000  140.250000      80.000000      32.000000   127.250000
```

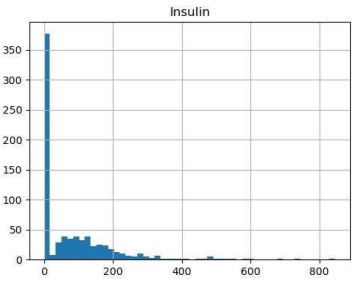
	BMI	DiabetesPedigreeFunction	Age	Outcome
count	768.000000	768.000000	768.000000	768.000000
mean	31.992578	0.471876	33.240885	0.348958
std	7.884160	0.331329	11.760232	0.476951
min	0.000000	0.078000	21.000000	0.000000
25%	27.300000	0.243750	24.000000	0.000000
50%	32.000000	0.372500	29.000000	0.000000
75%	36.600000	0.626250	41.000000	1.000000
max	17.000000	199.000000	122.000000	99.000000
846.000000				
max	67.100000	2.420000	81.000000	1.000000

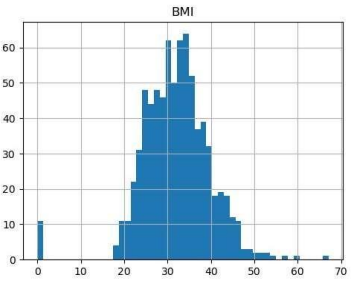

Pregnancies

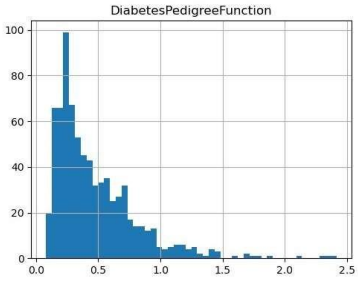

Glucose

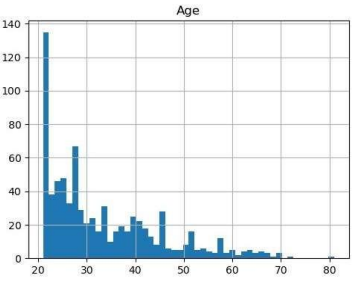

BloodPressure

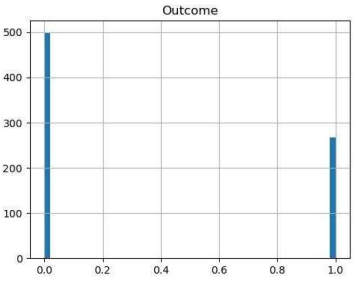

SkinThickness

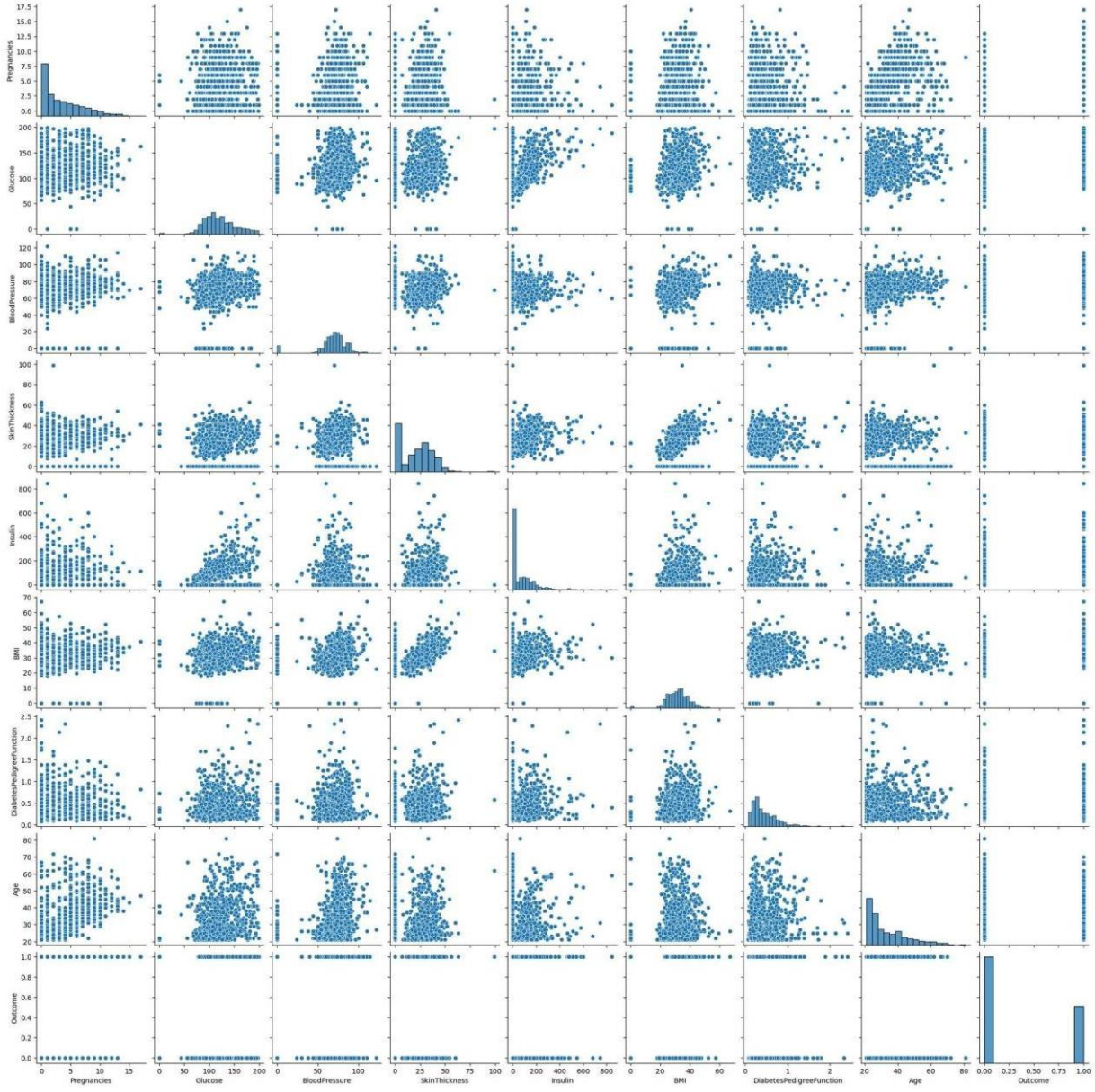

Insulin


BMI


DiabetesPedigreeFunction


Age


Outcome


Pregnancies
Glucose
BloodPressure
SkinThickness
Insulin
BMI
DiabetesPedigreeFunction
Age
Outcome

Exercise 6:

```
import numpy as np
import pandas as pd
df=pd.read_csv("E:\Hotel_Dataset.csv")
df.duplicated()
0     False
1     False
2     False
3     False
4     False
5     False
6     False
7     False
8     False
9     True
10     False
dtype: bool
df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 11 entries, 0 to 10
Data columns (total 9 columns):
 #    Column            Non-Null Count  Dtype
---   ------            --------------  -----
0     CustomerID         11 non-null     int64
1     Age_Group          11 non-null     object
2     Rating(1-5)        11 non-null     int64
3     Hotel              11 non-null     object
4     FoodPreference     11 non-null     object
5     Bill               11 non-null     int64
6     NoOfPax            11 non-null     int64
7     EstimatedSalary    11 non-null     int64   8    Age_Group.1       11
non-null     object
dtypes: int64(5), object(4)
memory usage: 920.0+ bytes

df.drop_duplicates(inplace=True)
df
```

	CustomerID	Age_Group	Rating(1-5)	Hotel	FoodPreference	Bill
0	1	20-25	4	Ibis	veg	1300
1	2	30-35	5	LemonTree	Non-Veg	2000
2	3	25-30	6	RedFox	Veg	1322

3	4	20-25	-1	LemonTree	Veg	1234
4	5	35+	3	Ibis	Vegetarian	989
5	6	35+	3	Ibys	Non-Veg	1909
6	7	35+	4	RedFox	Vegetarian	1000
7	8	20-25	7	LemonTree	Veg	2999
8	9	25-30	2	Ibis	Non-Veg	310

```
10     30-35          5     RedFox        non-Veg -6755
   NoOfPax  EstimatedSalary Age_Group.1 0 2
20-25 1 3           59000       30-35 2 2           30000
  3          2          120000       20-25 4          2
                                  35+
5                  2          122220         35+
6                  -1           21122
                   35+
7                  -10          345673       20-
                   25
8                  3          -99999        25-30
10       4           87777       30-35
```

```
    len(df)
10 index=np.array(list(range(0,len(df))))
    df.set_index(index,inplace=True) index
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
df
```

	CustomerID	Age_Group	Rating(1-5)	Hotel F	NoOfPax \
	1	20-25	4	Ibis	veg 13
	2	30-35	5	LemonTree	Non-
	3	25-30	6	RedFox	Veg
	4	20-25	-1	LemonTree	Ve
	5	35+	3	Ibis	Vegetarian
	6	35+	3	Ibys	Non-Veg
	7	35+	4	RedFox	Vegetaria

```
 0
2
 1
3
 2
2
 3
2
 4
2
 5
2
 6
```

```
-1
7           8       20-25                7   LemonTree                 Veg   2999
-10
8           9       25-30                2        Ibis             Non-Veg   3456
3
9          10       30-35                5      RedFox            non-Veg  -6755
4

   EstimatedSalary  Age_Group.1
0            40000        20-25
1            59000        30-35
2            30000        25-30
3           120000        20-25
4            45000          35+
5           122220          35+
6            21122          35+
7           345673        20-25
8           -99999        25-30   9                87777          30-35

df.drop(['Age_Group.1'],axis=1,inplace=True)
df

   CustomerID  Age_Group   Rating(1-5)        Hotel  FoodPreference    Bill
NoOfPax   \
0           1       20-25                4        Ibis                 veg   1300
2
1           2       30-35                5   LemonTree            Non-Veg   2000
3
2           3       25-30                6     RedFox                 Veg   1322
2
3           4       20-25               -1   LemonTree                 Veg   1234
2
4           5         35+                3        Ibis          Vegetarian    989
2
5           6         35+                3        Ibys            Non-Veg   1909
2
6           7         35+                4     RedFox          Vegetarian   1000
-1
7           8       20-25                7   LemonTree                 Veg   2999
-10
8           9       25-30                2        Ibis             Non-Veg   3456
3
9          10       30-35                5      RedFox            non-Veg  -6755
4

   EstimatedSalary
0            40000
1            59000
2            30000
3           120000
4            45000
5           122220
6            21122
7           345673
8           -99999  9         87777
```

df.CustomerID.loc[df.CustomerID<0]=np.nan
df.Bill.loc[df.Bill<0]=np.nan
df.EstimatedSalary.loc[df.EstimatedSalary<0]=np.nan df

C:\Users\REC\AppData\Local\Temp\ipykernel_4252\240701101.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy df.CustomerID.loc[df.CustomerI D<0]=np.nan
C:\Users\REC\AppData\Local\Temp\ipykernel_4252\240701101.PY:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy df.Bill.loc[df.Bill<0]=np.nan
C:\Users\REC\AppData\Local\Temp\ipykernel_4252\240701101.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html# returning-a-view-versus-a-copy
df.EstimatedSalary.loc[df.EstimatedSalary<0] =np.nan

CustomerID	Age	Group	Rating(1-5)	Hotel	FoodPreference	Bill	\
0	1.0	20-25	4	Ibis	veg	1300.0	
1	2.0	30-35	5	LemonTree	Non-Veg	2000.0	
2	3.0	25-30	6	RedFox	Veg	1322.0	
3	4.0	20-25	-1	LemonTree	Veg	1234.0	
4	5.0	35+	3	Ibis	Vegetarian	989.0	
5	6.0	35+	3	Ibys	Non-Veg	1909.0	
6	7.0	35+	4	RedFox	Vegetarian	1000.0	

```
7          8.0     20-25           7  LemonTree           Veg  2999.0
8          9.0     25-30           2       Ibis        Non-Veg 3456.0
10.0     30-35           5     RedFox        non-Veg     NaN
   NoOfPax  EstimatedSalary
0                2         40000.0
1                3         59000.0
2                2         30000.0
3                2        120000.0
4                2         45000.0
5                2        122220.0
6               -1
                  21122.0
7              -10
                  345673.0
8                3             NaN
9                4         87777.0
df['NoOfPax'].loc[(df['NoOfPax']<1) | (df['NoOfPax']>20)]=np.nan df
C:\Users\REC\AppData\Local\Temp\ipykernel_4252\2129877948.py:1:
SettingWithCopyWarning
A value is trying to be set on a copy of a slice from a DataFrame
See the caveats in the documentation: https://pandas.pydata.org/pandasdocs/stable/user_guide/indexi ng.html#
returning-a-view-versus-a-copy
  df['NoOfPax'].loc[(df['NoOfPax']<1) | (df['NoOfPax']>20)]=np.nan
     CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference     Bill


          1.0     20-25           4       Ibis            veg  1300.0
\
 0
1                2.0     30-35           5  LemonTree        Non-Veg 2000.0
2                3.0     25-30           6     RedFox           Veg  1322.0
3                4.0     20-25          -1  LemonTree           Veg  1234.0
4                5.0       35+           3       Ibis     Vegetarian  989.0
5                6.0       35+           3       Ibys        Non-Veg 1909.0
6                7.0       35+           4     RedFox     Vegetarian 1000.0

7                8.0     20-25           7  LemonTree           Veg  2999.0
```

```
8        9.0     25-30           2       Ibis        Non-Veg 3456.0
9       10.0     30-35           5     RedFox        non-Veg     NaN
  NoOfPax       EstimatedSalary    0    2.0
40000.0
1          3.0          59000.0
2          2.0          30000.0
3          2.0         120000.0
4array(['Ibis', 'LemonTree', 'RedFox', 'Ibys'], dtype=object )
5          2.0         122220.0
6          NaN                21122.0  7  NaN
345673.0 8 3.0             NaN
9                             4.0          87777.0
df.Age_Group.unique()
array(['20-25', '30-35', '25-30', '35+'], dtype=object)


df.Hotel.unique()
df.Hotel.replace(['Ibys'],'Ibis',inplace=True)  df.FoodPreference.unique
<bound method Series.unique of 0           veg
1                      Non-Veg
2                      Veg
3                      Veg
4                      Vegetarian
5                      Non-Veg
6                      Vegetarian
7                      Veg
8                      Non-Veg
9                      non-Veg
Name: FoodPreference, dtype: object>

df.FoodPreference.replace(['Vegetarian','veg'],'Veg',inplace=True) df.FoodPreference.replace(['non-
Veg'],'Non-Veg',inplace=True)

df.EstimatedSalary.fillna(round(df.EstimatedSalary.mean()),inplace=Tru e)
df.NoOfPax.fillna(round(df.NoOfPax.median()),inplace=True) df['Rating(1-
5)'].fillna(round(df['Rating(1-5)'].median()), inplace=True)
df.Bill.fillna(round(df.Bill.mean()),inplace=True) df
```

```
\  CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference     Bill

        1.0     20-25           4       Ibis           Veg  1300.0
```

```
                                                    9.0     25-30          2       Ibis       Non-Veg 3456.0
          2.0     30-35          5  LemonTree       Non-Veg 2000.0
          3.0     25-30          6     RedFox          Veg 1322.0
          4.0     20-25         -1  LemonTree          Veg 1234.0
          5.0       35+          3       Ibis          Veg  989.0
          6.0       35+          3       Ibis       Non-Veg 1909.0
          7.0       35+          4     RedFox          Veg 1000.0
          8.0     20-25          7  LemonTree          Veg 2999.0

10.0     30-35          5     RedFox       Non-Veg 1801.0
   NoOfPax  EstimatedSalary
             2.0                 40000.0  3.0
             59000.0 2.0          30000.0 2.0
             120000.0 2.0         45000.0 2.0
             122220.0 2.0          21122.0
                           2.0        345673.0
                           3.0         96755.0
                           4.0         87777.0

['Rating(1-5)'].fillna(round(df['Rating(1-5)'].median()), inplace=True)  df
   CustomerID Age_Group  Rating(1-5)      Hotel FoodPreference     Bill
\

         1.0     20-25          4       Ibis          Veg 1300.0

                                                    2.0     30-35          5  LemonTree       Non-Veg 2000.0
                                                       3.0     25-30          6     RedFox          Veg 1322.0


3                4.0     20-25          -1  LemonTree          Veg 1234.
```

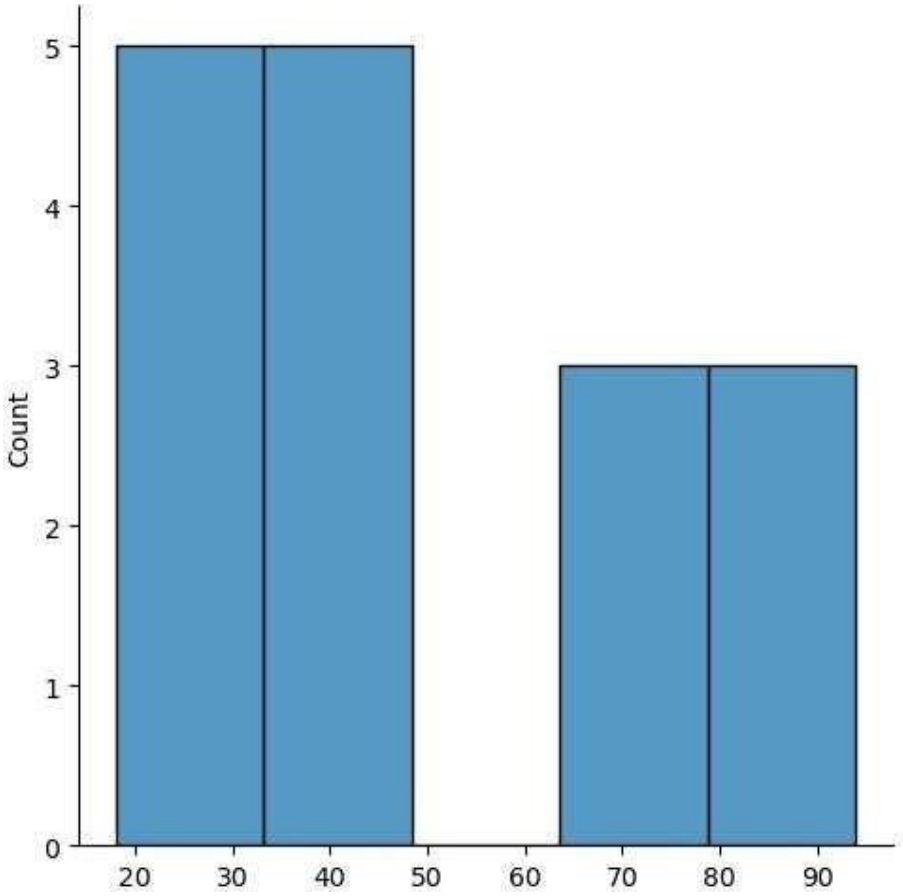
4	5.0	35+	3	Ibis	Veg	989.0
5	6.0	35+	3	Ibis	Non-Veg	1909.

6		7.0	35+	4	RedFox	Veg	1000.0		
7		8.0	20-25	7	LemonTree	Veg	2999.0		
8		9.0	25-30	2	Ibis	Non-Veg	3456.0		
9					10.0	30-35	5	RedFox	Non-Veg 1801.0

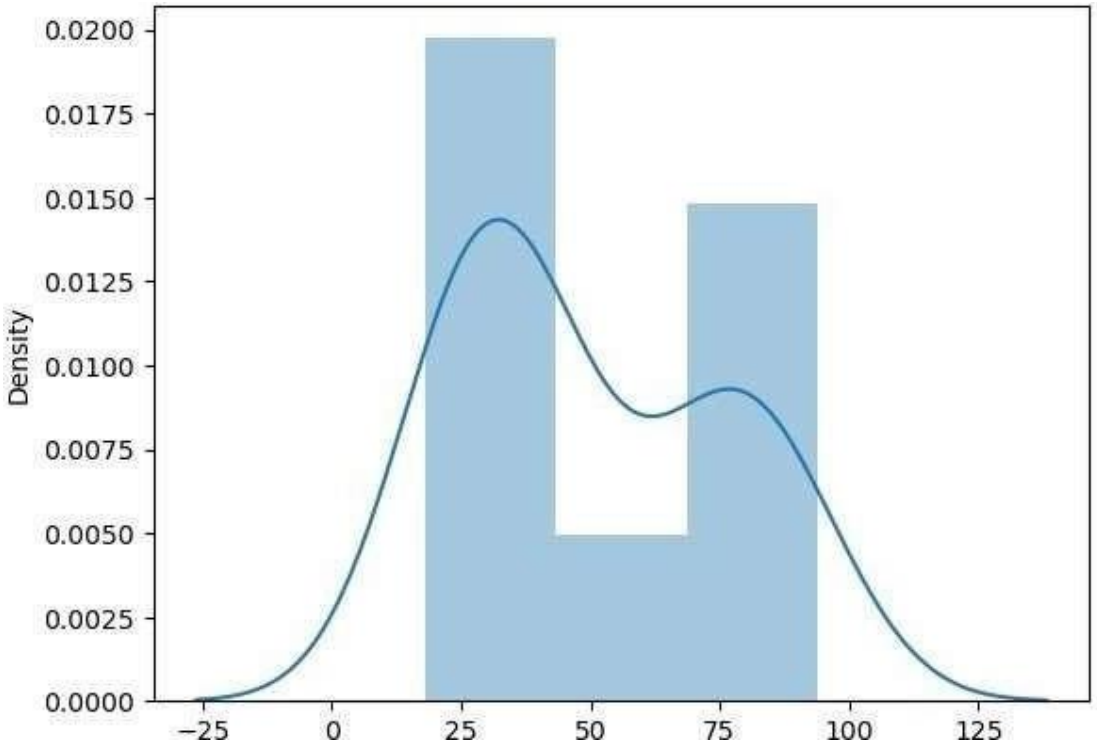
	NoOfPax	EstimatedSalary	0	2.0
40000.0				
1	3.0	59000.0		
2	2.0	30000.0		
3	2.0	120000.0		
4	2.0	45000.0		
5	2.0	122220.0		
6	2.0	21122.0	7	2.0
345673.0				
8	3.0	96755.0		
9		4.0	87777.0	

Exercise 7:

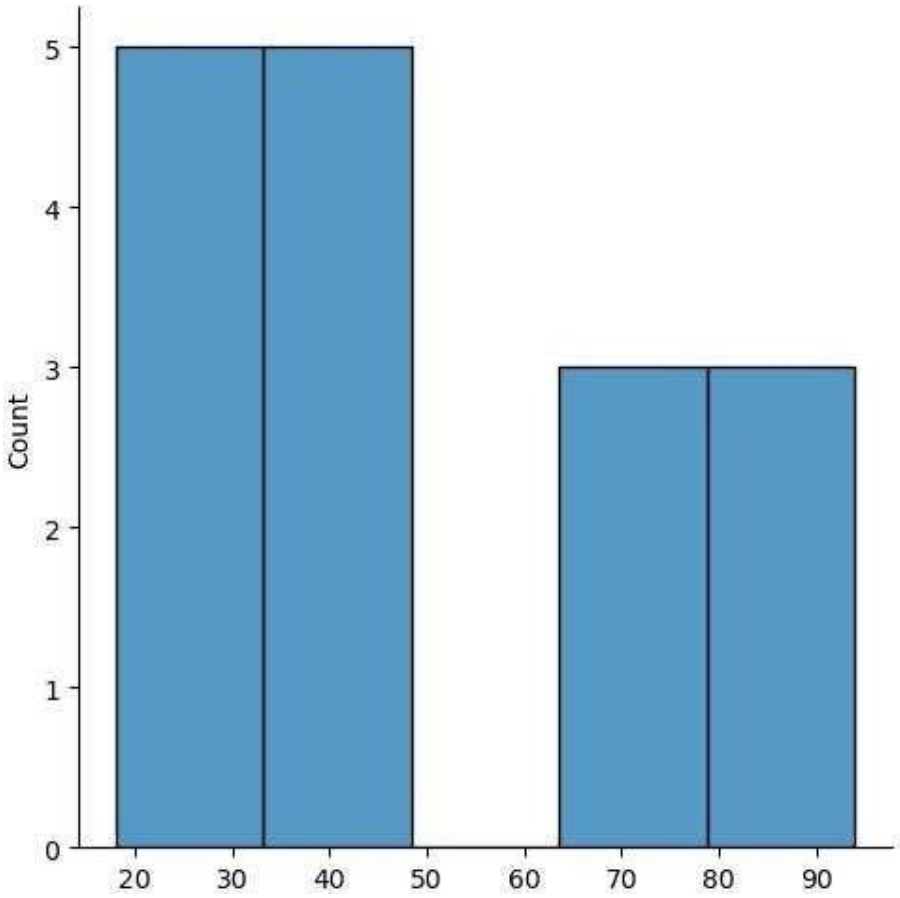
```
import numpy as np array=np.random.randint(1,100,16) # randomly generate 16 numbers between 1 to 100 array
array([35, 18, 94, 35, 71, 83, 85, 21, 74, 37, 29, 27, 74, 45, 27, 48])
array.mean()
50.1875
np.percentile(array,25)
28.5
np.percentile(array,50)
41.0
np.percentile(array,75)
74.0
np.percentile(array,100)
94.0
def outDetection(array):
sorted(array)
Q1,Q3=np.percentile(array,[25,75]) IQR=Q3-Q1 lr=Q1-(1.5*IQR) ur=Q3+(1.5*IQR) return lr,ur lr,ur=outDetection(array) lr,ur
(-39.75, 142.25)
import seaborn as sns %matplotlib inline
sns.displot(array)
<seaborn.axisgrid.FacetGrid at 0x1c7ed3de080>
```



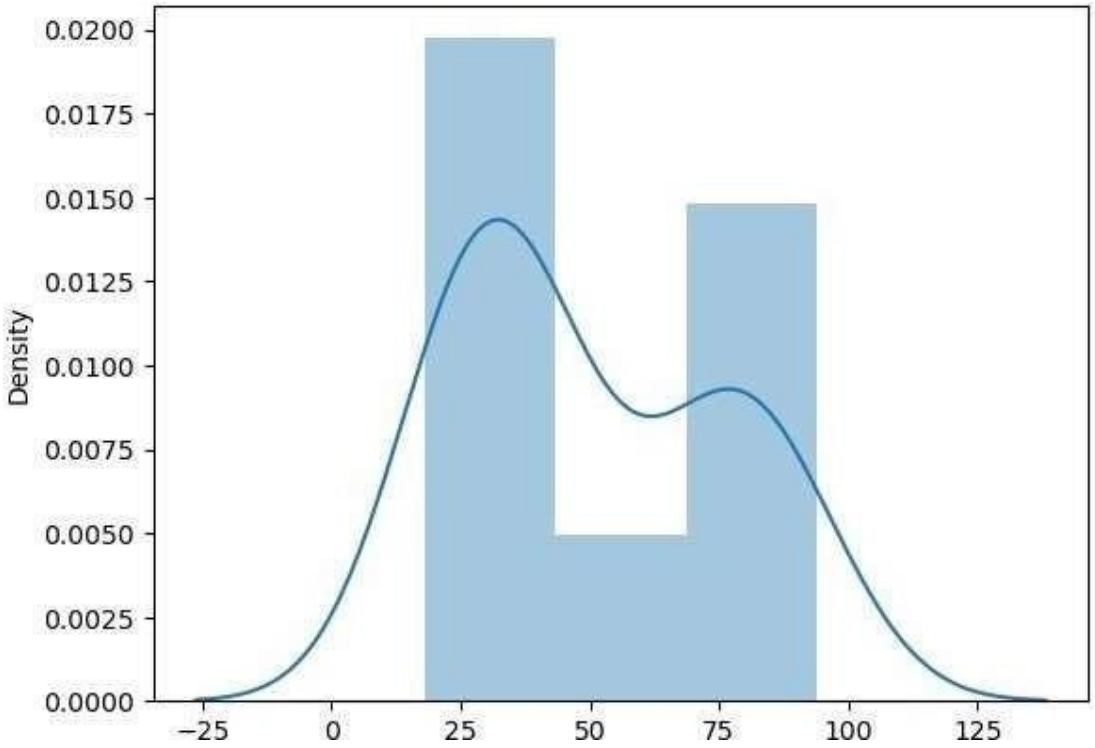

```
sns.distplot(array)
C:\Users\REC\AppData\Local\Temp\ipykernel_5860\240701144.py:1:
UserWarning:
`distplot` is a deprecated function and will be removed in
seaborn
v0.14.0.

Please adapt your code to use either `displot` (a figure-level
function with
similar flexibility) or `histplot` (an axes-level function for
histograms).
For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(array)
<Axes: ylabel='Density'>
```




```
new_array=array[(array>lr) & (array<ur)] new_array
array([35, 18, 94, 35, 71, 83, 85, 21, 74, 37, 29, 27, 74, 45, 27,
48])

sns.displot(new_array)
<seaborn.axisgrid.FacetGrid at 0x1c7f392ec80>
```



```
lr1,ur1=outDetection(new_array) lr1,ur1
(-39.75, 142.25)
final array=new array[(new array>lr1) & (new array<ur1)] final array
array([35, 18, 94, 35, 71, 83, 85, 21, 74, 37, 29, 27, 74, 45, 27,
48])
sns.distplot(final_array)
C:\Users\REC\AppData\Local\Temp\ipykernel_5860\240701144.py:1:
UserWarning :
`distplot` is a deprecated function and will be removed in seaborn

v0.14.0.

Please adapt your code to use either `displot` (a figure-level
function with

similar flexibility) or `histplot` (an axes-level function for

histograms).
For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(final_array)
<Axes: ylabel='Density'>
```



Exercise 8:

```
import numpy as np import pandas as
pd
df=pd.read_csv('E:/pre_process_datasample.csv')  df
```

```
  Country   Age   Salary Purchased
0          France  44.0  72000.0       No
1          Spain  27.0  48000.0       Yes
2          Germany  30.0  54000.0       No
3          Spain  38.0  61000.0       No
4          Germany  40.0     NaN       Yes 5 France  35.0
58000.0       Yes
6          Spain   NaN  52000.0       No
7          France  48.0  79000.0       Yes
8          Germany  50.0  83000.0       No
9          France  37.0  67000.0       Yes
```

```
df.head()
```

```
  Country   Age   Salary Purchased
0          France  44.0  72000.0       No
1          Spain  27.0  48000.0       Yes
2          Germany  30.0  54000.0       No
3          Spain  38.0  61000.0       No
4          Germany  40.0     NaN       Yes
```

```
df.Country.fillna(df.Country.mode()[0],inplace=True) features=df.iloc[:,:-1].values label=df.iloc[:,-
1].values
```

```
 SimpleImputer()
from sklearn.impute import SimpleImputer age=SimpleImputer(strategy="mean",missing_values=np.nan)
Salary=SimpleImputer(strategy="mean",missing_values=np.nan) age.fit(features[:,[1]])
Salary.fit(features[:,[2]])
```

```
                                SimpleImputer()
                                SimpleImputer()
SimpleImputer()
features[:,[1]]=age.transform(features[:,[1]])
features[:,[2]]=Salary.transform(features[:,[2]]) features
```

```
array([['France', 44.0, 72000.0],
['Spain', 27.0, 48000.0],
```

```
       ['Germany', 30.0, 54000.0],
       ['Spain', 38.0, 61000.0],
       ['Germany', 40.0, 63777.77777777778],
       ['France', 35.0, 58000.0],
       ['Spain', 38.77777777777778, 52000.0],
       ['France', 48.0, 79000.0],
       ['Germany', 50.0, 83000.0],
       ['France', 37.0, 67000.0]], dtype=object)

from sklearn.preprocessing import OneHotEncoder oh =
OneHotEncoder(sparse_output=False)
Country=oh.fit_transform(features[:,[0]]) Country

array([[1., 0., 0.],
[0., 0., 1.],
       [0., 1., 0.],
       [0., 0., 1.],
       [0., 1., 0.],
       [1., 0., 0.],
       [0., 0., 1.],
       [1., 0., 0.],
       [0., 1., 0.],        [1., 0., 0.]])

 array([[1.0, 0.0, 0.0, 44.0, 72000.0]
                                    [0.0, 0.0, 1.0, 27.0, 48000.0],
       [0.0, 1.0, 0.0, 30.0, 54000.0],
       [0.0, 0.0, 1.0, 38.0, 61000.0],
       [0.0, 1.0, 0.0, 40.0, 63777.77777777778],
       [1.0, 0.0, 0.0, 35.0, 58000.0],
       [0.0, 0.0, 1.0, 38.77777777777778, 52000.0],
       [1.0, 0.0, 0.0, 48.0, 79000.0],
       [0.0, 1.0, 0.0, 50.0, 83000.0],
       [1.0, 0.0, 0.0, 37.0, 67000.0]], dtype=object)
final_set=np.concatenate((Country,features[:,[1,2]]),axis=1)  final_set




from sklearn.preprocessing import StandardScaler sc=StandardScaler() sc.fit(final_set)
feat_standard_scaler=sc.transform(final_set) feat_standard_scaler
array([[ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,
         7.58874362e-01,  7.49473254e-01],
       [-8.16496581e-01, -6.54653671e-01,  1.52752523e+00,
        -1.71150388e+00, -1.43817841e+00],
       [-8.16496581e-01,  1.52752523e+00, -6.54653671e-01,
        -1.27555478e+00,  -8.91265492e-01],
```

[-8.16496581e-01, -6.54653671e-01, 1.52752523e+00,

```
       -1.13023841e-01,  -2.53200424e-01],
      [-8.16496581e-01,  1.52752523e+00, -6.54653671e-01,
        1.77608893e-01,  6.63219199e-16],
      [ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,        -5.48972942e-01, -5.26656882e-01],
      [-8.16496581e-01, -6.54653671e-01,  1.52752523e+00,
        0.00000000e+00, -1.07356980e+00],
      [ 1.22474487e+00, -6.54653671e-01, -6.54653671e-01,       1.34013983e+00,  1.38753832e+00], [-
      8.16496581e-01,  1.52752523e+00, -6.54653671e-01,         1.63077256e+00,  1.75214693e+00], [
      1.22474487e+00, -6.54653671e-01, -6.54653671e-01,
       -2.58340208e-01,  2.93712492e-01]])
```

```
from sklearn.preprocessing import MinMaxScaler
mms=MinMaxScaler(feature_range=(0,1)) mms.fit(final_set)
feat_minmax_scaler=mms.transform(final_set)
feat_minmax_scaler array([[1.         , 0.         , 0.         , 0.73913043, 0.68571429],
```

```
[0.         , 0.         , 1.         , 0.         , 0.         ],
      [0.         , 1.         , 0.         , 0.13043478, 0.17142857],
      [0.         , 0.         , 1.         , 0.47826087, 0.37142857], [0. , 1.         , 0.         , 0.56521739, 0.45079365],
[1.                     , 0.         , 0.         , 0.34782609, 0.28571429],
[0.                     , 0.         , 1.         , 0.51207729, 0.11428571],
[1.                     , 0.         , 0.         , 0.91304348, 0.88571429],
[0.                     , 1.         , 0.         , 1.         , 1.         ],
[1.                                  , 0.         , 0.         , 0.43478261, 0.54285714]])
```

```
                    df.info()
```

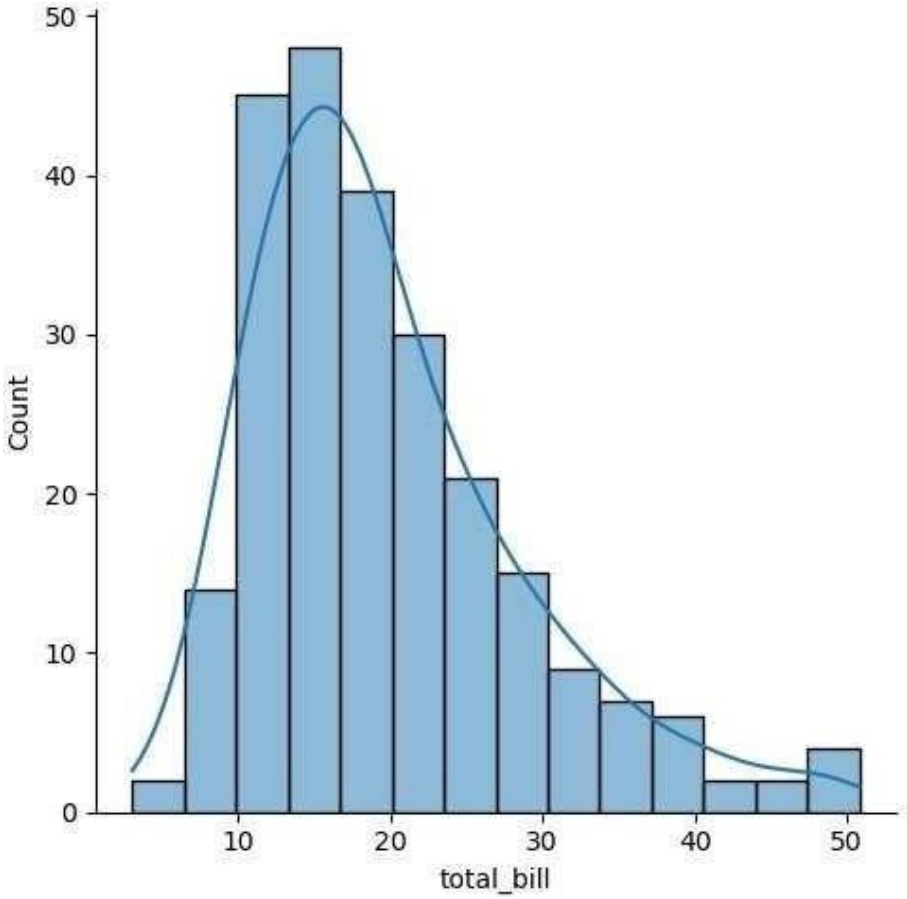
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9 Data columns (total 4
columns):
 #   Column     Non-Null Count  Dtype
--  ----     --------------- ------
0 Country      10 non-null       object   1 Age          9 non-null
float64
2 Salary     9 non-null      float64  3   Purchased  10 non-null      object dtypes: float64(2), object(2) memory
        usage: 448.0+ bytes df.Country.mode()
```

```
0    France
Name: Country, dtype: object
```

```
df.Country.mode()[0]
'France'
type(df.Country.mode())
pandas.core.series.Series
df.Country.fillna(df.Country.mode()[0],inplace=True)
df.Age.fillna(df.Age.median(),inplace=True)
df.Salary.fillna(round(df.Salary.mean()),inplace=True ) df
  Country   Age   Salary Purchased
0          France  44.0  72000.0        No
1          Spain  27.0  48000.0       Yes
2          Germany  30.0  54000.0       No
3          Spain  38.0  61000.0        No
4          Germany  40.0  63778.0     Yes 5 France 35.0
58000.0       Yes
6          Spain  38.0  52000.0        No
7          France  48.0  79000.0       Yes
8          Germany  50.0  83000.0        No
9          France  37.0  67000.0       Yes
pd.get_dummies(df.Country)
  France  Germany  Spain
0              1       0     0
1              0       0     1
2              0       1     0
3              0       0     1
4              0       1     0
5              1       0     0
6              0       0     1
7              1       0     0
8              0       1     0
9              1       0     0
updated_dataset=pd.concat([pd.get_dummies(df.Country),df.iloc[:,
[1,2,3]]],axis=1) updated_dataset
  France  Germany  Spain   Age   Salary Purchased
0              1       0     0  44.0  72000.0        No
1              0       0     1  27.0  48000.0       Yes
2              0       1     0  30.0  54000.0        No
3              0       0     1  38.0  61000.0        No
4              0       1     0  40.0  63778.0       Yes
5              1       0     0  35.0  58000.0       Yes
6              0       0     1  38.0  52000.0        No
```

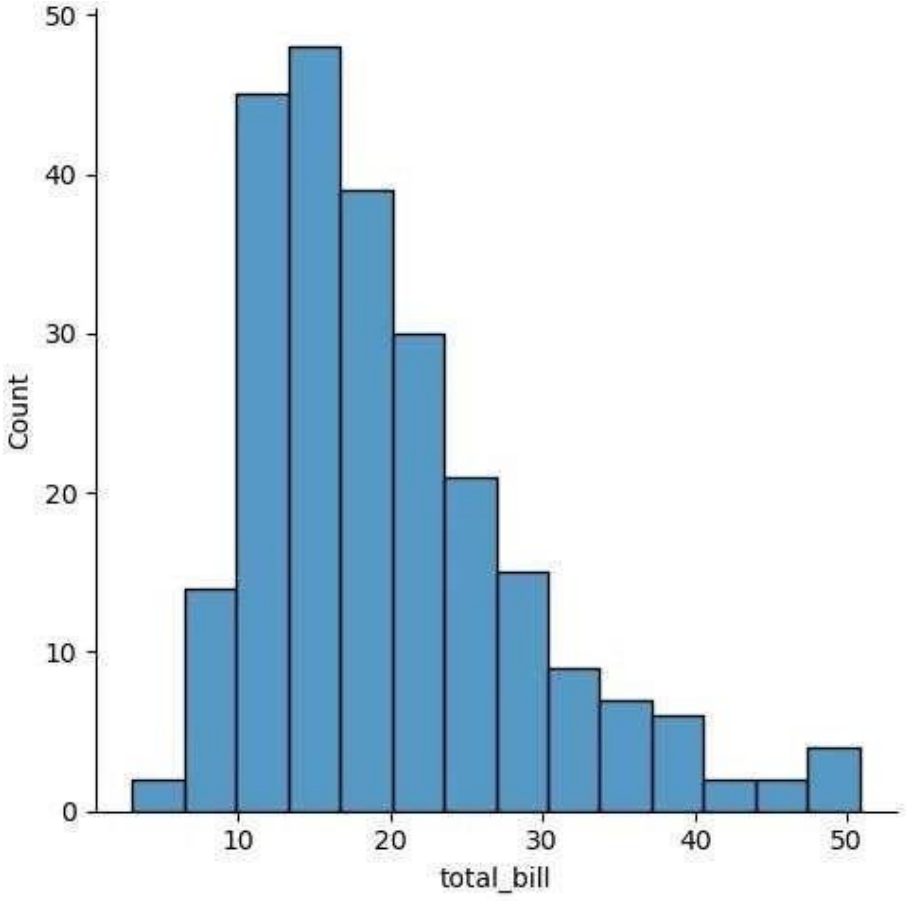
```
7              1       0     0  48.0  79000.0       Yes
8              0       1     0  50.0  83000.0        No
9              1       0     0  37.0  67000.0       Yes
```

```
df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9 Data columns (total 4
columns):
 #   Column     Non-Null Count  Dtype
--- ------     -------------- -----  0   Country    10 non-null
object
1           Age        10 non-null     float64
2           Salary     10 non-null     float64  3   Purchased  10 non-null   object  dt
float64(2), object(2) memory usage: 448.0+ bytes

updated_dataset.Purchased.replace(['No','Yes'],[0, updated_dataset
   France  Germany  Spain  Age   Salary  Purchased
0               1       0      0  44.0   72000.0                                          1],inplace=True)
1               0       0      1  27.0   48000.0
2               0       1      0  30.0   54000.0
3               0       0      1  38.0   61000.0                                          0
4               0       1      0  40.0   63778.0                                          1
5               1       0      0  35.0   58000.0                                          0
6               0       0      1  38.0   52000.0                                          0
7               1       0      0  48.0   79000.0                                          1
8               0       1      0  50.0   83000.0                                          1
9               1       0      0  37.0   67000.0                                          0
                                                                                          1
                                                                                          0
                                                                                          1


import seaborn as sns import pandas as pd import
numpy as np import matplotlib.pyplot as plt
    total_bill   tip      sex smoker  d  y    time   size 0        1  .99   1.01   Female      No
 Sun   Dinner     2
 1              10.34   1.66     Male     No   Sun   Dinner     3
 2              21.01   3.50     Male     No   Sun   Dinner     3
 3              23.68   3.31     Male     No   Sun   Dinner     2
 4              24.59   3.61   Female     Nc   Sun   Dinner     4
%matplotlib inline tips=sns.load_dataset('tips') tips.head()



sns.displot(tips.total_bill,kde=True)
<seaborn.axisgrid.FacetGrid at 0x1cbb0db2d70>
```



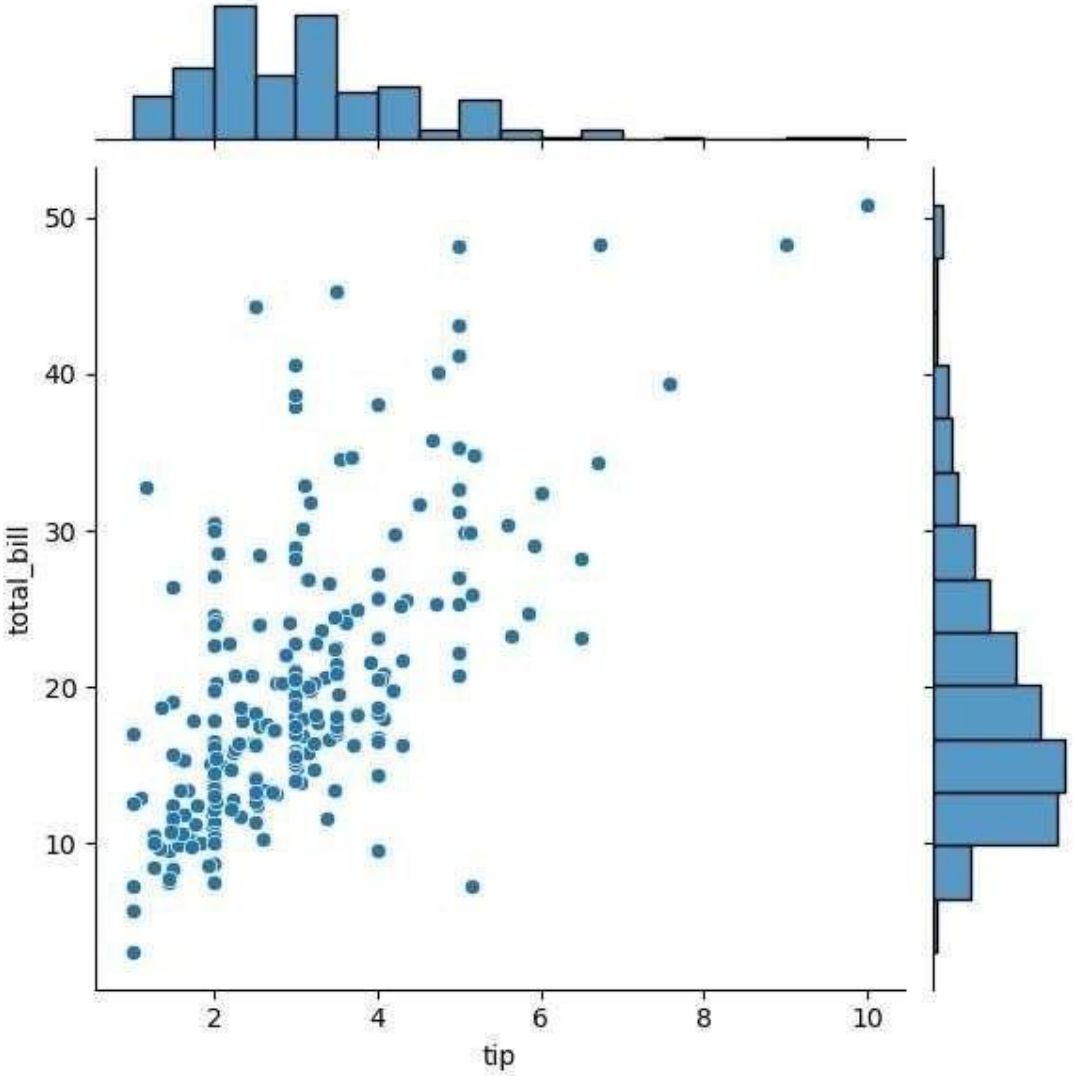

```
sns.displot(tips.total_bill,kde=False)
```

```
<seaborn.axisgrid.FacetGrid at 0x1cbb0f51510>
```



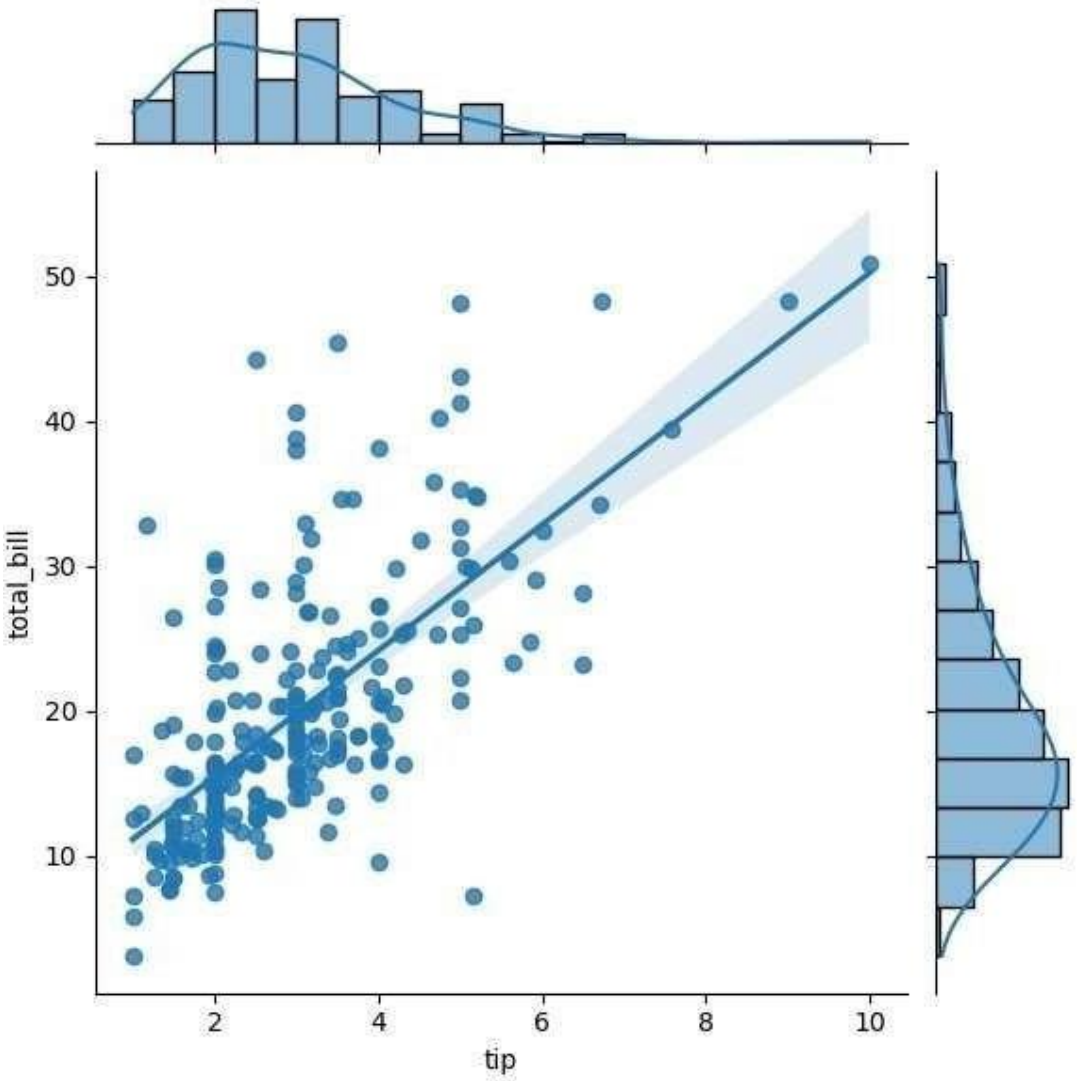
```
sns.jointplot(x=tips.tip,y=tips.total_bill)
```

```
<seaborn.axisgrid.JointGrid at 0x1cbb0db3f70
```



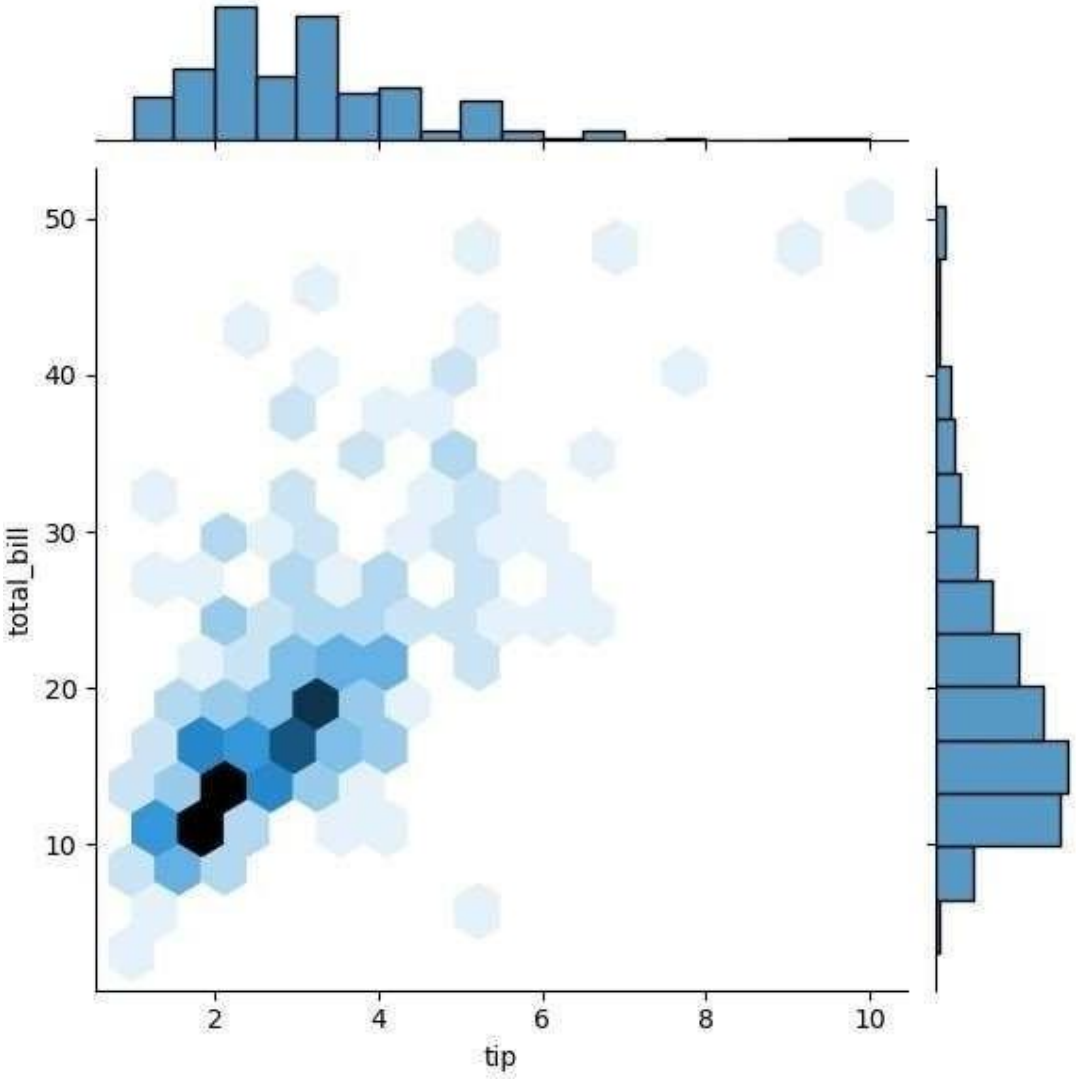

```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="reg")
```

```
<seaborn.axisgrid.JointGrid at 0x1cbb1f8da20
```



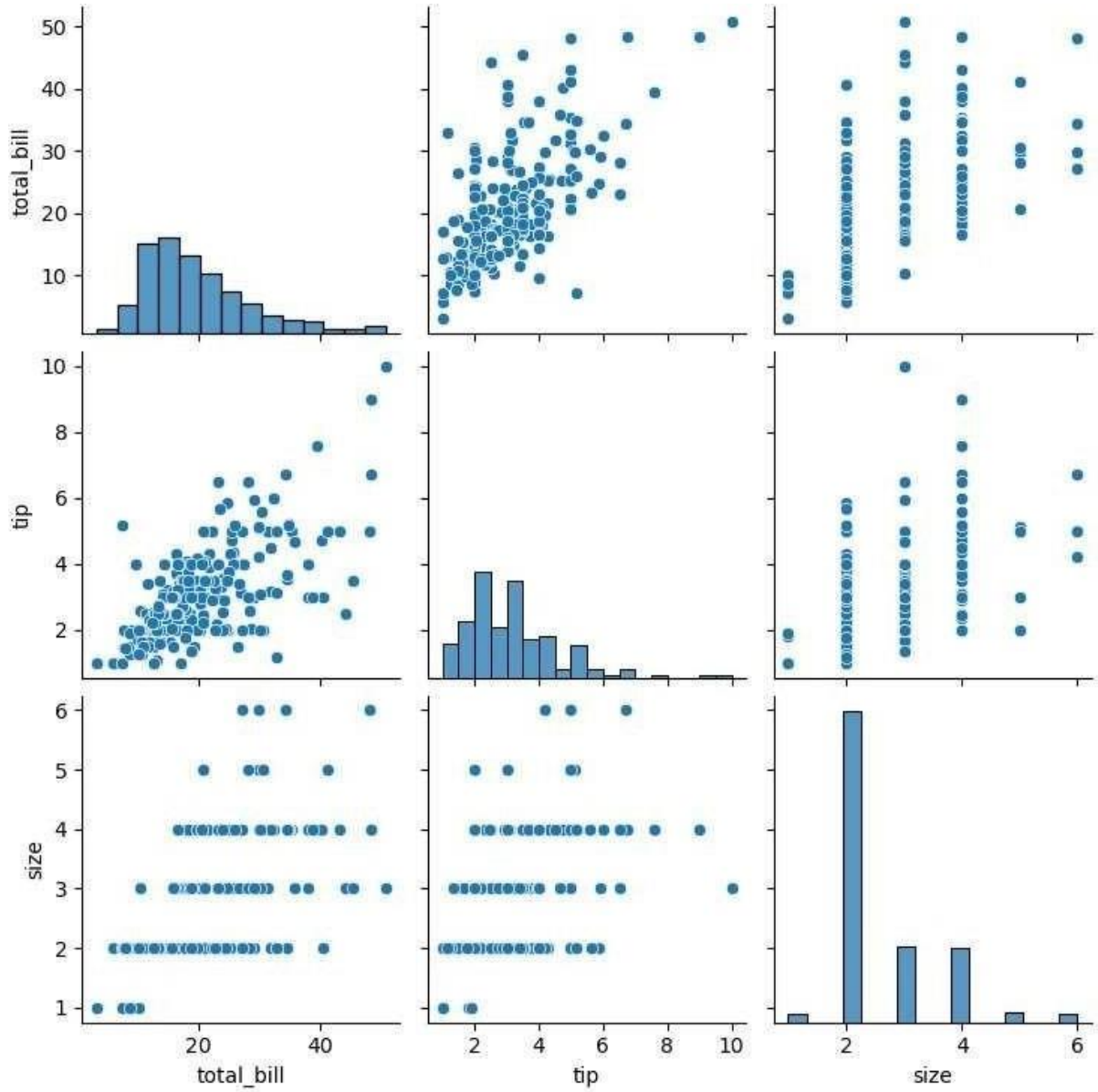

```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex")
```

```
<seaborn.axisgrid.JointGrid at 0x1cbb258da20
```




```
sns.pairplot(tips)
```

```
<seaborn.axisgrid.PairGrid at 0x1cbb391a7d0>
```

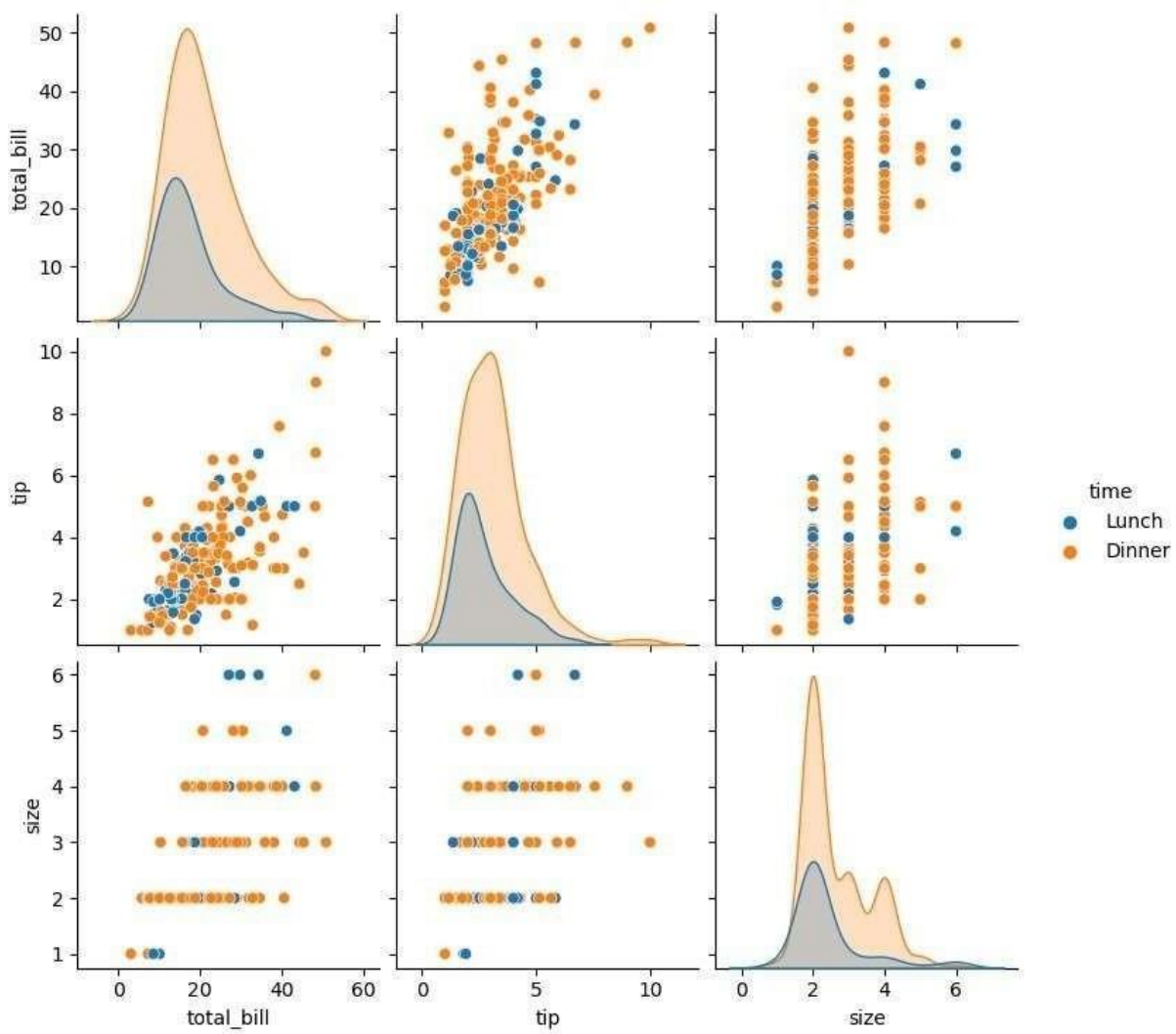



```
tips.time.value_counts()
```

```
Dinner    176
Lunch      68
Name: time, dtype: int64
```

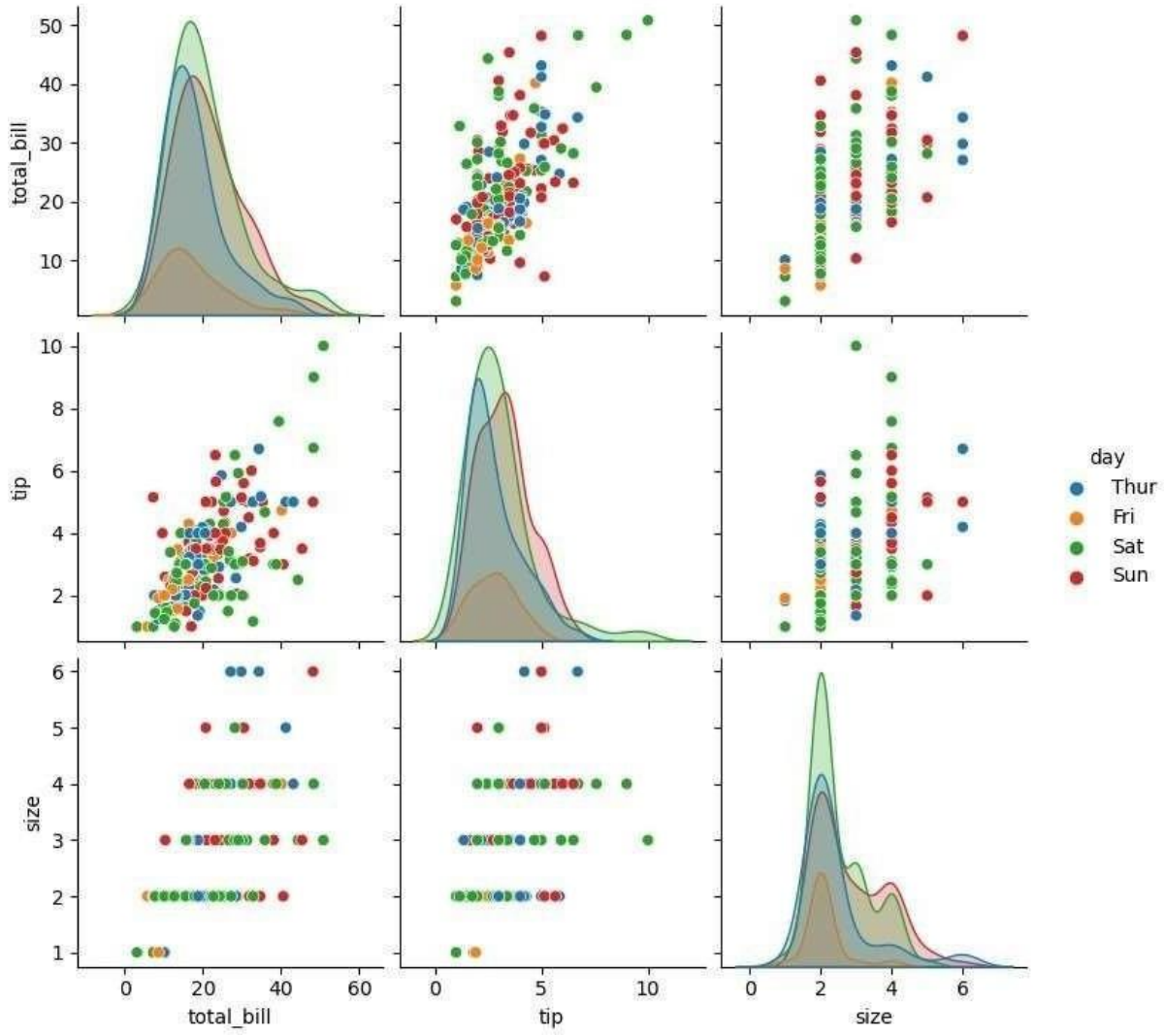
```
sns.pairplot(tips,hue='time')
```

```
<seaborn.axisgrid.PairGrid at 0x1cbb258d8a0>
```



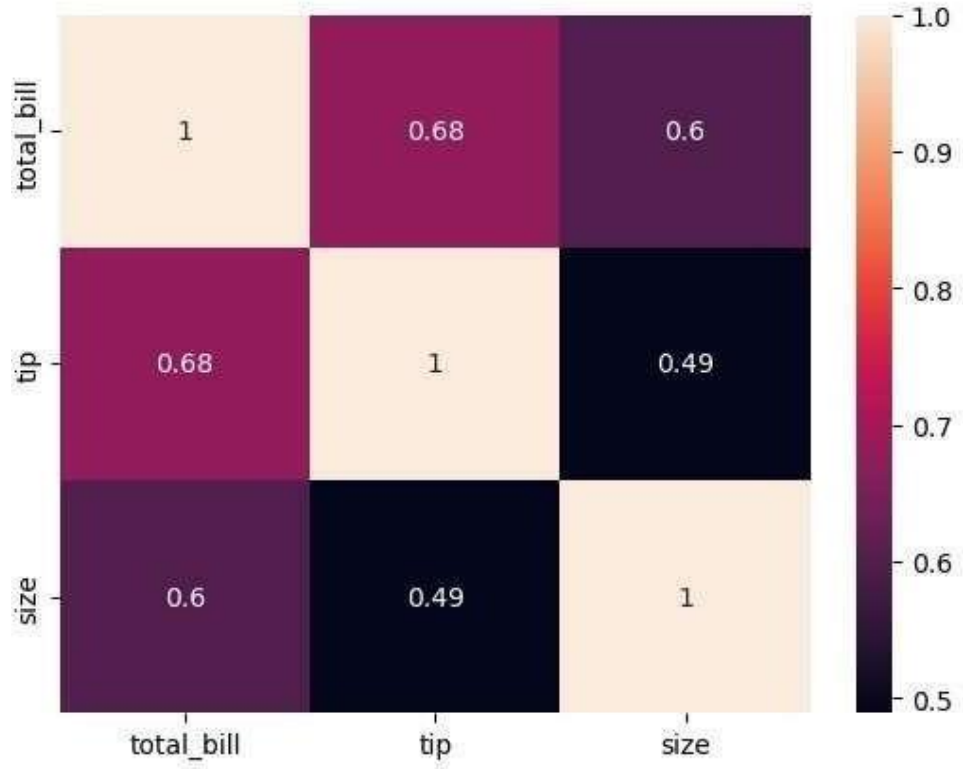

```
sns.pairplot(tips,hue='day')
```

```
<seaborn.axisgrid.PairGrid at 0x1cbb20b9120>
```



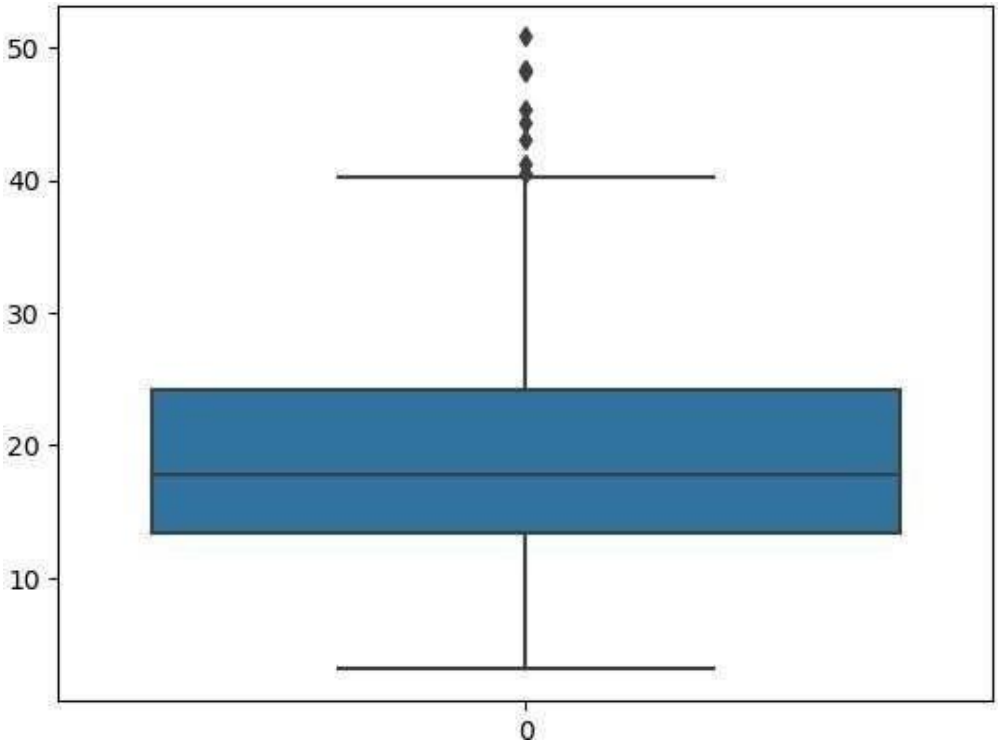

```
sns.heatmap(tips.corr(numeric_only=True),annot=True)
```

```
<Axes:
```



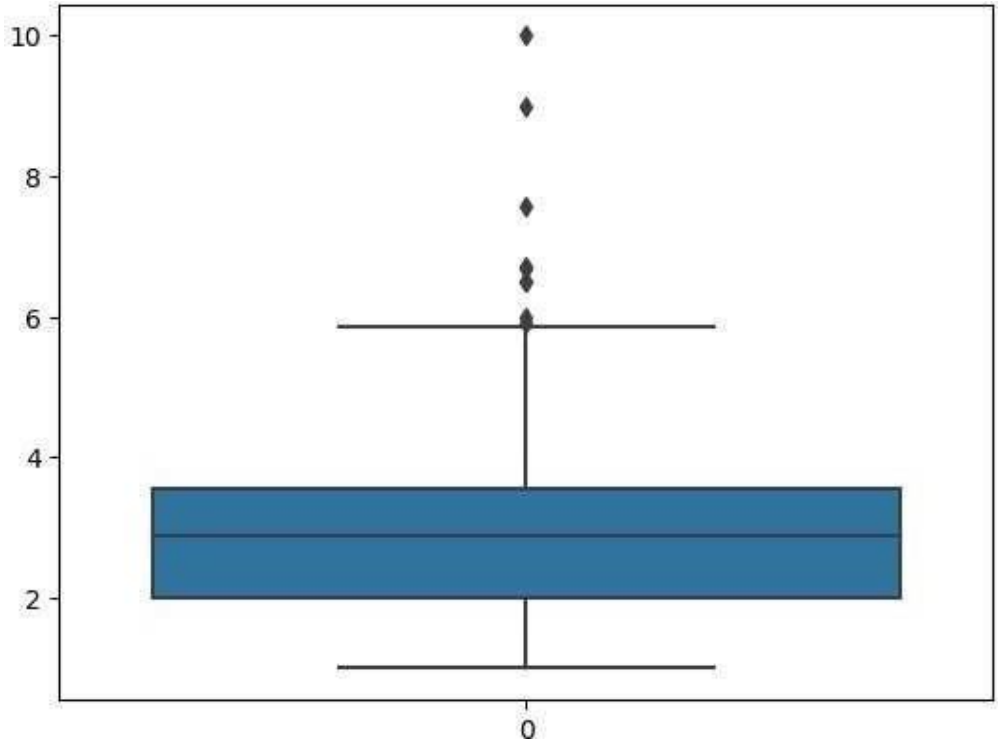

```
sns.boxplot(tips.total_bill)
```

<Axes:



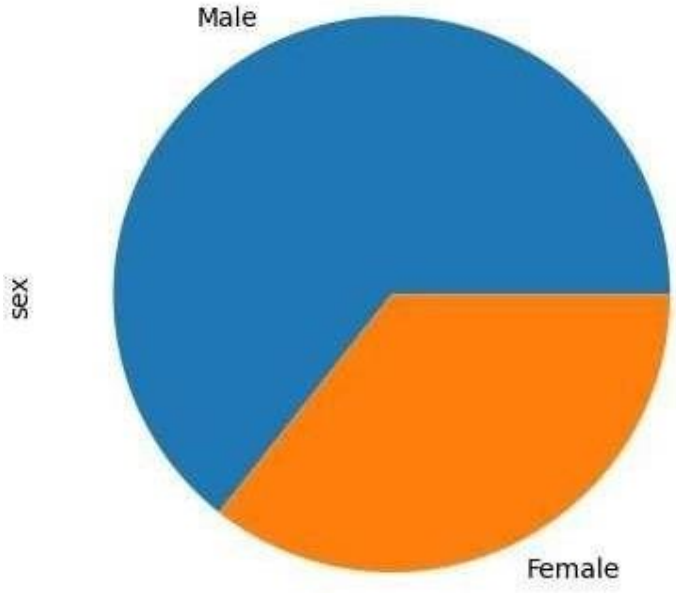

```
sns.boxplot(tips.tip)
```

<Axes:



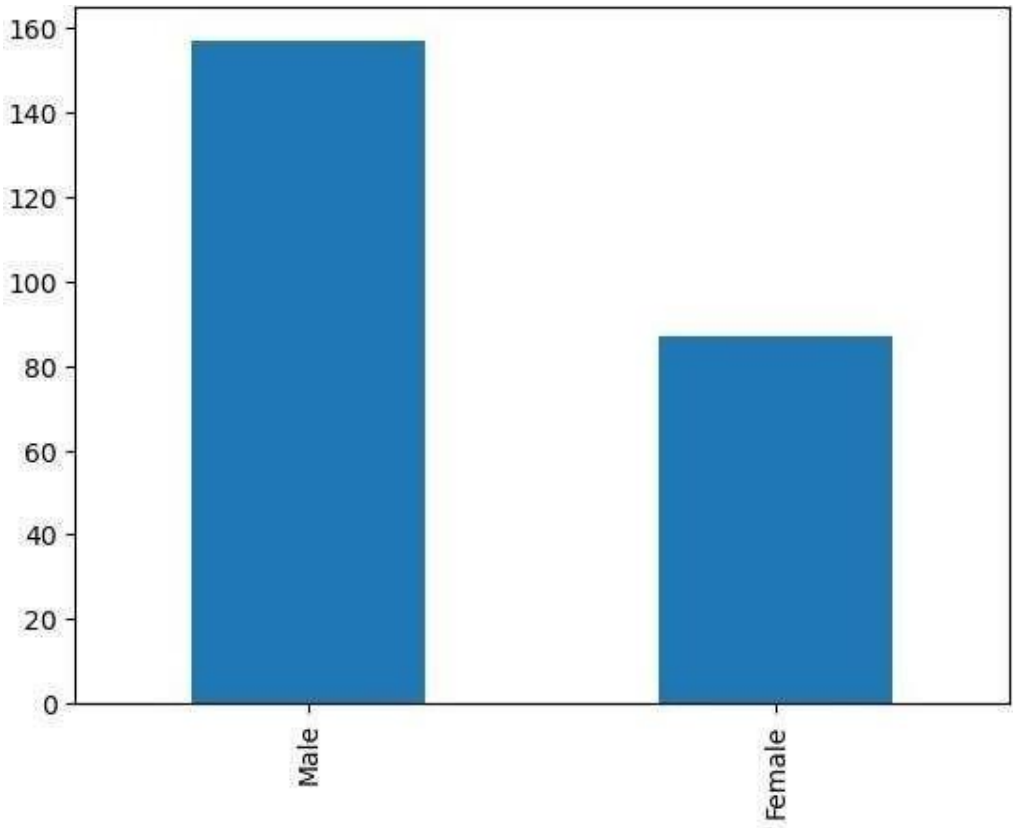

```
tips.sex.value_counts().plot(kind='pie')
```

<Axes: ylabel='sex'




```
tips.sex.value_counts().plot(kind='bar')
```

```
<Axes:
```


160
140
120
100
80
60
40
20
0
Male
Female

```
import numpy as np import pandas as
pd
df=pd.read_csv('E:/Salary_data.csv') df df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29 Data columns (total 2
columns):
 #   Column          Non-Null Count  Dtype
--  ----          --------- ---·
 0  YearsExperience  30 non-null     float64  1   Salary          30
non-null     int64   dtypes: float64(1), int64(1) memory usage: 608.0
bytes

df.dropna(inplace=True) df.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29 Data columns (total 2
columns):
 #   Column          Non-Null Count  Dtype
--  ----          --------- ---·
 0  YearsExperience  30 non-null     float64  1   Salary          30
non-null     int64   dtypes: float64(1), int64(1) memory usage: 608.0
bytes df.describe()
      YearsExperience          Salary count         30.000000
30.000000 mean             5.313333     76003.000000 std
2.837888      27414.429785  min                   1.100000
37731.000000 25%          3.200000   56720.750000
50%         4.700000   65237.000000 75%          7.700000
100544.750000 max          10.500000  122391.000000




features=df.iloc[:,[0]].values label=df.iloc[:,[1]].values
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(features,label,test_siz e=0.2,random_state=42)
from sklearn.linear_model import LinearRegression
model=LinearRegression() model.fit(x_train,y_train)

LinearRegression()
```

```
model.score(x_train,y_train)
```

```
0.9645401573418146
```

```
model.score(x_test,y_test)
```

```
0.9024461774180497
```

```
model.coef_
```

```
array([[9423.81532303]])
```

```
model.intercept_
```

```
array([25321.58301178])
```

```
import pickle pickle.dump(model,open('SalaryPred.model','wb'))
model=pickle.load(open('SalaryPred.model','rb')) yr_of_exp=float(input("Enter Years of
Experience: ")) yr_of_exp_NP=np.array([[yr_of_exp]]) Salary=model.predict(yr_of_exp_NP)
```

```
Enter Years of Experience: 44
```

```
print("Estimated Salary for {} years of experience is {}: " .format(yr_of_exp,Salary))
```

Estimated Salary for 44.0 years of experience is [[439969.45722514]]:

```
import numpy as np import pandas as pd
df=pd.read_csv('E:/Social_Network_Ads.csv') df
```

```
    User ID  Gender  Age  EstimatedSalary  Purchased
0          15624510    Male   19            19000          0
1          15810944    Male   35            20000          0
2          15668575  Female   26            43000          0
3          15603246  Female   27            57000          0
4          15804002    Male   19            76000          0 ..        ...      ...  ...               ...
... 395 15691863  Female   46            41000          1
396       15706071    Male   51            23000          1
397       15654296  Female   50            20000          1
398       15755018    Male   36            33000          0
399       15594041  Female   49            36000          1
```

```
[400 rows x 5 columns]
```

```
    User ID  Gender  Age  EstimatedSalary  Purchased 0 15624510     Male    19 df .head()
 19000          0
 1     15810944    Male   35            20000          0
 2     15668575  Female   26            43000          0
 3     15603246  Female   27            57000          0
 4     15804002    Male   19            76000          0
```

```
features=df.iloc[:,[2,3]].values
label=df.iloc[:,4].values features
```

```
array([[    1  ,  19000 ,
                          [    35,  20000],
       [    26,  43000],
       [    27,  57000],
       [    19,  76000],
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       [    18,  82000],
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```

```
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```

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```

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label
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    1
0,
    0
                                                                                ,
                                                                                ,
                                                                                ,
                                                                                ,
```

```
0,
```

```
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```

```
0,
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0,
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```

```
0,
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1,
       0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 0, 0,  1,
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1,
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       0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0,  1,
       1, 1, 0, 1], dtype=int64)
```

```
from sklearn.model_selection import train_test_split from sklearn.linear_model import
LogisticRegression

for i in range(1,401):
    x_train,x_test,y_train,y_test=train_test_split(features,label,test_siz
e=0.2, random_state=42)    model=LogisticRegression()    model.fit(x_train,y_train)
train_score=model.score(x_train,y_train)    test_score=model.score(x_test,y_test)    if
test_score>train_score:
print("Test {} Train{} Random State {}".format(test_score,train_score,i))
```

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Test 0.65 Train0.640625 Random State 1
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Test 0.65 Train0.640625 Random State 398
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x_train,x_test,y_train,y_test=train_test_split(features,label,test_siz e=0.2,random_state=42)
finalModel=LogisticRegression() finalModel.fit(x_train,y_train)
LogisticRegression()
print(finalModel.score(x_train,y_train))  print(finalModel.score(x_test,y_test))
```

```
from sklearn.metrics import classification_report
print(classification_report(label,finalModel.predict(features)))
precision    recall  f1-score   support
0          0.64      1.00      0.78       257 1      0.00      0.00      0.00
143
   accuracy                           0.64       400 macro avg       0.32      0.50      0.39
400 weighted avg       0.41      0.64      0.50       400
```

```
C:\ProgramData\anaconda3\lib\site-packages\sklearn\metrics\
_classification.py:1344: UndefinedMetricWarning: Precision and F-score are ill-defined and being set to 0.0
in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
C:\ProgramData\anaconda3\lib\site-packages\sklearn\metrics\
_classification.py:1344: UndefinedMetricWarning: Precision and F-score are ill-defined and being set to 0.0
in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
C:\ProgramData\anaconda3\lib\site-packages\sklearn\metrics\
_classification.py:1344: UndefinedMetricWarning: Precision and F-score are ill-defined and being set to 0.0
in labels with no predicted samples. Use `zero_division` parameter to control this behavior.
_warn_prf(average, modifier, msg_start, len(result))
```

```
import numpy as np import pandas as pd
df=pd.read_csv('E:/Iris.csv') df.info()

<class 'pandas.core.frame.DataFrame'> RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
 #   Column        Non-Null Count  Dtype
---  ------        --------------  -----   0             sepal.length  150 non-
null    float64
1           sepal.width   150 non-null    float64
2           petal.length  150 non-null    float64
3           petal.width   150 non-null    float64 4   variety       150 nonnull    object  dtypes: float64(4),
object(1) memory usage: 6.0+ KB df.variety.value_counts()
Setosa        50
Versicolor    50
Virginica     50
Name: variety, dtype: int64
   sepal.length  sepal.width  petal.length  petal.width variety 0          5.1          3.5           1.4          0.2 df.head()
 Setosa
 1                    4.9          3.0           1.4          0.2  Setosa
 2                    4.7          3.2           1.3          0.2  Setosa
 3                    4.6          3.1           1.5          0.2  Setosa
 4                    5.0          3.6           1.4          0.2  Setosa
features=df.iloc[:,:-1].values  label=df.iloc[:,4].values

from sklearn.model_selection import train_test_split from sklearn.neighbors import
KNeighborsClassifier
xtrain,xtest,ytrain,ytest=train_test_split(features,label,test_size=.2
,random_state=42) model_KNN=KNeighborsClassifier(n_neighbors=5)
model_KNN.fit(xtrain,ytrain)
KNeighborsClassifier()
print(model_KNN.score(xtrain,ytrain))  print(model_KNN.score(xtest,ytest))

 0.9666666666666667
 1.0
```

```
from sklearn.metrics import confusion_matrix confusion_matrix(label,model_KNN.predict(features))
 array([[50,  0,  0], [ 0, 47,  3],

       [ 0,  1, 49]], dtype=int64)
from sklearn.metrics import classification_report
print(classification  report(label,model  KNN.predict(features)))
precision    recall  f1-score   support

     Setosa       1.00      1.00      1.00        50

 Versicolor       0.98      0.94      0.96        50    Virginica       0.94      0.98      0.96
50     accuracy                           0.97       150 macro avg       0.97      0.97      0.97
150 weighted avg       0.97      0.97      0.97       150
```

```
import numpy as np import pandas as
pd
import matplotlib.pyplot as plt import seaborn as
sns %matplotlib inline
df=pd.read_csv('E:/Mall_Customers.csv') df.info()
```

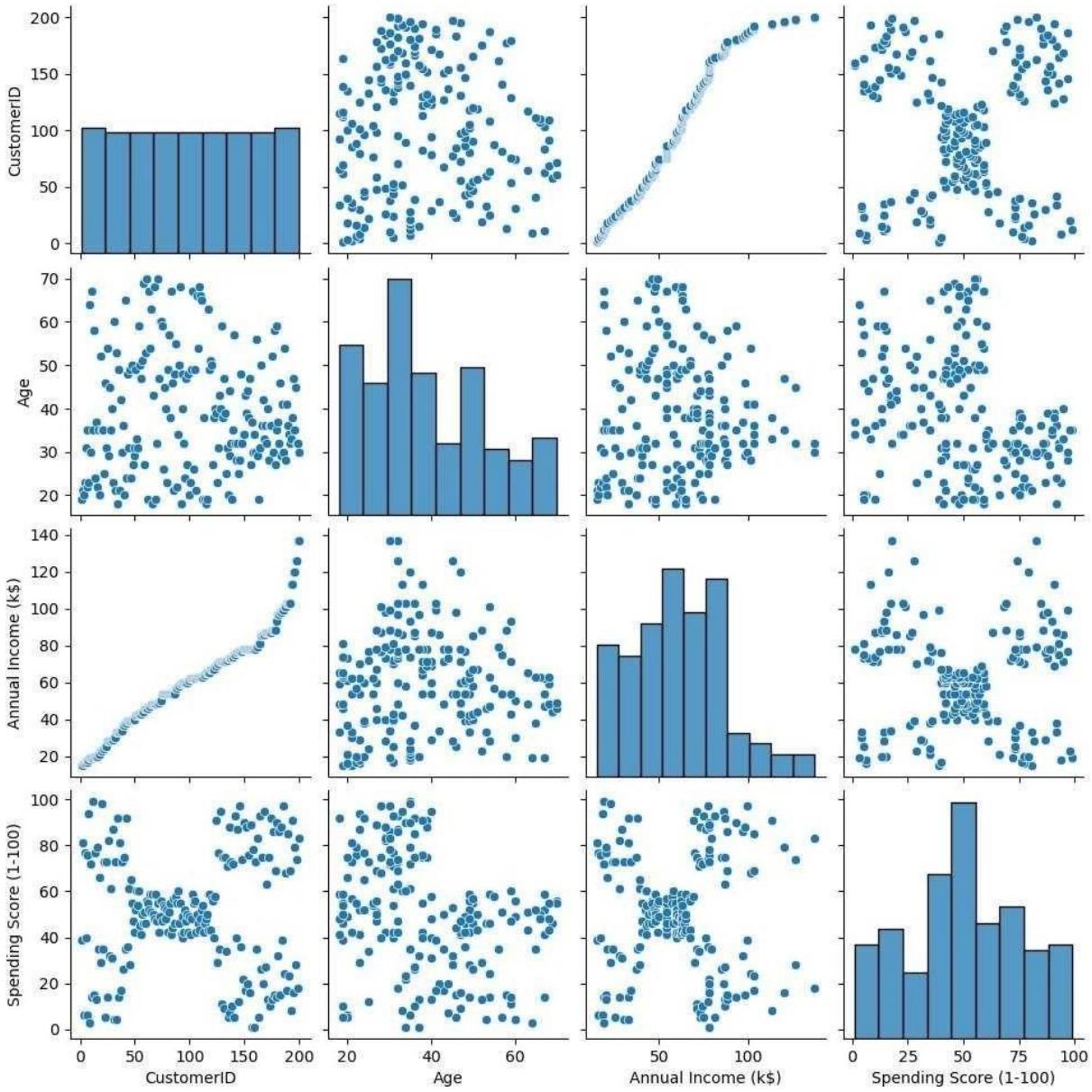
```
<class 'pandas.core.frame.DataFrame'> RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----  0   CustomerID              200 non-null
int64
1         Gender                  200 non-null    object
2         Age                     200 non-null    int64
3         Annual Income (k$)      200 non-null    int64  4   Spending
Score (1-100)  200 non-null    int64  dtypes: int64(4),
```

	CustomerID	Gender	Age	Annual Income (k$)	Spending Score (1-100)
0	1	Male	19	15	39
1	2	Male	21	15	81
2	3	Female	20	16	6
3	4	Female	23	16	77
4	5	Female	31	17	40

```
object(1) memory usage: 7.9+ KB df.head()
```

```
sns.pairplot(df)
```

```
<seaborn.axisgrid.PairGrid at 0x1dc59c15c90>
```




```
features =df.iloc[:,[                3 ,4  ]] .values

from sklearn.cluster  import KMeans
model  =  KMeans(n_clusters  =  5  )
model.fit(features)  KMeans(n_clusters
= 5 )
```

```
C:\ProgramData\anaconda3\lib\site-packages\sklearn\cluster\_kmeans.py:870: FutureWarning: The
default value of `n_init ` will  change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly  to
suppress the warnin g  warnings.warn (
```

```
C:\ProgramData\anaconda3\lib\site-packages\sklearn\cluster\
_kmeans.py:1382: 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(
```

```
KMeans(n_clusters=5)
```

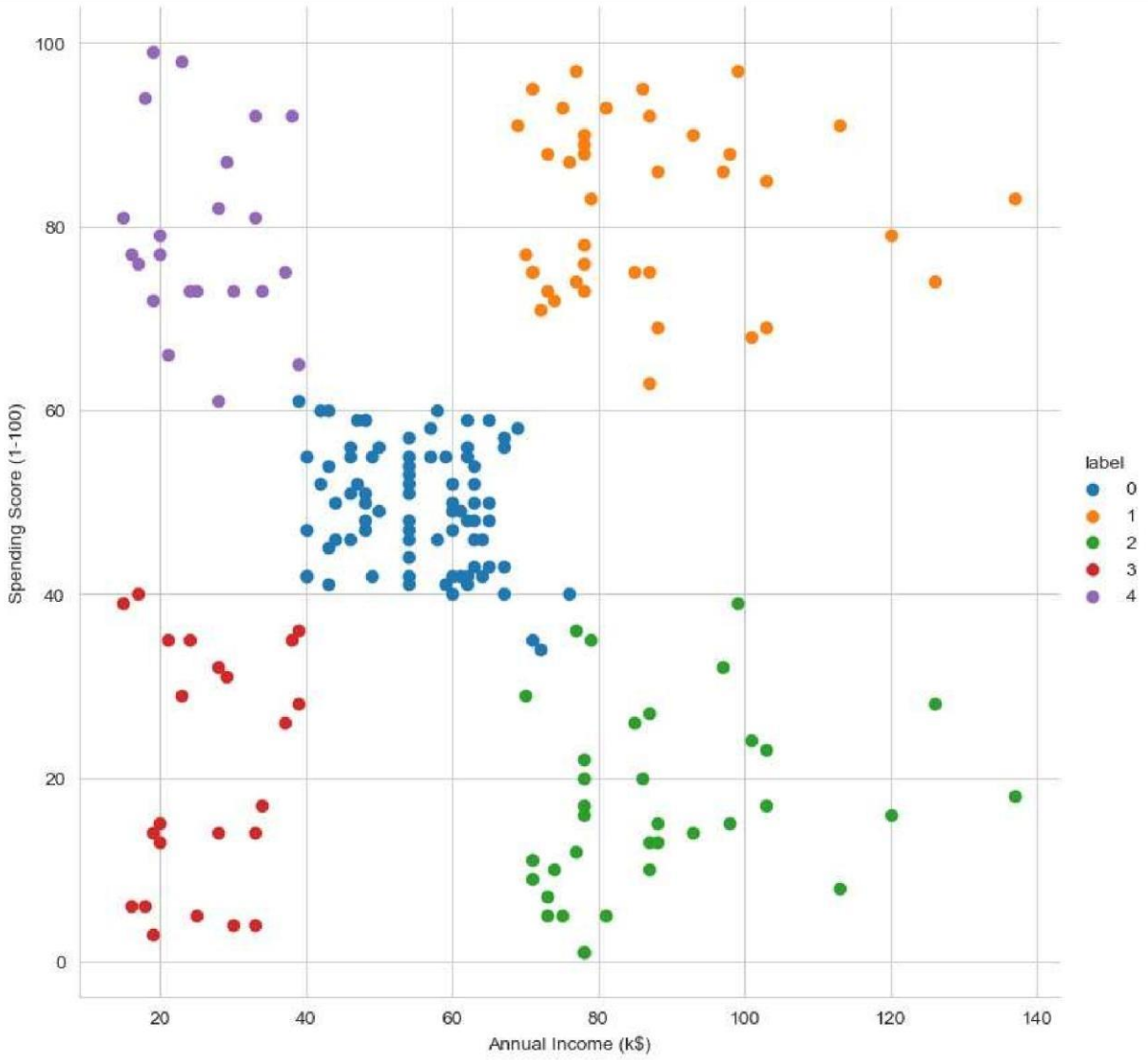
```
Final=df.iloc[:,[3,4]]
Final['label']=model.predict(features)
Final.head()
```

```
C:\Users\REC\AppData\Local\Temp\ipykernel_7552\470183701.py:2:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
```

	Annual Income (k$)	Spending Score (1-100)	label
0	15	39	3
1	15	81	4
2	16	6	3
3	16	77	4 4
	17	40	3

```
sns.set_style("whitegrid")  sns.FacetGrid(Final,hue="label",height=8)  \
.map(plt.scatter,"Annual Income (k$)", "Spending Score (1-100)") \
.add_legend(); plt.show()
```




```
features_el=df.iloc[:,[2,3,4]].values
from sklearn.cluster import KMeans
wcss=[]
for i in range(1,10):
    model=KMeans(n_clusters=i)
    model.fit(features_el)
    wcss.append(model.inertia_)
plt.plot(range(1,10),wcss)
```

```
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_kmeans.py:870: FutureWarning: The default value of `n_init` will
change from 10 to 'auto' in 1.4. Set the value of `n_init` explicitly
to suppress the warning
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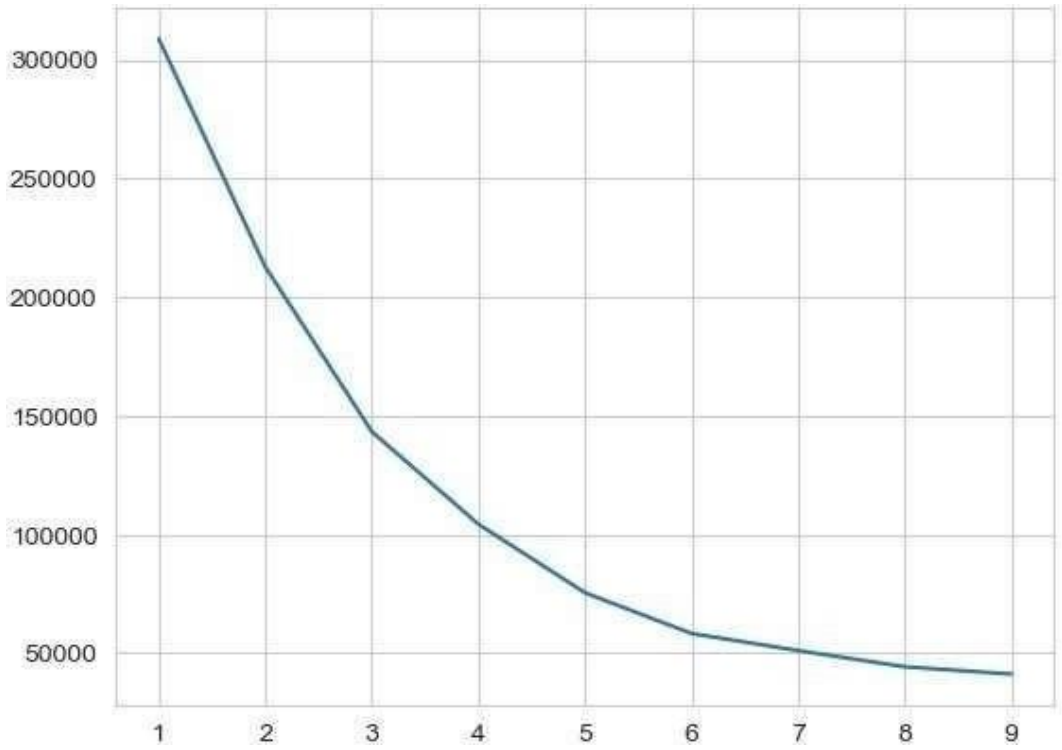
[<matplotlib.lines.Line2D at 0x1dc61c56380>]



T-statistic: 1.993

P-value: 0.0774

Fail to Reject Null Hypothesis → No significant difference.

```
import numpy as np from scipy import stats
marks = np.array([72, 68, 75, 70, 74, 69, 71, 73, 70, 72]) mu_0 = 70
t_stat, p_value = stats.ttest_1samp(marks, mu_0) print(f"Tstatistic: {t_stat:.3f}") print(f"P-value:
{p_value:.4f}") alpha = 0.05 if p_value<alpha:     print("Reject Null Hypothesis → Mean is significantly
different from 70.") else:     print("Fail to Reject
                                                                                    Null Hypothesis
                                                                                    → No
```

Z-statistic: 2.400

P-value: 0.0164)

Reject Null Hypothesis → Mean is significantly different from 50 g.

```
import numpy as np from math import sqrt from scipy.stats import norm x_bar = 51.2 mu_0 = 50
sigma = 3 n = 36  z_stat = (x_bar - mu_0) / (sigma / sqrt(n)) p_value = 2 * (1 -
norm.cdf(abs(z_stat))) print(f"Z-statistic: {z_stat:.3f}") print(f"P-value: {p_value:.4f}") alpha =
0.05 if p_value < alpha:
print("Reject Null Hypothesis → Mean is significantly different from 50 g.") else:      print("Fail to
```

Reject Null Hypothesis → No significant difference.")

```
import numpy as np from scipy import stats

A         = [20, 22,
23]
B         = [19, 20,
18] C = [25, 27,
26] f_stat, p_value = stats.f_oneway(A, B, C)
```

```
print(f"F-statistic: {f_stat:.3f}") print(f"P-
value: {p_value:.4f}")

alpha = 0.05 if p_value < alpha:      print("Reject Null
Hypothesis → Means are significantly different.") else:
print("Fail to Reject Null Hypothesis → No significant
difference.")
F-statistic: 25.923
P-value: 0.0011

Reject Null Hypothesis → Means are significantly different.
```