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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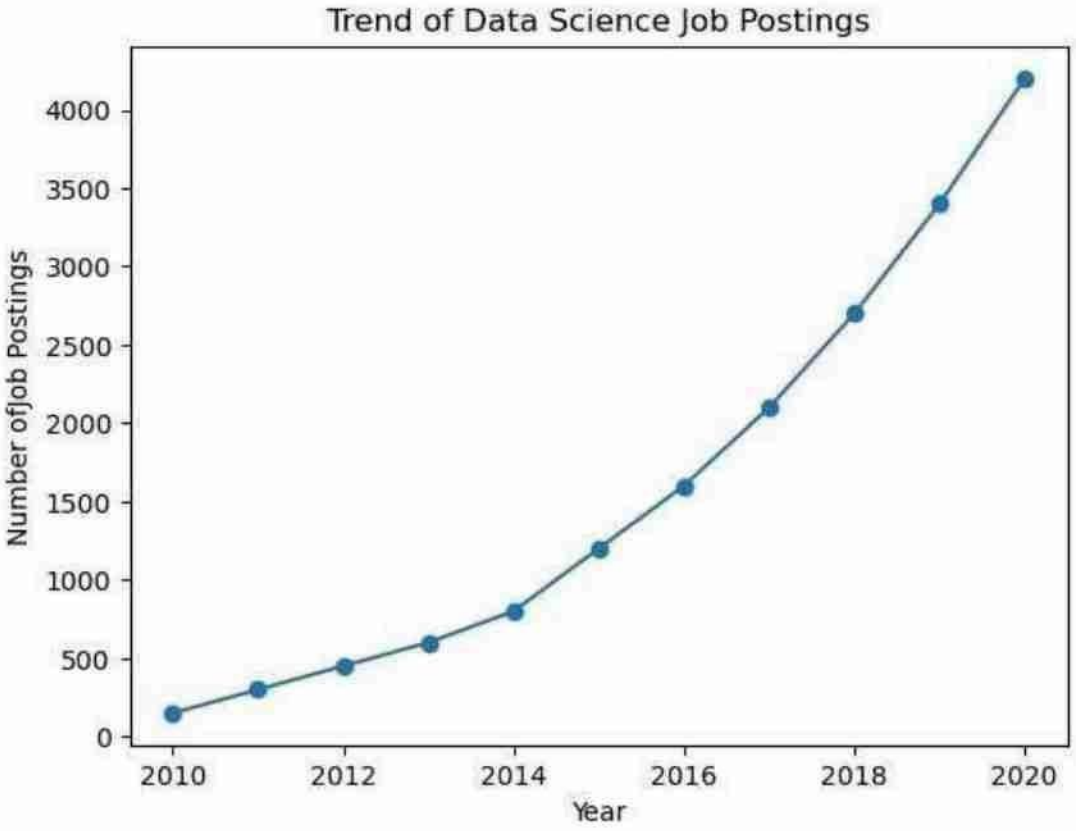
Exercise 1: A]

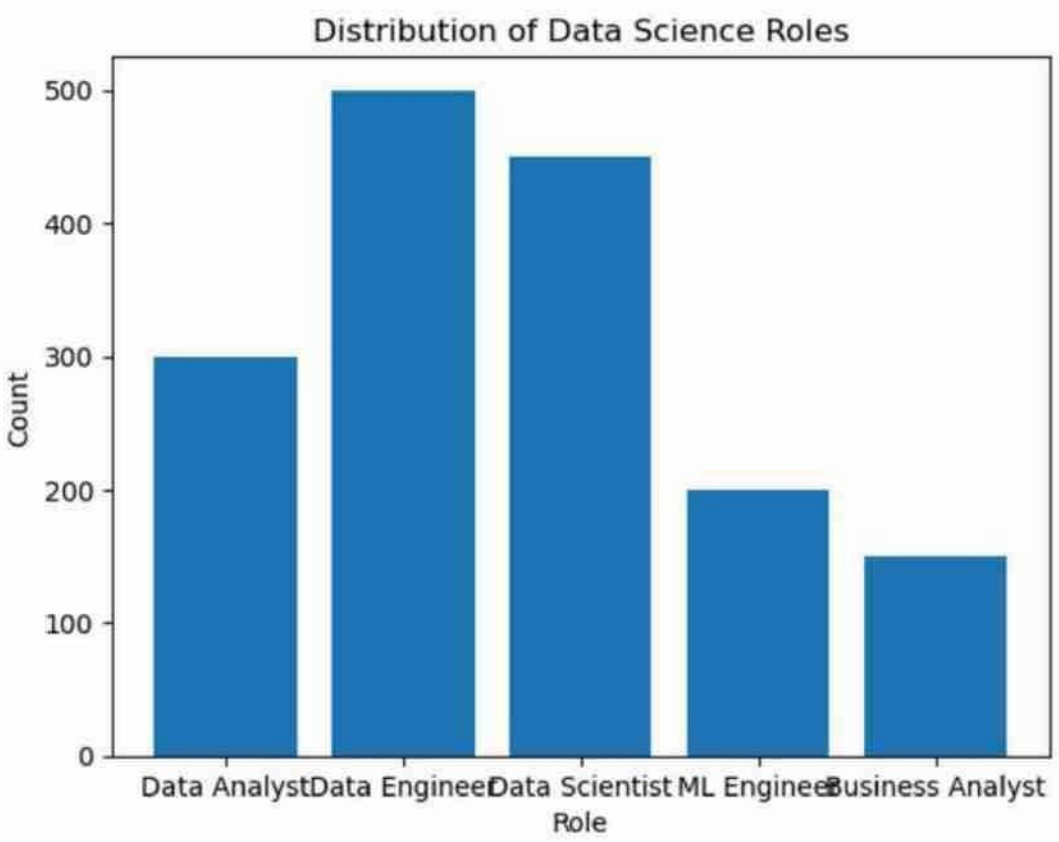
```
import pandas aspdimport matplotlib.pyplot
as plt
data = {'Year': list(range(2010, 2021)),
'Job Postings': [150, 300, 450, 600, 800, 1200, 1600, 2100, 2700,
3400, 4200]}

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.
```

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

{6 8}}

D]

```
 romcryptography.fernet import Fernet key =
Fernet.generate_key() f = Fernet(key)
 oken= f.encrypt(b"Rajalakshmi Engineering College") token b'...'
 .decrypt(token) b'Rajalakshmi Engineering College' key =
Fernet.generate_key() cipher_suite = Fernet(key) plain_text =
b"Rajalakshmi Engineering College." cipher_text =
 ipher_suite.encrypt(plain_text) decrypted_text =
 ipher_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'gAAAAABolBkq8QPVjqIo662CR3sV8YryaRBeq-6ysuG-FyeHltJZePo_537_IUtW3ALng5dvaGzFo5uW23q- hDEwDOVwlrwzrGBiOC_CleO6dyfujpyEn-TQnKRvI0mwCCiVnEghUdgV' Decrypted Data: b'Rajalakshmi Engineering College.'

Exercise 2

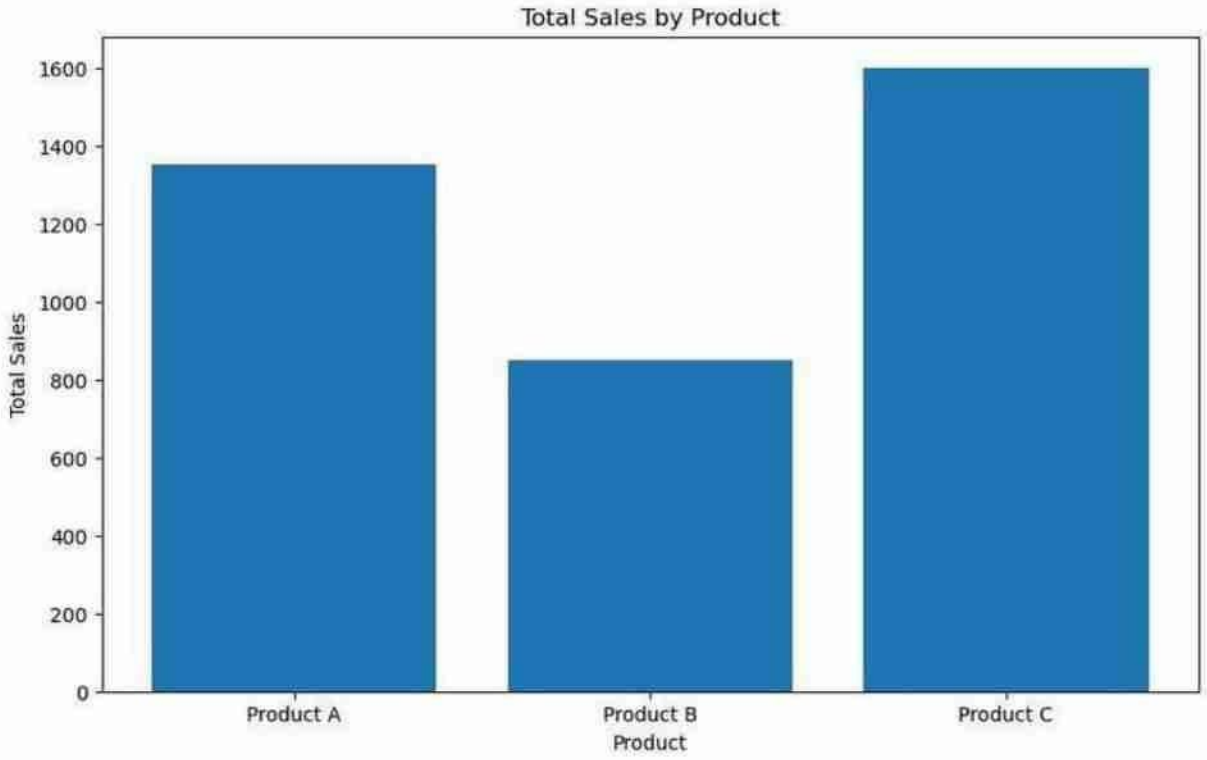
```
import pandas as pd import numpy as np import
matplotlib.pyplot as plt df =
pd.read_csv('E:/sales_data.csv') print(df.head())
print(df.isnull().sum())
df['Sales'].fillna(df['Sales'].mean(), inplace=True)
df.dropna(subset=['Product', 'Quantity', 'Region'], inplace=True) print(df.describe())
product_summary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

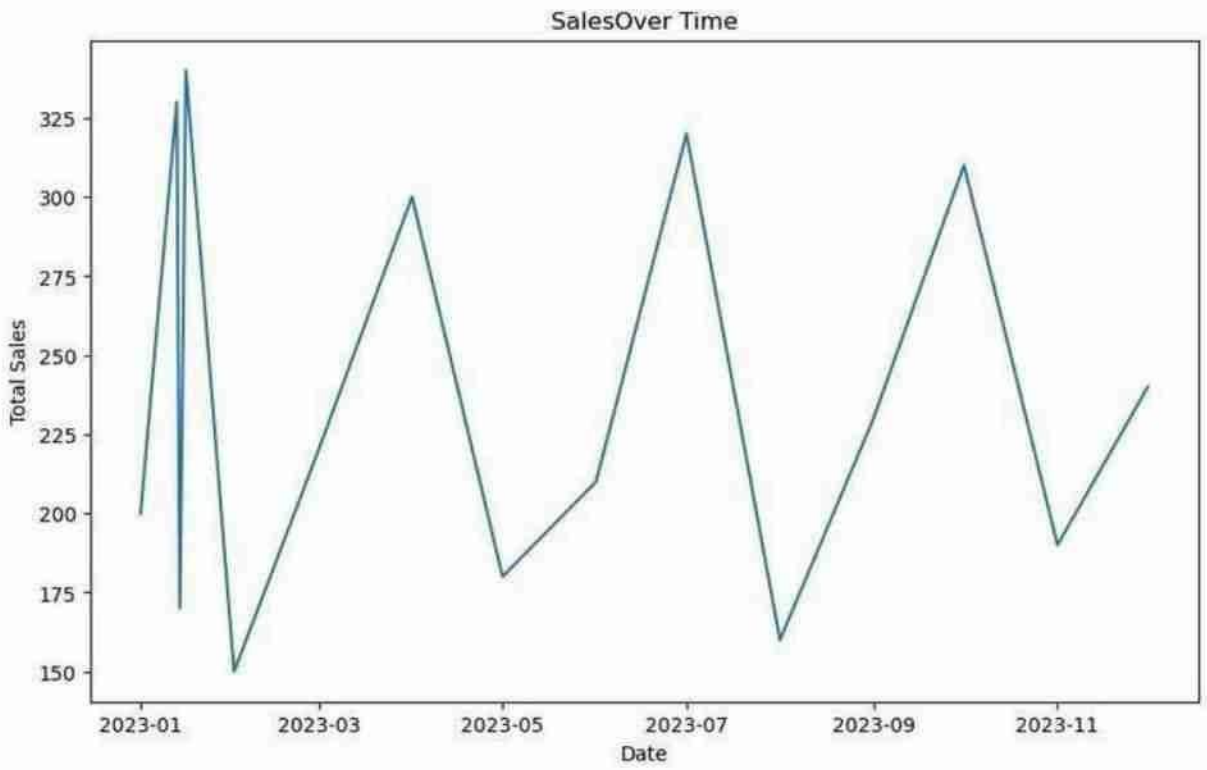
```
3   04-01-2023 Product C   300       6 East
4   05-01-2023 Product B 180         4 West
Date       0
Product    0
Sales      0
Quantity   0 Region     0
dtype: int64
              Sales Quantity count 16.000000
    16.000000 mean 237.500000 5.375000
std           64.031242       1.746425 min
150.000000 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()
```



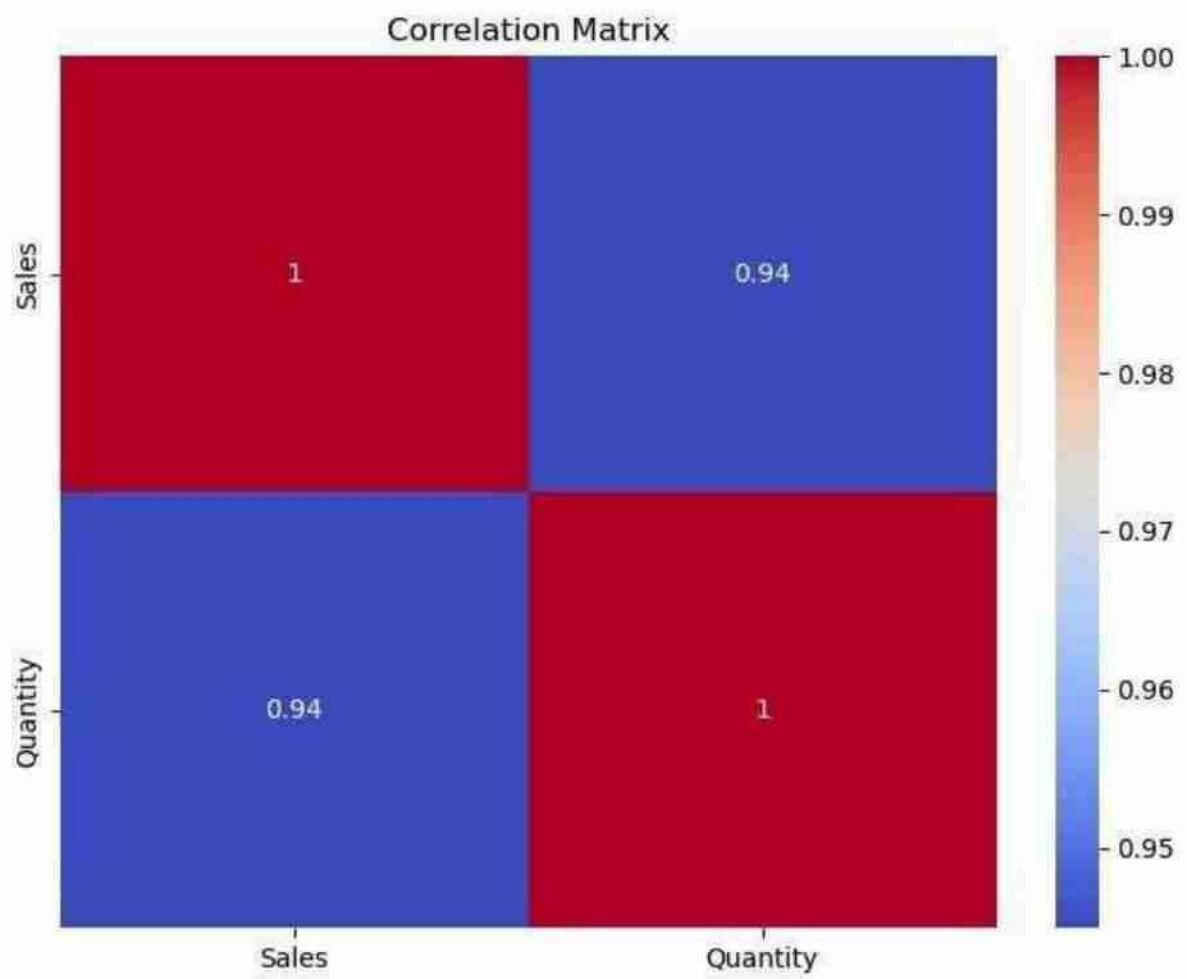

```
C:\Users\REC\AppData\Local\Temp\ipykernel_7888\2790720894.py:7:
UserWarning: Parsing dates in DD/MM/YYYY format when dayfirst=False
(the default) was specified. This may lead to inconsistently parsed
dates! Specify a format to ensure consistent parsing.
  df['Date'] = pd.to_datetime(df['Date'])
```



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

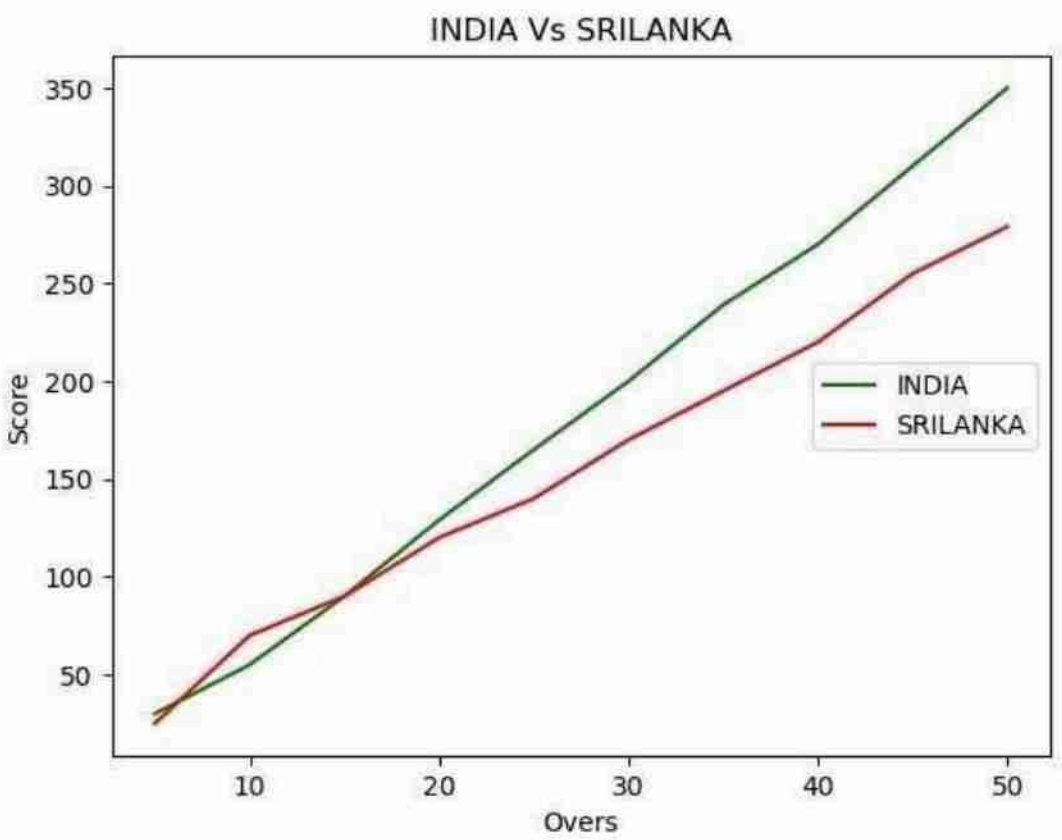
```
C:\Users\REC\AppData\Local\Temp\ipykernel_7888\240701101.py:18:
FutureWarning: The default value of numeric_only in DataFrame.corr is
deprecated. In a future version, it will default to False. Select only
valid columns or specify the value of numeric_only to silence this
warning.
  correlation_matrix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



Exercise 3:

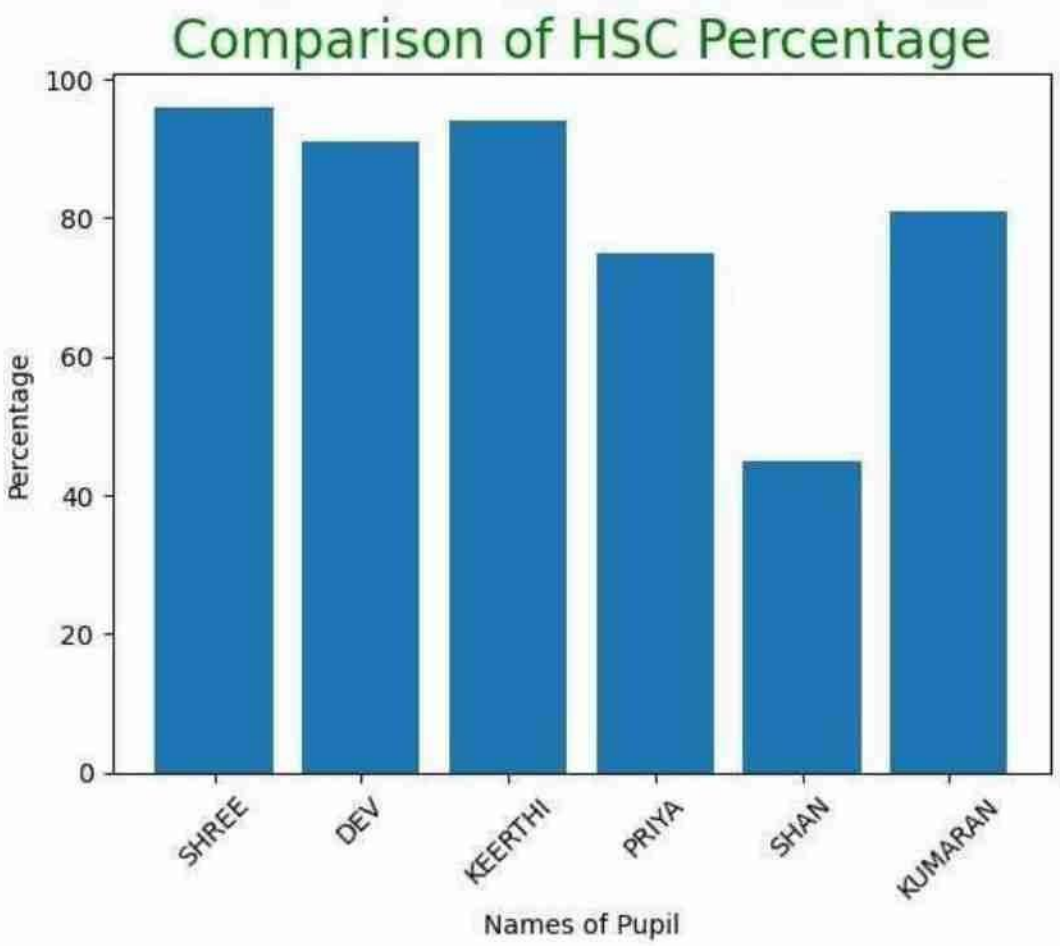
A]

```
importmatplotlib.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]

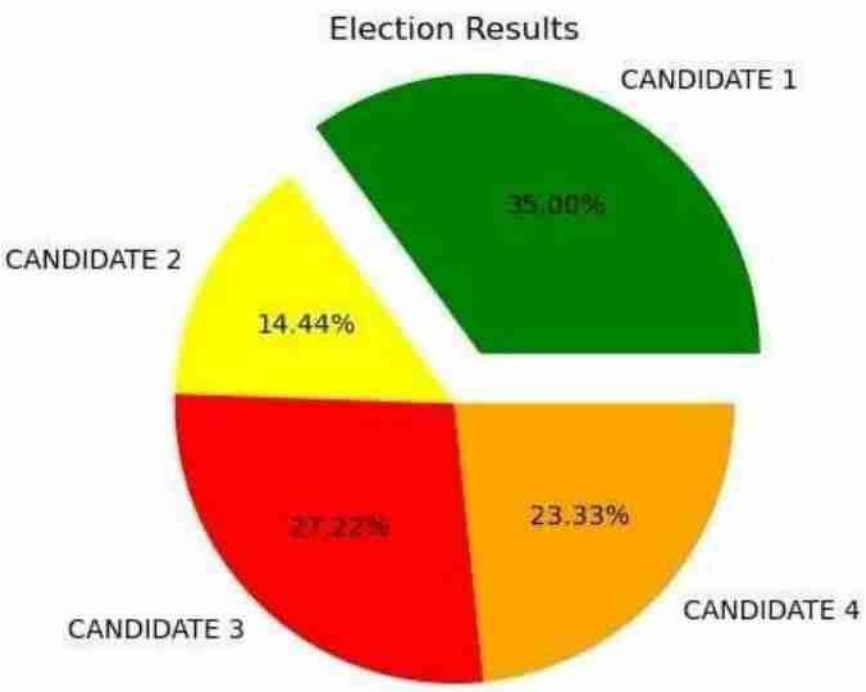
```
Names = ['SHREE', 'DEV', 'KEERTHI', 'PRIYA', 'SHAN', 'KUMARAN'] xaxis = np.arange(len(Names))
Percentage_hsc = [96, 91, 94, 75, 45, 81] hscmark.bar(Names, Percentage_hsc)
hscmark.xticks(xaxis, Names, rotation=45) hscmark.xlabel("Names of Pupil")
hscmark.ylabel("Percentage")
hscmark.title("Comparison 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\
                                                                0
1                                  1   85    66    29   0 26.6
                                   6  148    72    35   0 33.6
```

Exercise 4:

2 8 183 64 0 0 23.3

3 1 89 66 23 94 28.1

4 0 137 40 35

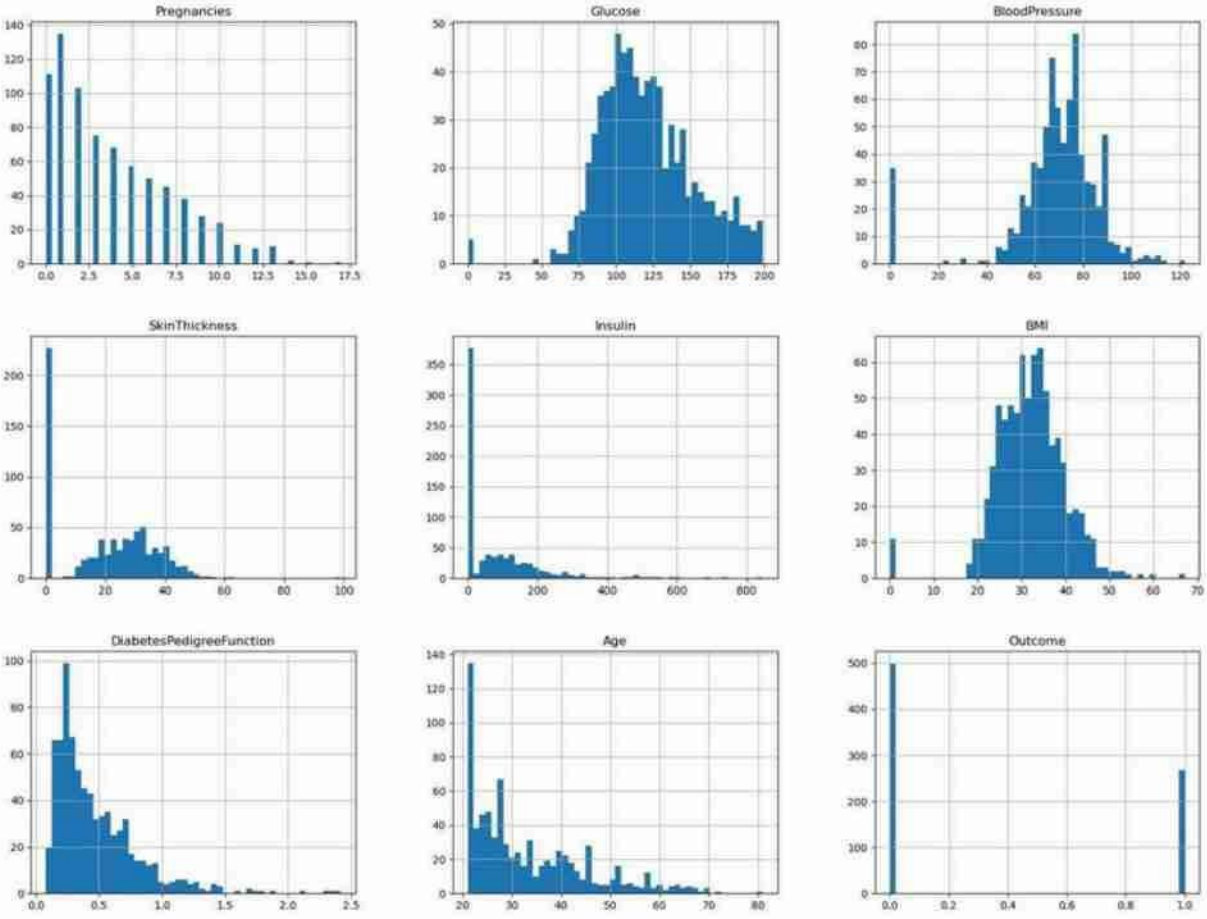
168 43.1

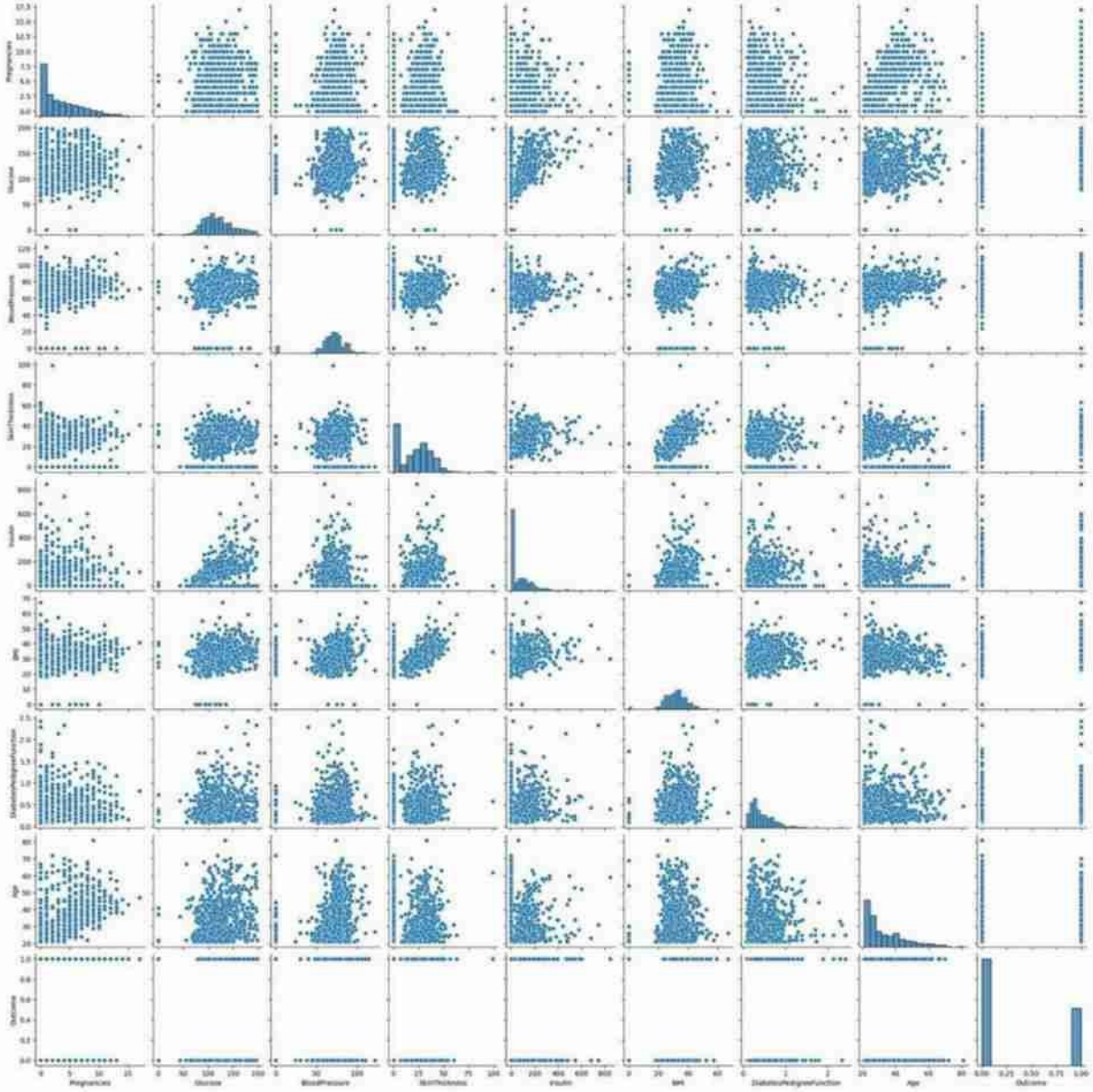
DiabetesPedigreeFunction Age Outcome
0 0.627 50 1
1 0.351 31 0
2 0.672 32 1
3 0.167 21 0
4 2.288 33 1
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 768 entries, 0 to 767
Data columns (total 9 columns):
Column Non-Null Count Dtype
--- ------ -------------- -----
0 Pregnancies 768 non-null int64
1 Glucose 768 non-null int64
2 BloodPressure 768 non-null int64 3 SkinThickness 768 non-null int64 4 Insulin
5 768 non-null int64
6 BMI 768 non-null float64
7 DiabetesPedigreeFunction 768 non-null float64
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 314056	

```
10    30-35          5    RedFox       non-Veg -6755
   NoOfPax EstimatedSalary Age_Group.1 0 2          40000
20-25 1 3          59000      30-35 2 2          30000      25-30
  3          2          120000      20-25 4          2          45000
                                  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
   CustomerIDAge_GroupRating(1-5)       Hotel F
 NoOfPax \
          1    20-25          4       Ibis          veg 130

          2    30-35          5LemonTree         Non-V

          3    25-30          6     RedFox          Veg

          4    20-25          -1LemonTree            Veg

          5     35+           3       Ibis     Vegetarian 9

          6     35+           3       Ibys       Non-Veg

          7     35+           4     RedFox     Vegetarian
 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           -999999        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.CustomerID<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    8.0    20-25          7 LemonTree           Veg 2999.0
10.0     9.0    25-30          2      Ibis       Non-Veg 3456.0
         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
Avalueis trying to be set on a copy of a slice from a DataFrame
Seethecaveats in the documentation: https://pandas.pydata.org/pandasdocs/stable/user_guide/indexing.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          5LemonTree         Non-Veg 2000.0
2               3.0    25-30          6    RedFox          Veg 1322.0
3               4.0    20-25         -1LemonTree           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          7LemonTree           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
4a rray(['I2b.0is ' , ' L e m 4o5n0T0r0e.e0' , 'RedFox', 'Iby s '], 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

0
        1.0    20-25          4      Ibis          Veg 1300.0
```

```
1
2
3
4
5
6                                                    9.0    25-30        2      Ibis      Non-Veg 3456.0
         2.0 30-35 3.0       5 LemonTree       Non-Veg 2000.0
7        25-30 4.0 20-       6 RedFox           Veg 1322.0
8        25                  -1 LemonTree       Veg 1234.0
         5.0 6.0 35+         3 3    Ibis        Veg 989.0
         7.0     35+         4 RedFox   Ibis     Non-Veg 1909.0
0        8.0 20-25 35+                          Veg 1000.0
1                            7 LemonTree        Veg 2999.0
2                                                                                                    9
310.0   30-35          5    RedFox      Non-Veg1801.0
4 NoOfPaxEstimatedSalary
5           2.0                40000.0 3.0
6           59000.0 2.0        30000.0 2.0
7           120000.02.0        45000.02.0
8           122220.02.0        21122.0
9                        2.0    345673.0
                         3.0     96755.0
                         4.0     87777.0
```

```
f['Rating(1-5)'].fillna(round(df['Rating(1-5)'].median()), inplace=True) df
```

```
  CustomerIDAge_GroupRating(1-5)       HotelFoodPreference    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.
```

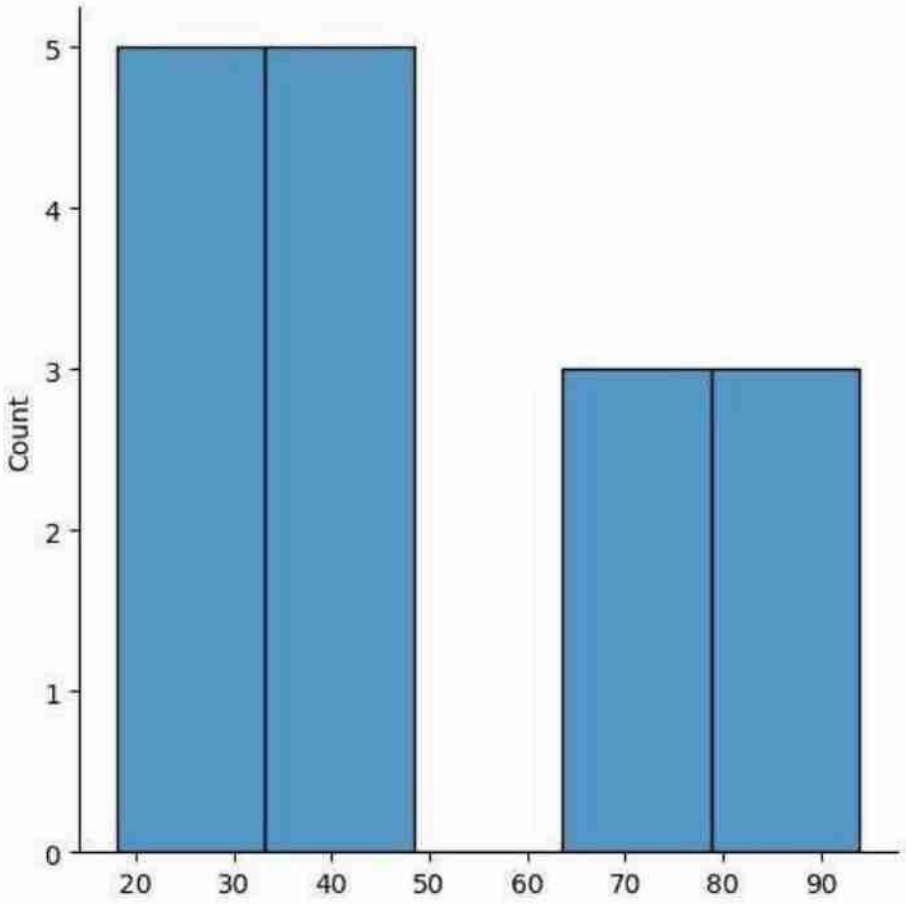
4	5.0	35+	3	Ibis	Veg 989.0
5	6.0	35+	3	Ibis	Non-Veg 1909.

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	7	2.0
6	2.0	21122.0	87777.0	
345673.083.0		96755.0		
9		4.0		

Exercise 7:

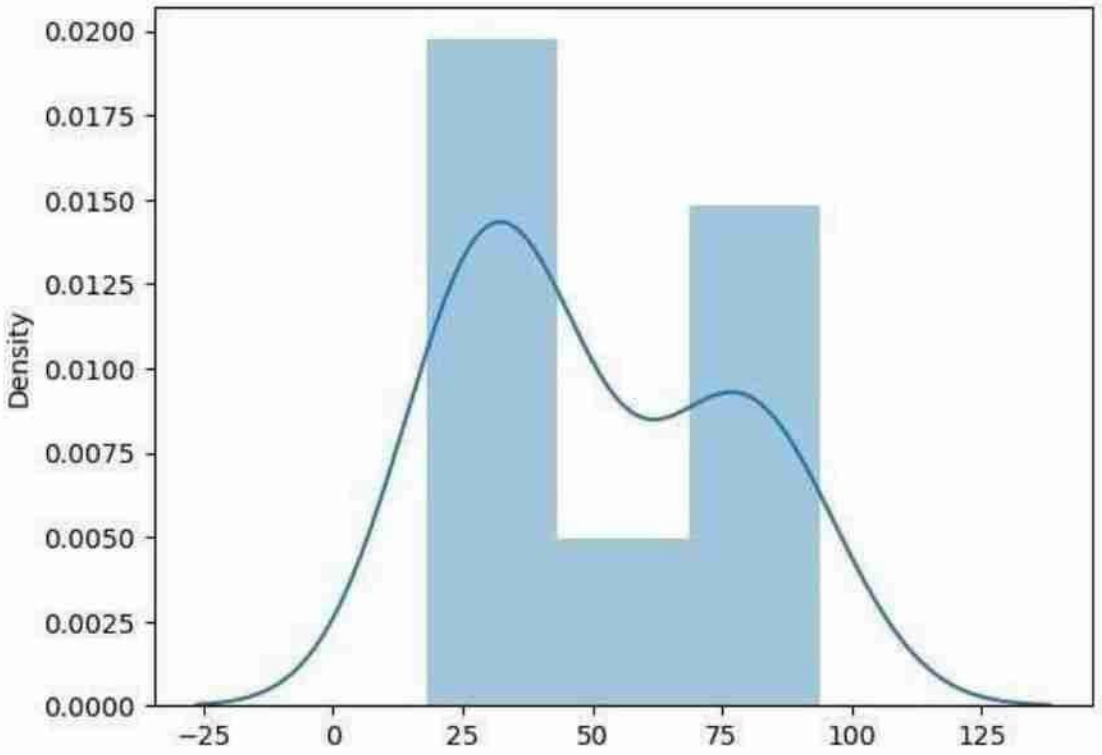
```
import numpyas np array=np.random.randint(1,100,16) # randomly generate 16 numbers between 1 to100 array
array([35, 18,94, 35, 71, 83, 85, 21, 74, 37, 29, 27, 74, 45, 27, 48])
array.mean()
50.1875
np.percentile(array,25)
28.5
np.percentile(array,50)
41.0
np.percentile(array,75)
74.0
np.percentile(array,100)
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>
```



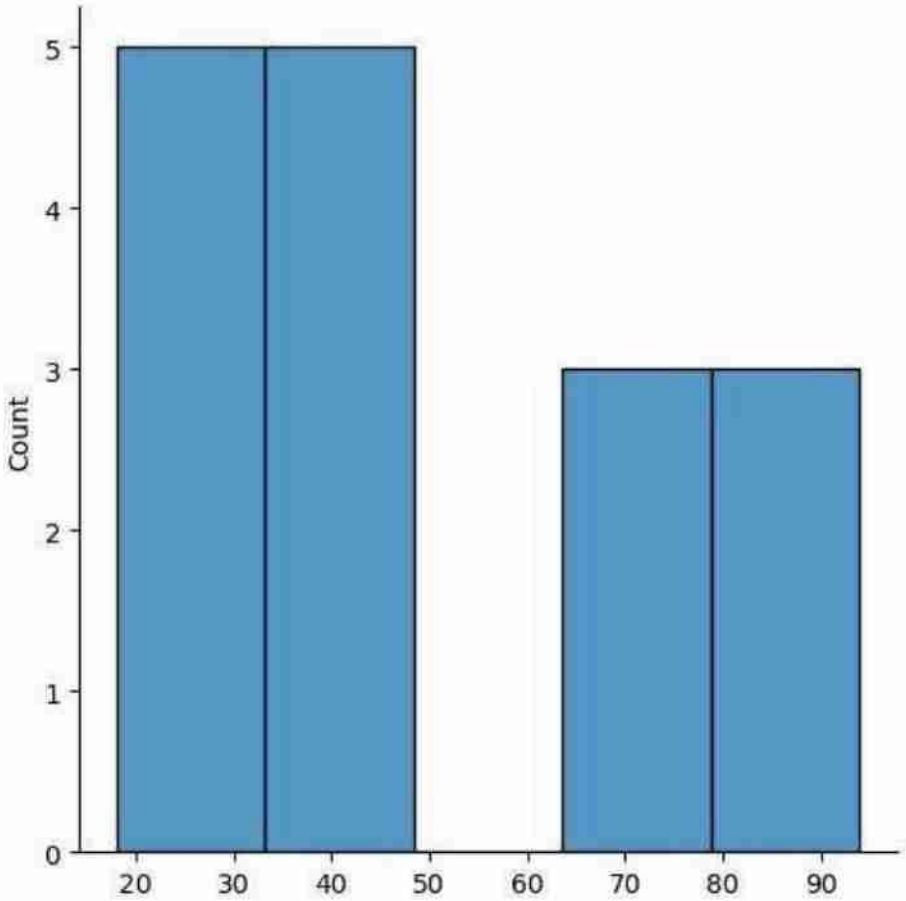

```
sns.distplot(array)
C:\Users\REC\AppData\Local\Temp\ipykernel_5860\240701144.py:1:
UserWarning:
`distplot` is a deprecated function and will be removed in
seaborn
v0.14.0.

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>
```



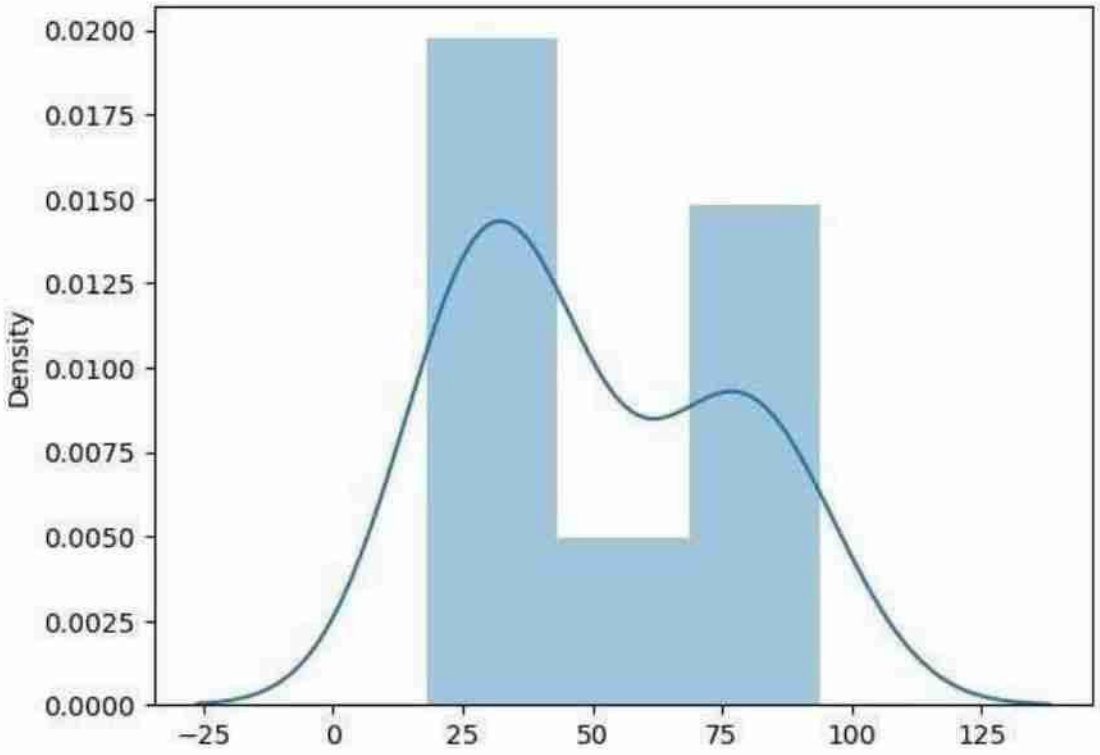
```
lr1,ur1=outDetection(new_array) lr1,ur1
(-39.75, 142.25)
final_array=new_array[(new_array>lr1) & (new_array<ur1)] final_array
array([35, 18, 94, 35, 71, 83, 85, 21, 74, 37, 29, 27, 74, 45, 27,
48])
sns.distplot(final_array)
C:\Users\REC\AppData\Local\Temp\ipykernel_5860\240701144.py:1:
UserWarning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

```
importnumpyas 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()

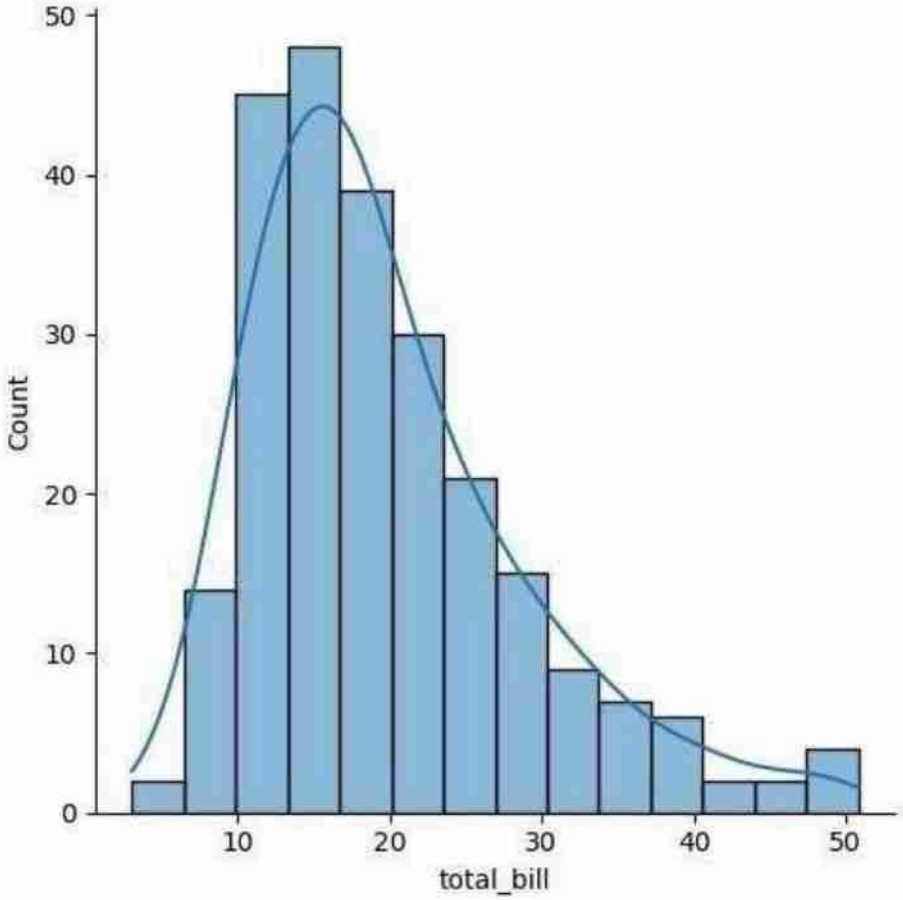
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10 entries, 0 to 9 Data columns (total 4
columns):
 # Column      Non-Null Count Dtype
--- ------      -------------- ----- 0 Country         10 non-null
object
1         Age       10 non-null     float64
2         Salary    10 non-null     float64 3 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 day     time size 0       16.99 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     No Sun Dinner      4
%matplotlib inline tips=sns.load_dataset('tips') tips.head()

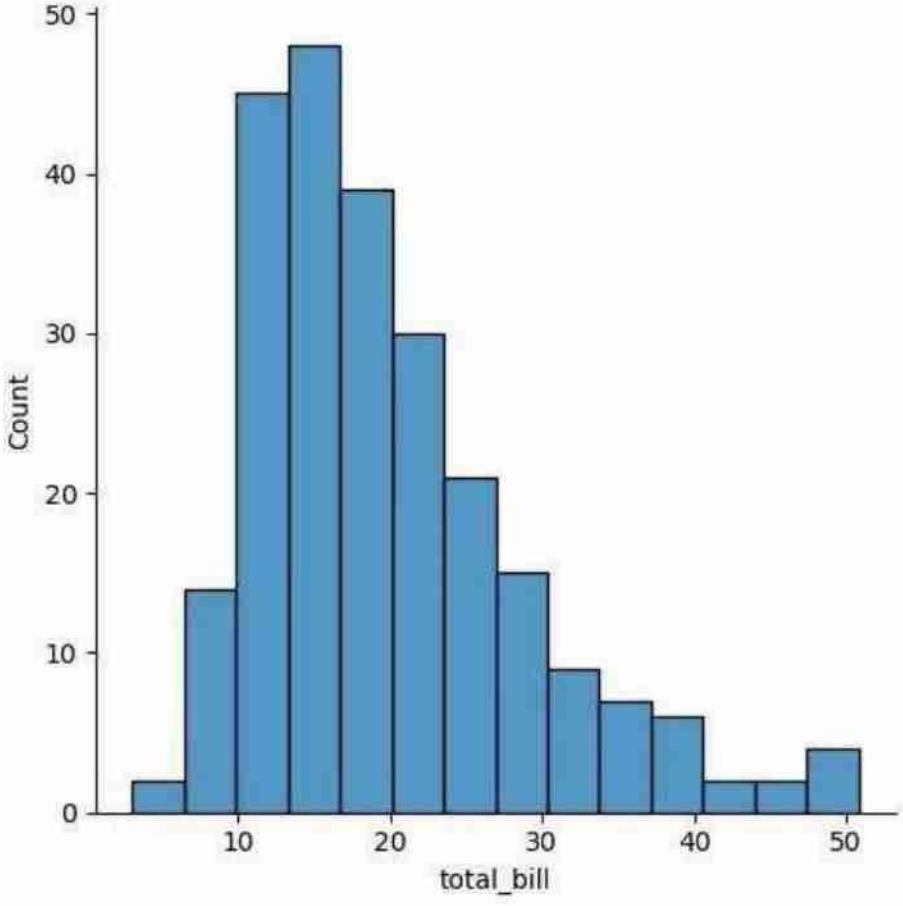


sns.displot(tips.total_bill,kde=True)
<seaborn.axisgrid.FacetGrid at 0x1cbb0db2d70>
```



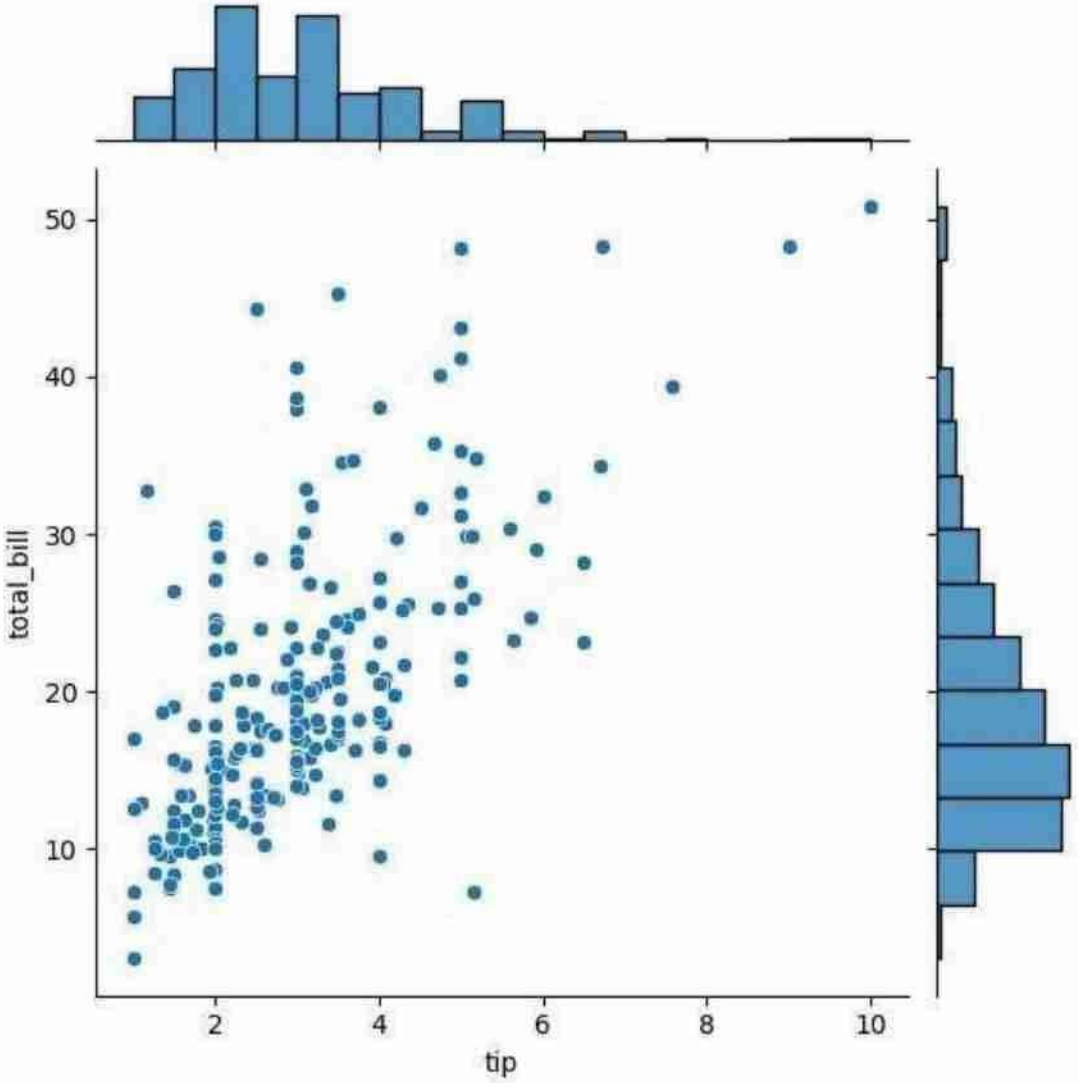

```
sns.displot(tips.total_bill,kde=False)
```

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



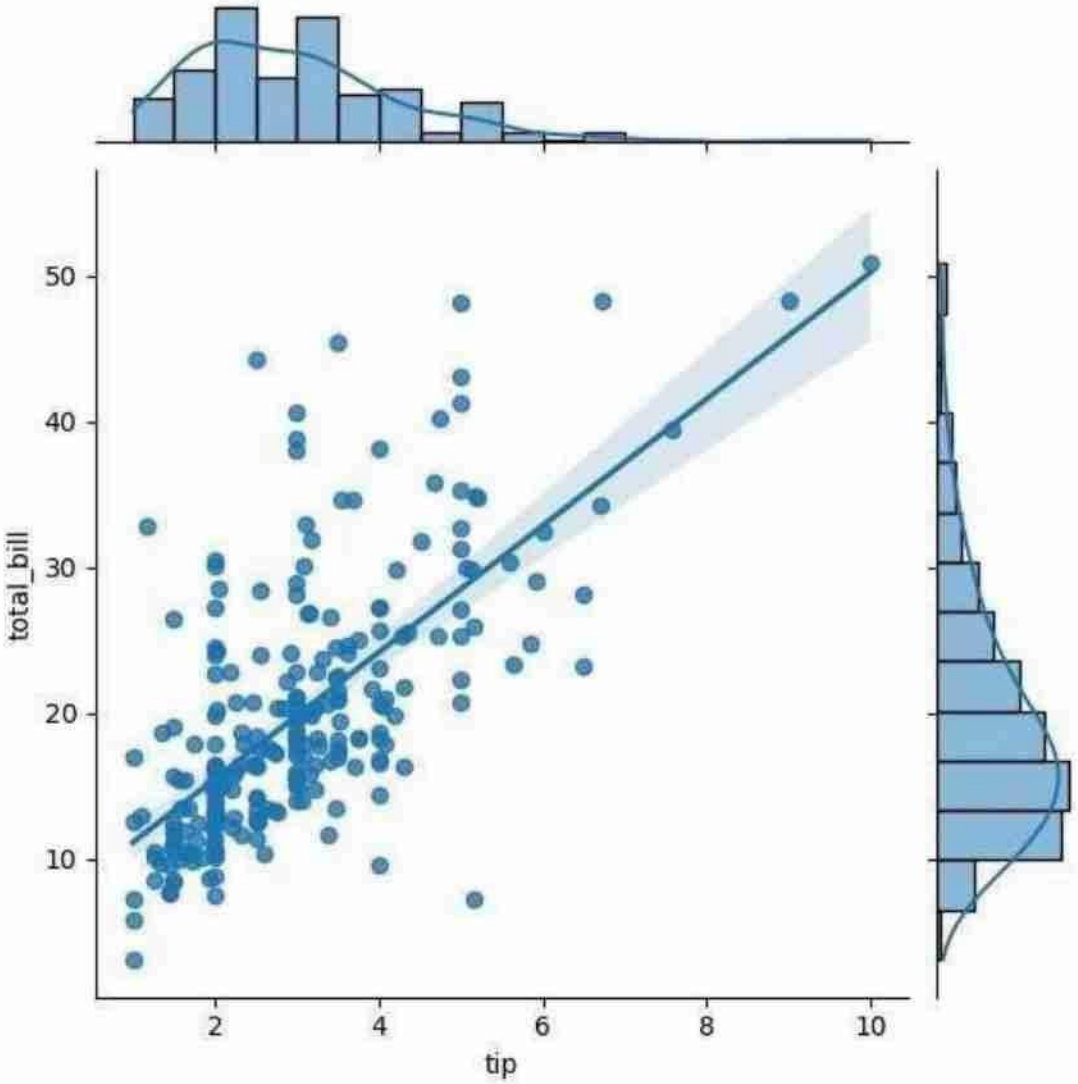
```
sns.jointplot(x=tips.tip,y=tips.total_bill)
```

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



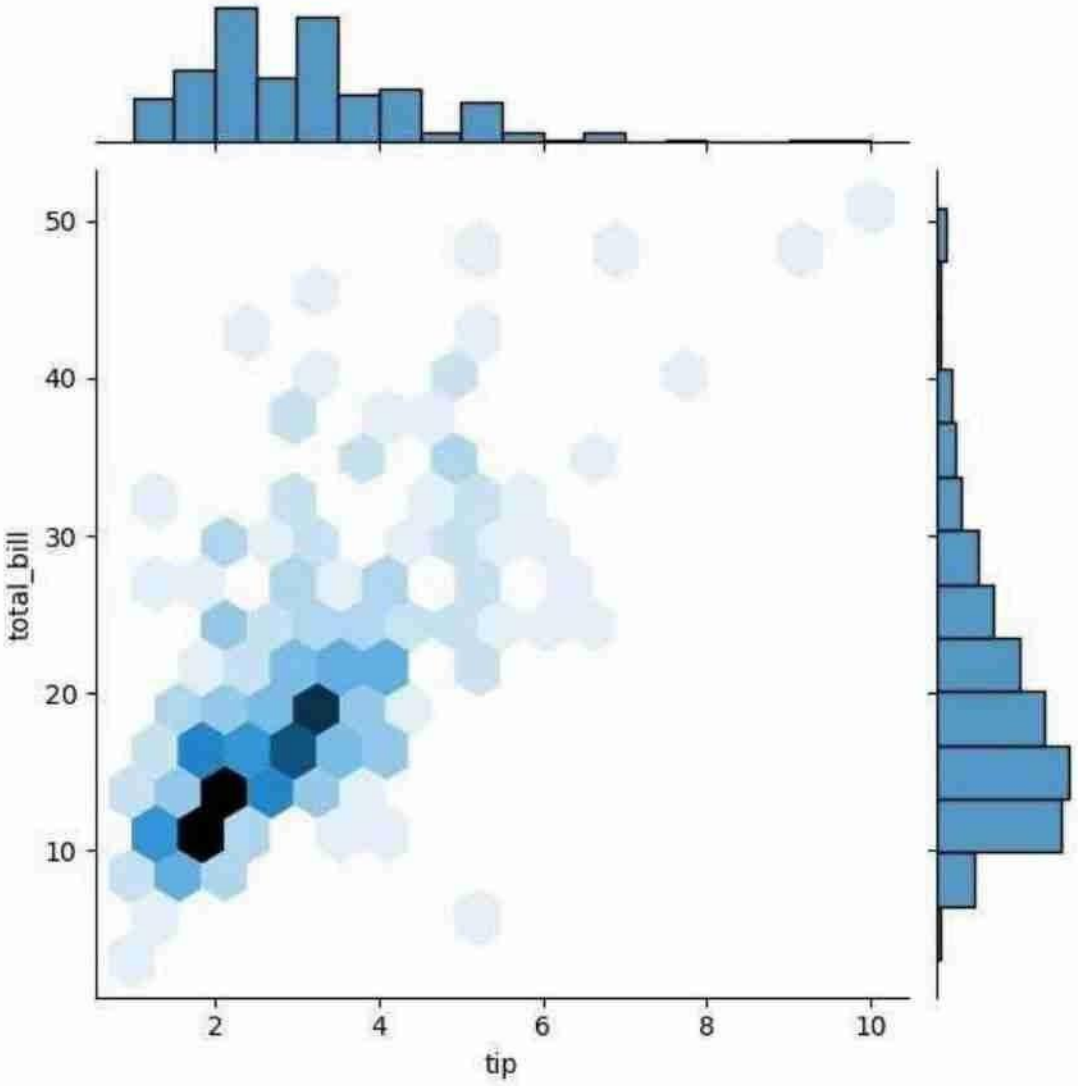

```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="reg")
```

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



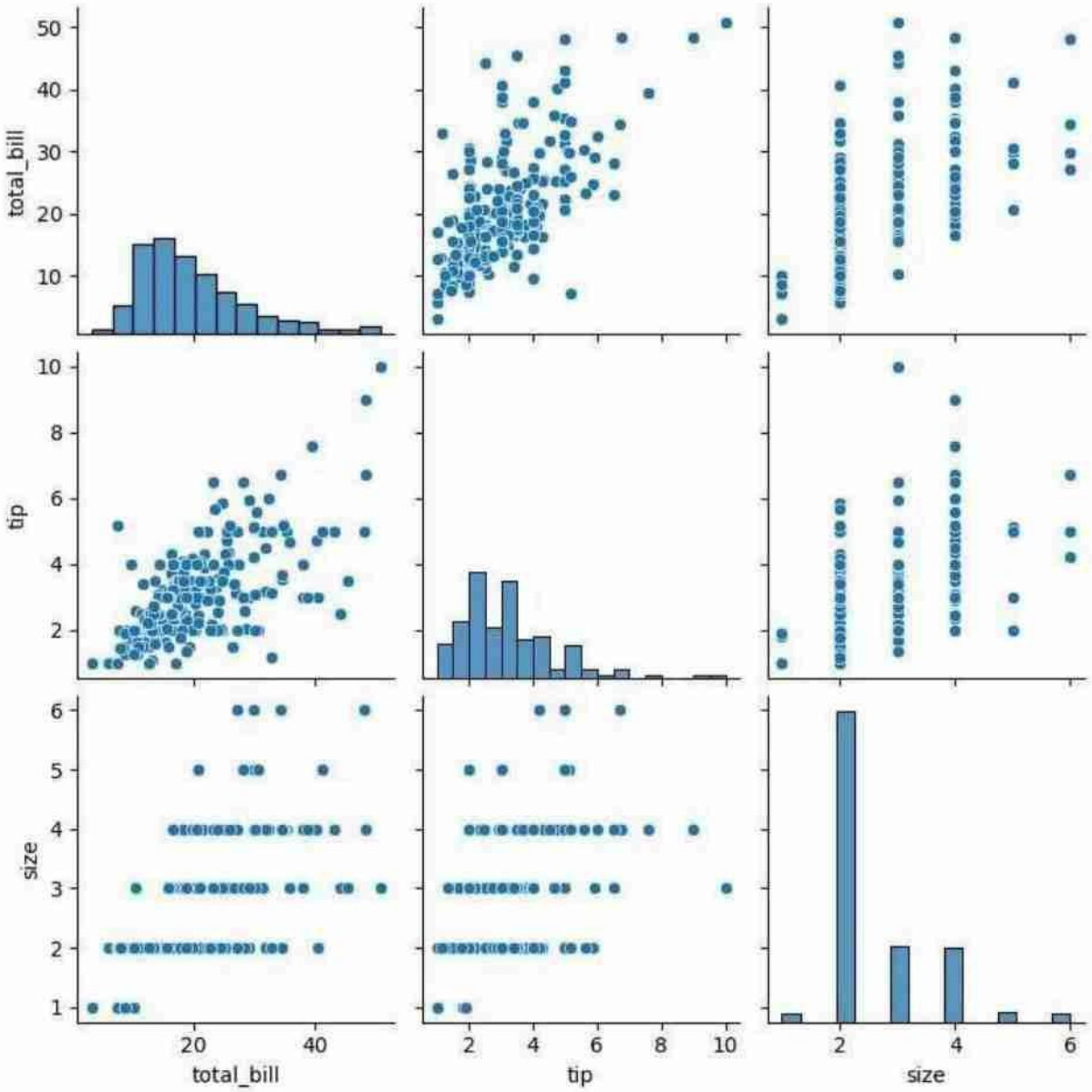

```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex")
```

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




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

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

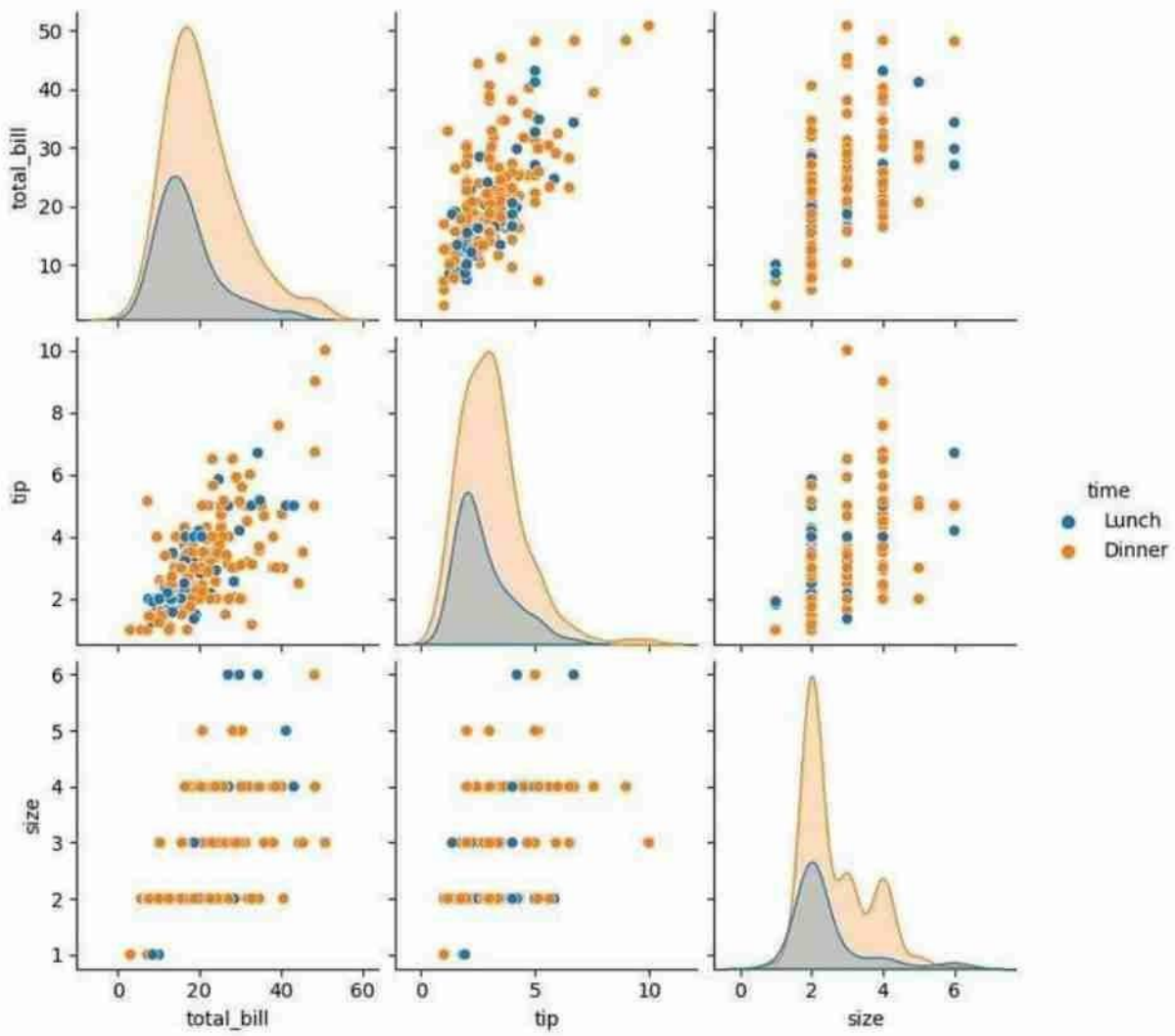



```
tips.time.value_counts()
```

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

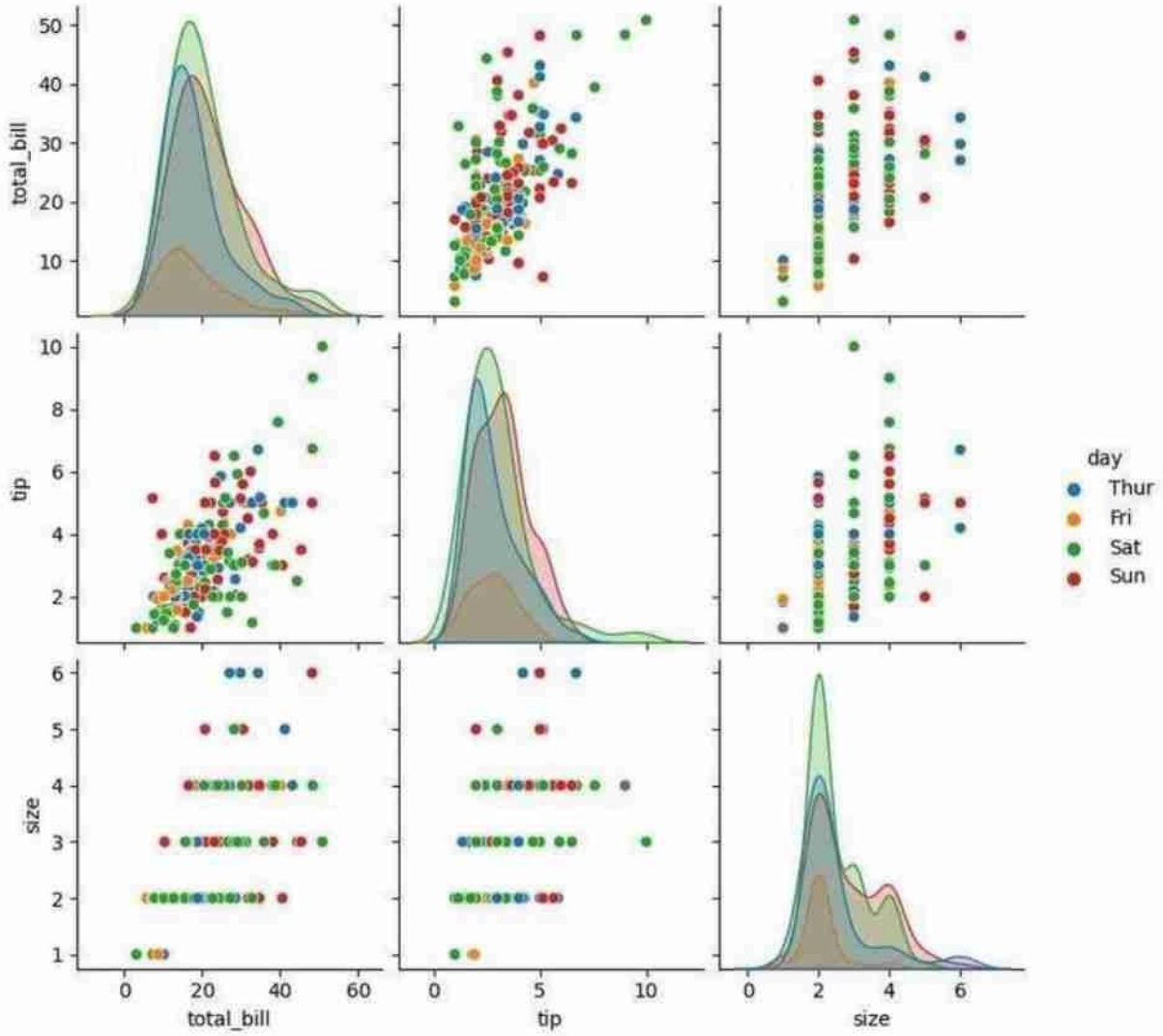
```
sns.pairplot(tips,hue='time')
```

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



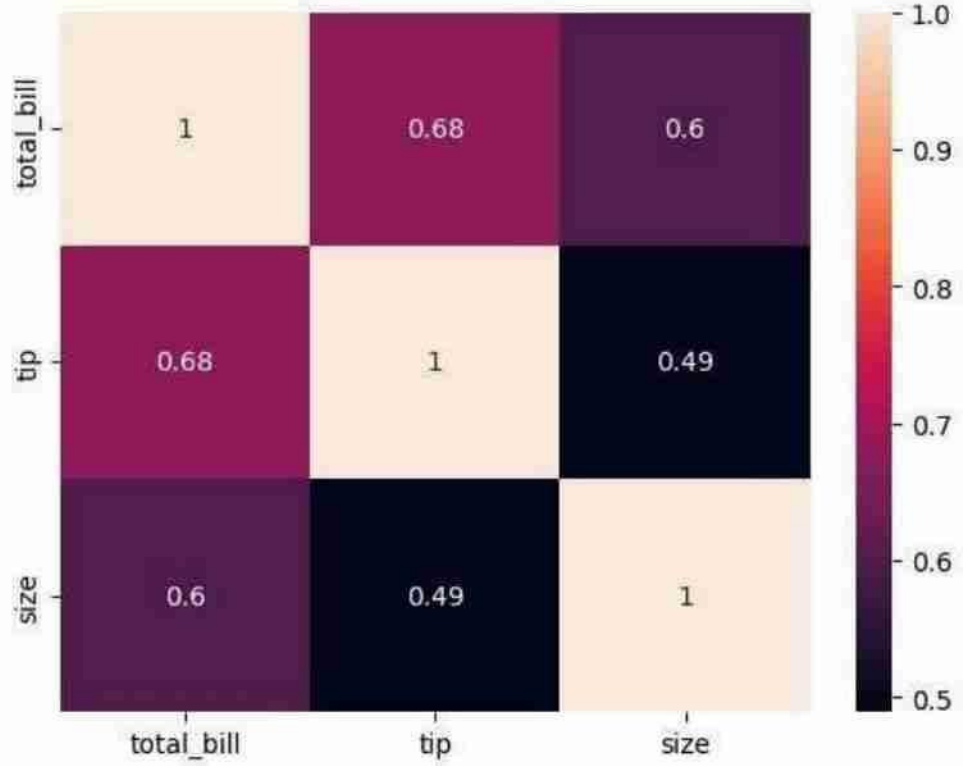

```
sns.pairplot(tips,hue='day')
```

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



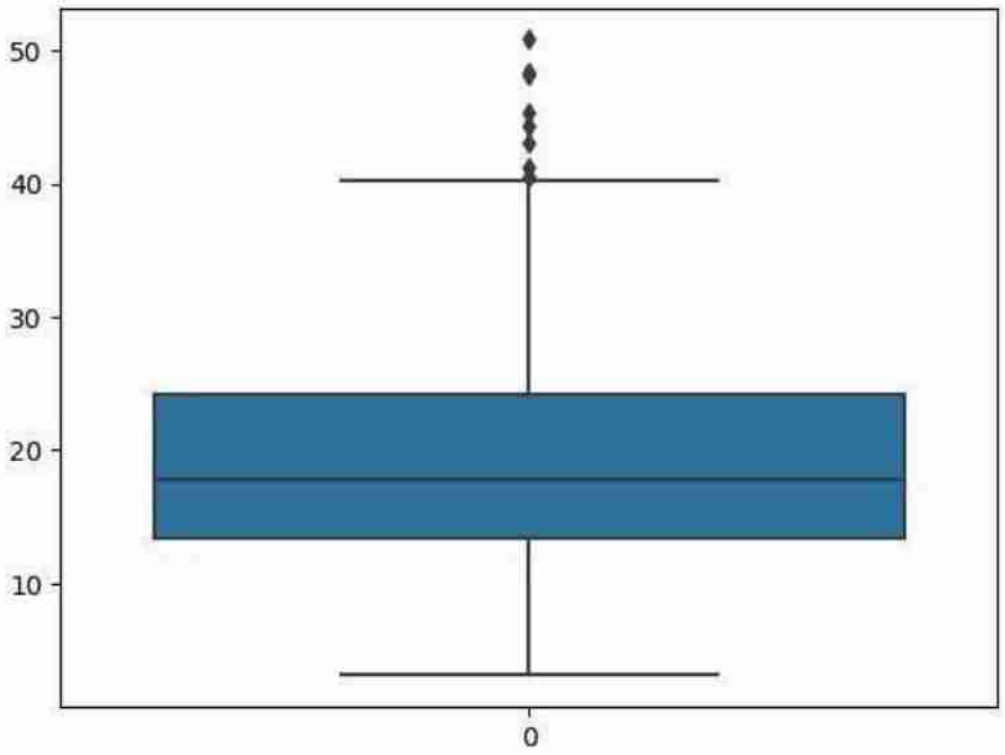

```
sns.heatmap(tips.corr(numeric_only=True),annot=True)
```

```
<Axes:
```



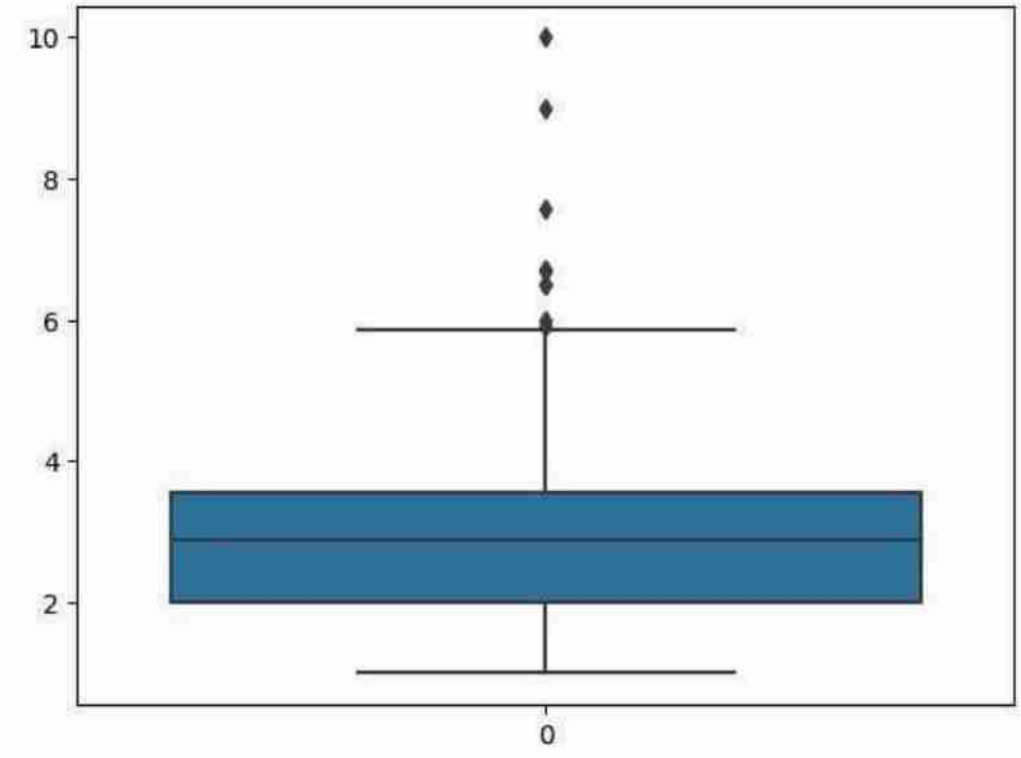

```
sns.boxplot(tips.total_bill)
```

<Axes:



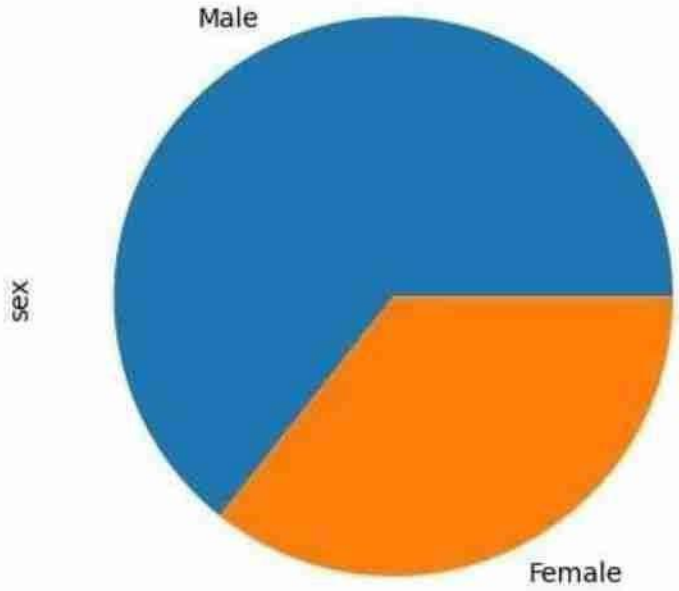

```
sns.boxplot(tips.tip)
```

<Axes:



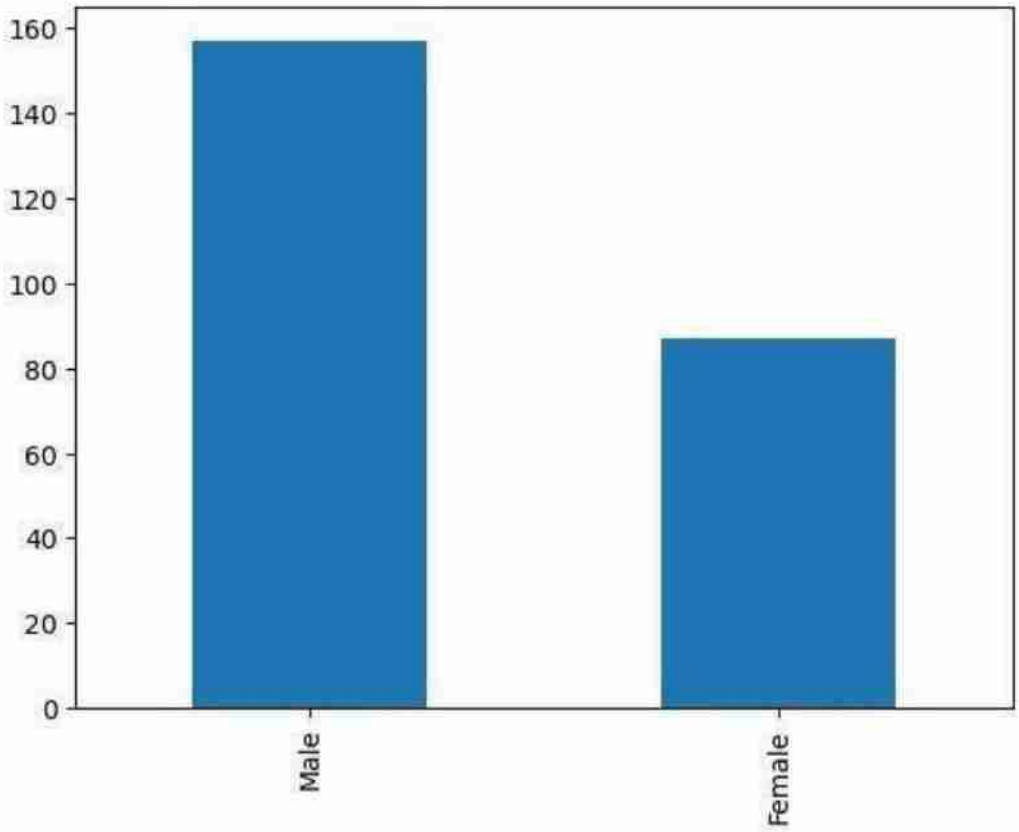

```
tips.sex.value_counts().plot(kind='pie')
```

<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([[
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```

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```

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

```
fromsklearn.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))
```

```
Test 0.65 Train0.640625 Random State 1
Test 0.65 Train0.640625 Random State 2
Test 0.65 Train0.640625 Random State 3
Test 0.65 Train0.640625 Random State 4
```

```
Test 0.65 Train0.640625 Random State 5
Test 0.65 Train0.640625 Random State 6
Test 0.65 Train0.640625 Random State 7
Test 0.65 Train0.640625 Random State 8
Test 0.65 Train0.640625 Random State 9
Test 0.65 Train0.640625 Random State 10
Test 0.65 Train0.640625 Random State 11
Test 0.65 Train0.640625 Random State 12
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Test 0.65 Train0.640625 Random State 14
Test 0.65 Train0.640625 Random State 15
Test 0.65 Train0.640625 Random State 16
Test 0.65 Train0.640625 Random State 17
Test 0.65 Train0.640625 Random State 18
Test 0.65 Train0.640625 Random State 19
Test 0.65 Train0.640625 Random State 20
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Test 0.65 Train0.640625 Random State 22
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Test 0.65 Train0.640625 Random State 29
Test 0.65 Train0.640625 Random State 30
Test 0.65 Train0.640625 Random State 31
```

Test 0.65 Train0.640625 Random State 32 Test 0.65 Train0.640625 Random State 33
Test 0.65 Train0.640625 Random State 34 Test 0.65 Train0.640625 Random State 35
Test 0.65 Train0.640625 Random State 36 Test 0.65 Train0.640625 Random State 37
Test 0.65 Train0.640625 Random State 38 Test 0.65 Train0.640625 Random State 39
Test 0.65 Train0.640625 Random State 40 Test 0.65 Train0.640625 Random State 41
Test 0.65 Train0.640625 Random State 42 Test 0.65 Train0.640625 Random State 43
Test 0.65 Train0.640625 Random State 44 Test 0.65 Train0.640625 Random State 45
Test 0.65 Train0.640625 Random State 46 Test 0.65 Train0.640625 Random State 47
Test 0.65 Train0.640625 Random State 48 Test 0.65 Train0.640625 Random State 49
Test 0.65 Train0.640625 Random State 50 Test 0.65 Train0.640625 Random State 51
Test 0.65 Train0.640625 Random State 52 Test 0.65 Train0.640625 Random State 53

Test 0.65 Train0.640625 Random State 54
Test 0.65 Train0.640625 Random State 55
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Test 0.65 Train0.640625 Random State 99

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Test 0.65 Train0.640625 Random State 101

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```
x_train,x_test,y_train,y_test=train_test_split(features,label,test_size=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.
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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  2  3              4.9          3.0          1.4          0.2    Setosa
 4                    4.7          3.2          1.3          0.2    Setosa
                      4.6          3.1          1.5          0.2    Setosa
                      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()
```

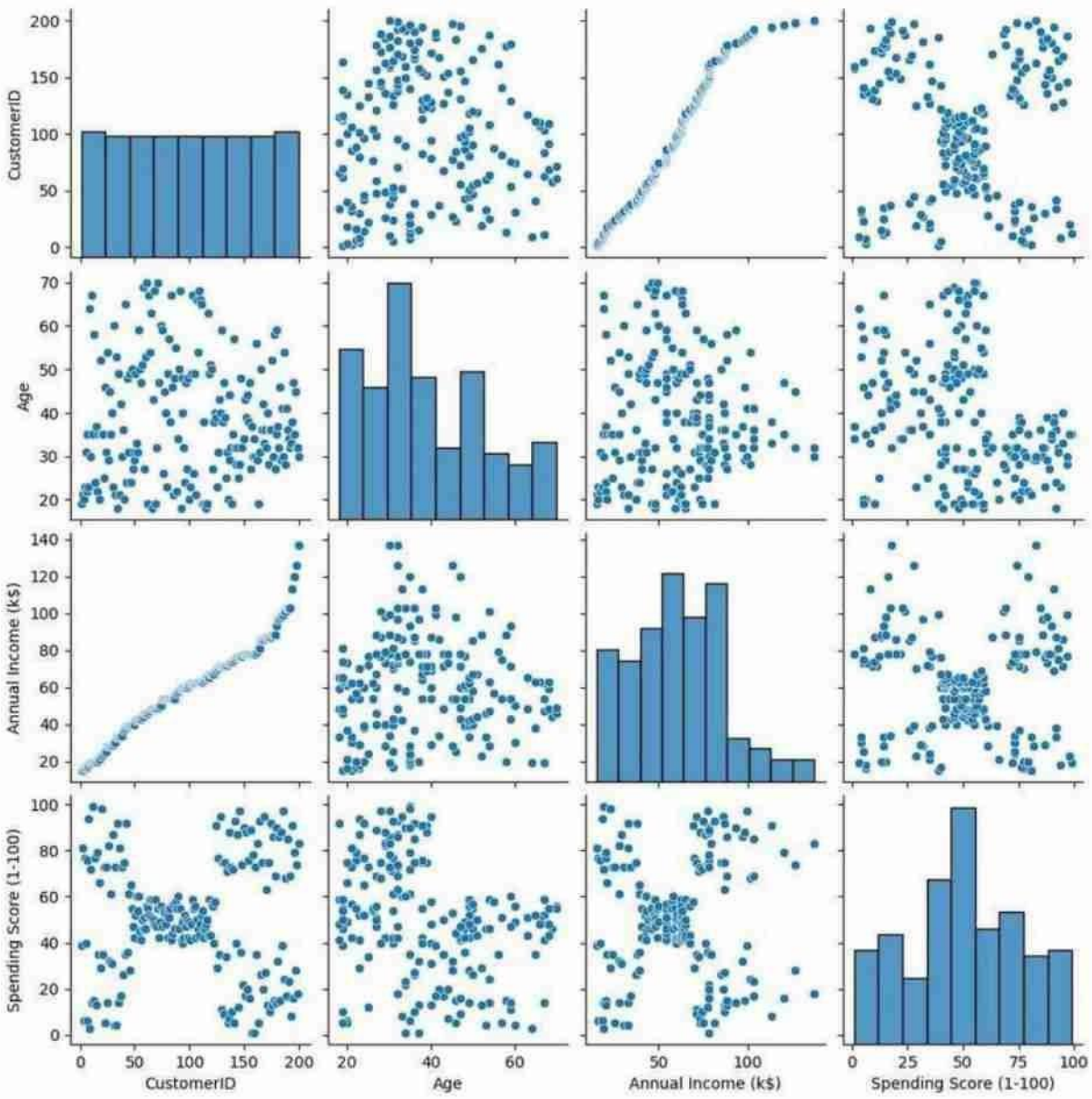
```
<class 'pandas.core.frame.DataFrame'> RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 # Column                  Non-Null Count Dtype
--- ------                  -------------- ----- 0       CustomerID              200 non-null
int64
1Gender                    200 non-null    object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

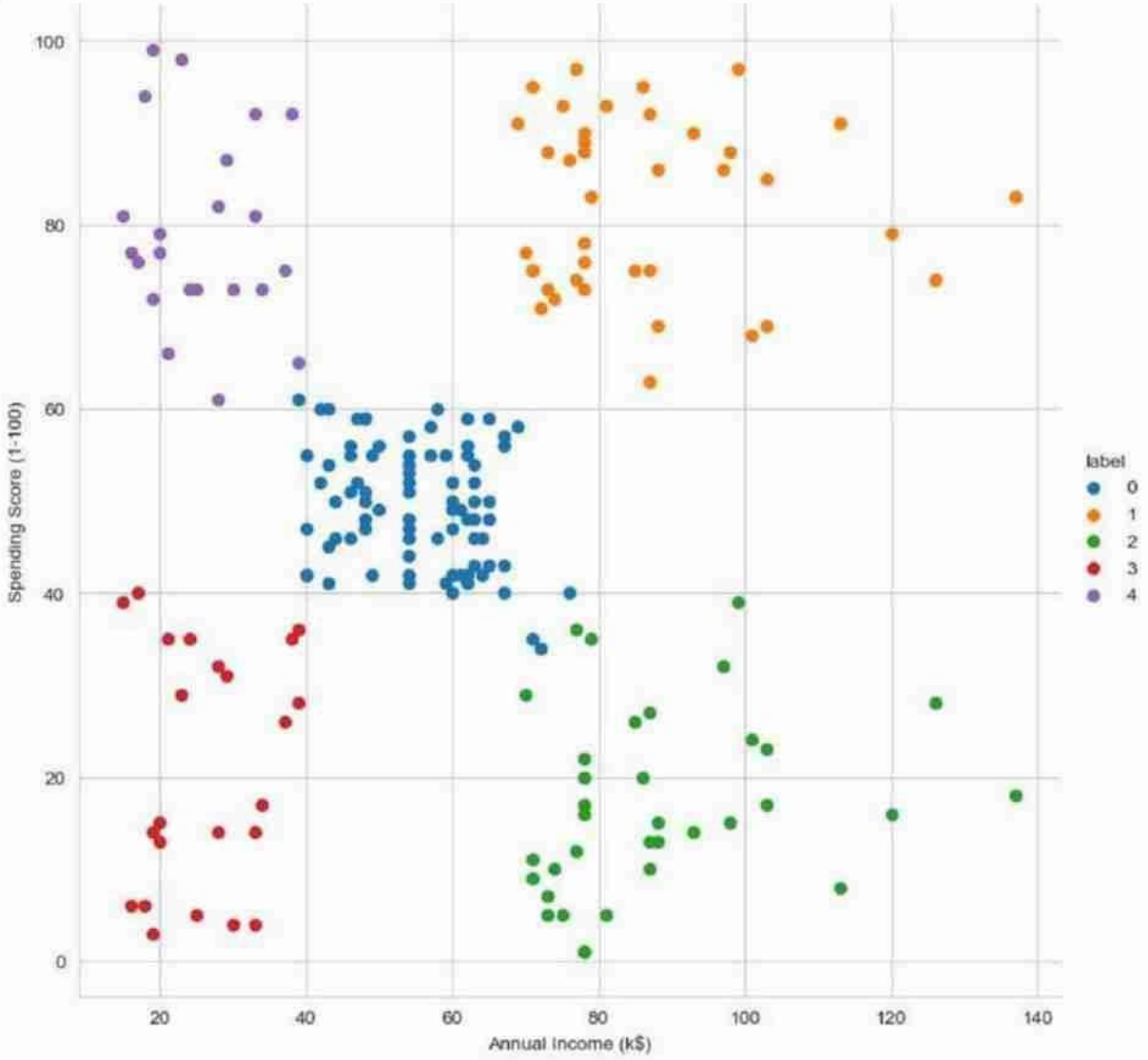
```
KMeans(n_clusters=5)
```

```
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
F iAnanln[u'labl eInl'c]=omoe d(ekl$.p) r eSdpiecnt(dfienagtu Srecso)r e (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)
```

```
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 warning
  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
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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
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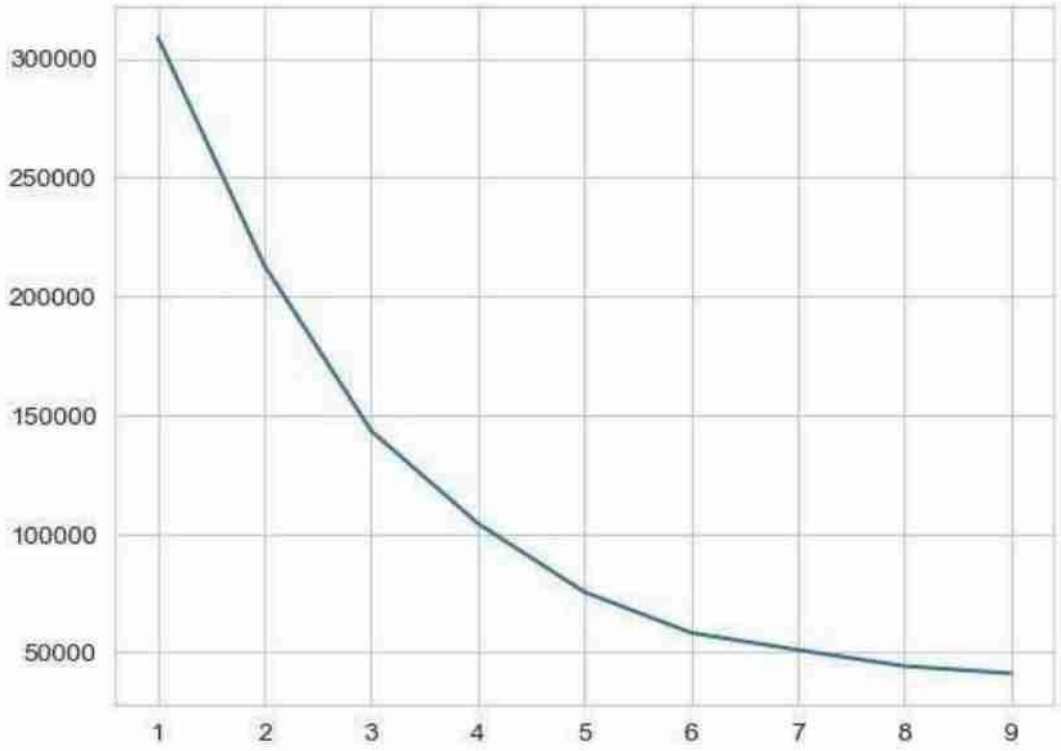
[<matplotlib.lines.Line2D at 0x1dc61c56380>]



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
                                                                                    significant
                                                                                    difference.")
```

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.
```