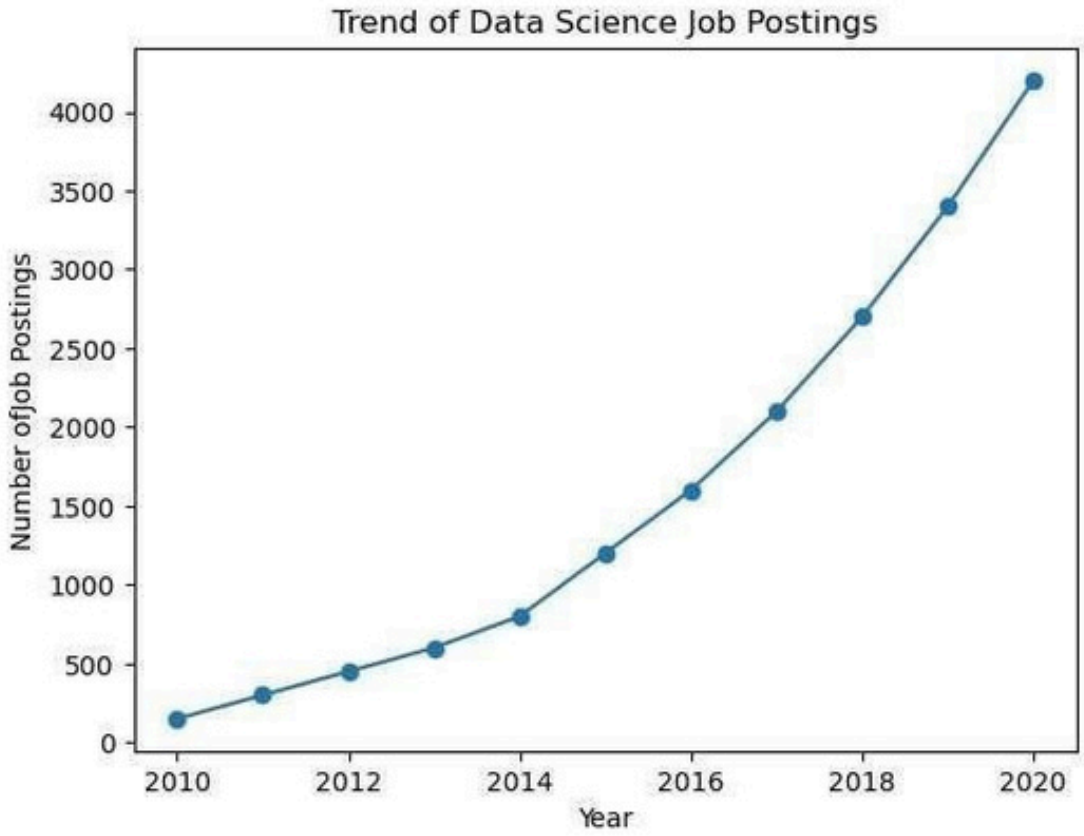
Department of Computer Science and Engineering

CS23334 Fundamentals of Data Science Lab

III semester II Year (2023R)

Name of the Student : Harsha Vardhini S

Register Number : 240701180



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()
```

```
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
1.	01-01-2023	Product A	200	4	North
2.	02-01-2023	Product B	150	3	South
3.	03-01-2023	Product A	220	5	North

1. 04-01-2023 Product C 300 6 East
2. 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

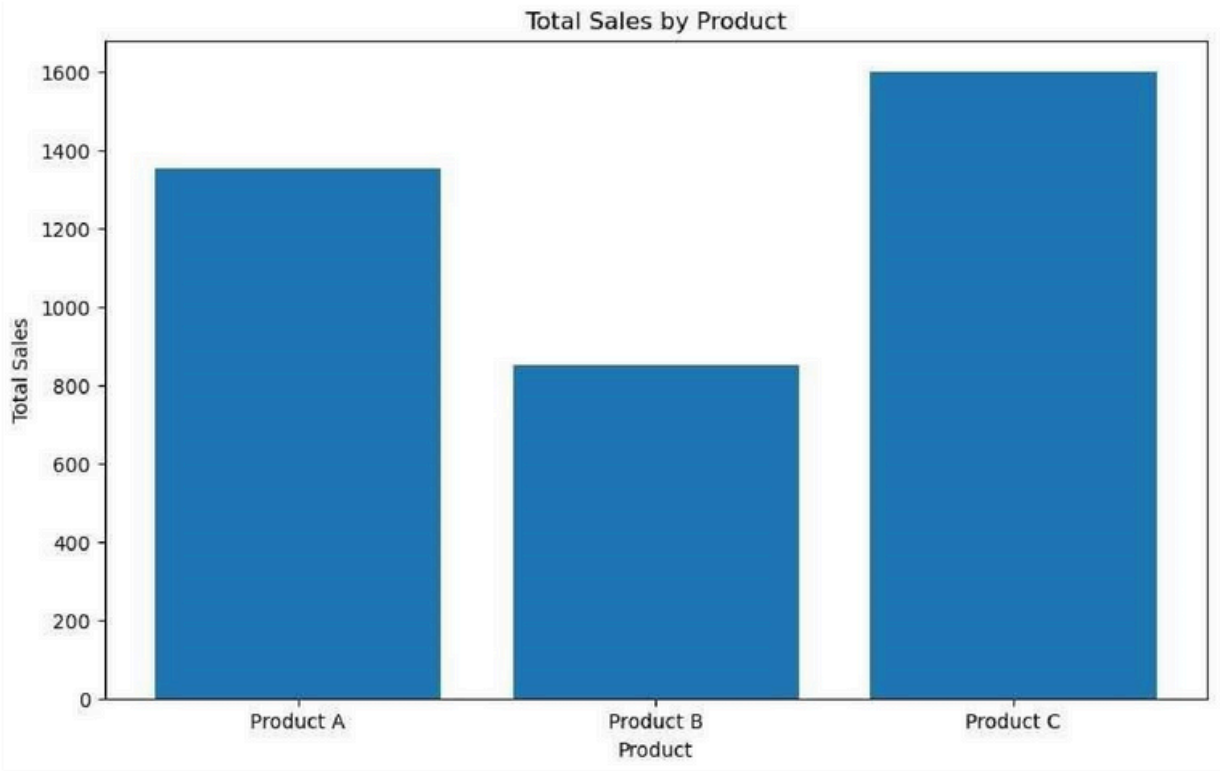
8.000000

Product Sales Quantity

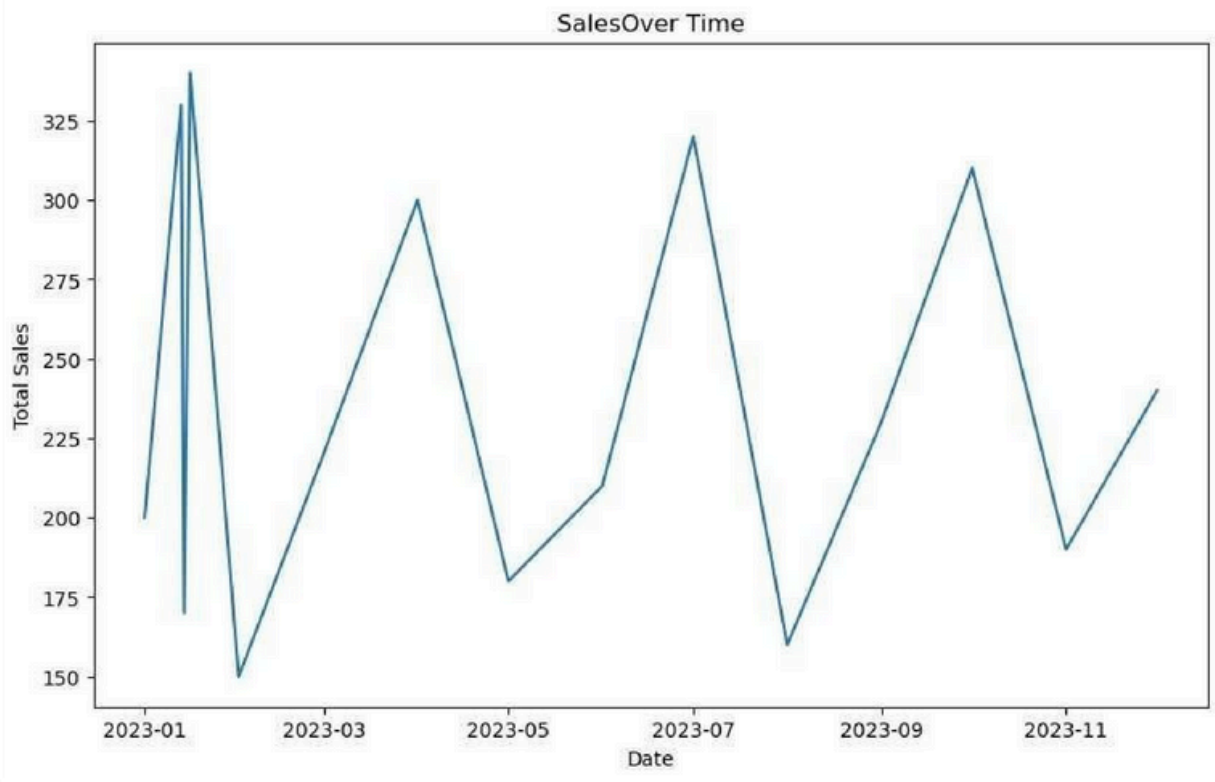
1. Product A 1350 33
2. Product B 850 17 2 Product C 1600 36

```
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'])
```



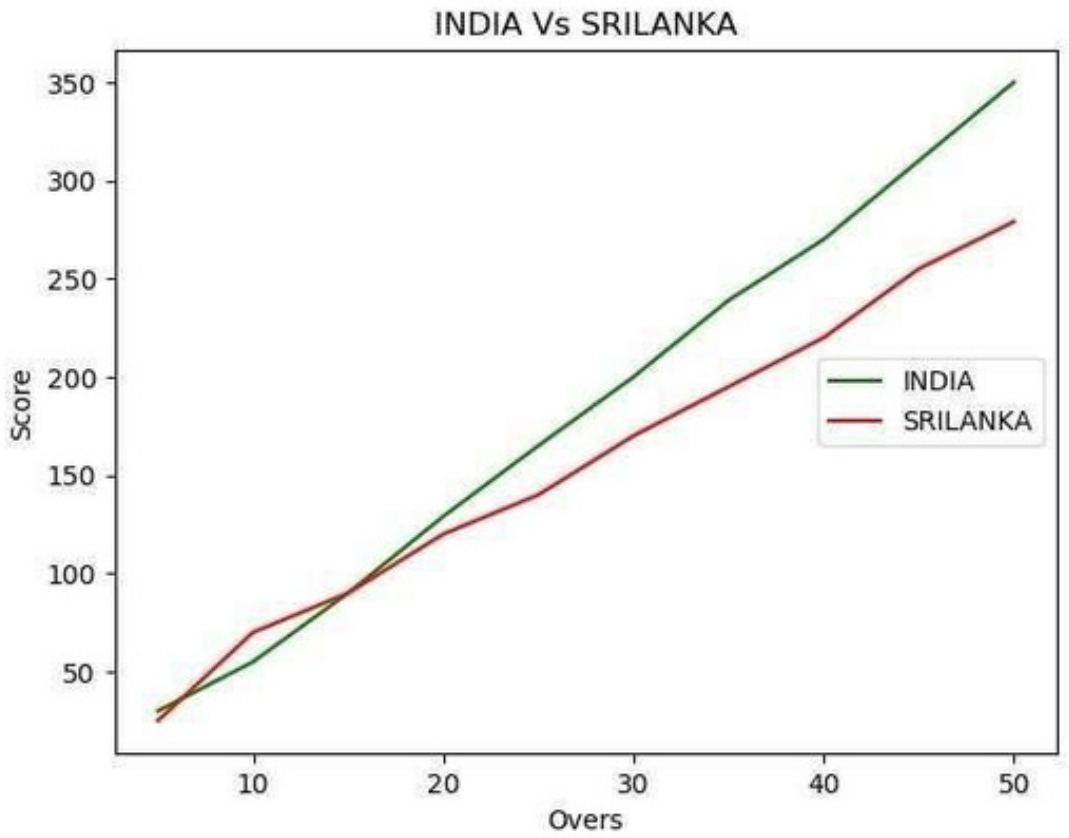
Product	Product A	Product B	Product C
Region			
East	0	0	160
North	1350	0	0
South	0	480	0
West	0	370	0

	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")
```



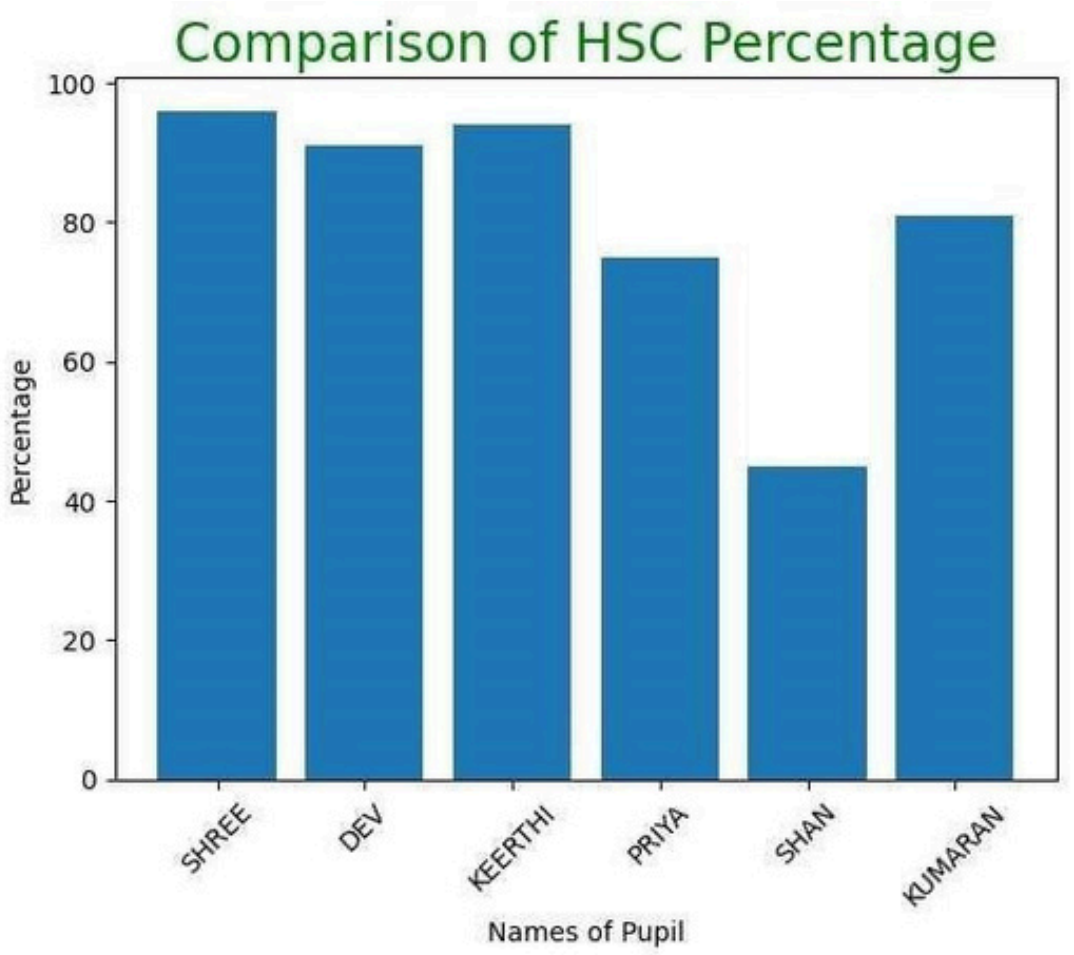
B]

```
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()

```
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_dat
a..
.


[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  \
6     148          72          35       0  33.6
```

0

Exercise 4:

1. 8 183 64 0 0 23.3
2. 1 89 66 23 94 28.1
3. 0 137 40 35

168 43.1

DiabetesPedigreeFunction Age Outcome

1. 0.627 50 1
2. 0.351 31 0
3. 0.672 32 1
4. 0.167 21 0
5. 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

--- ------ -------------- -----

1. Pregnancies 768 non-null int64
2. Glucose 768 non-null int64
3. BloodPressure 768 non-null int64 3 SkinThickness 768 non-null int64 4 Insulin

768 non-null int64

1. BMI 768 non-null float64
2. DiabetesPedigreeFunction 768 non-null float64
3. 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

```
max    67.100000            2.420000  81.000000   1.000000
```

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

             1     20-25             4        Ibis            veg  1300


\
0

1            2     30-35             5  LemonTree        Non-Veg  2000
```

3	25-30	6	RedFox	Veg	1322

3

4

5

6	7	35+	4	RedFox	Vegetarian	1000
7	8	20-25	7	LemonTree	Veg	2999
8	9	25-30	2	Ibis	Non-Veg	34510

6

10 30-35 5 RedFox non-Veg -6755

40000

20-25 1 3 59000 30-35 2 2 30000 25-30

45000

```
len(df)  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
```

0

V

g 9 n

0

2

1

3

2

2

3

2

4

2

```
5
2
6
```

1. 122220
2. 21122
3. 345673
4.

```
-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
```

1. -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.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/pandasdocs/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							
1.	3.0	25-30	6	RedFox	Veg	1322.0	
2.	4.0	20-25	-1	LemonTree	Veg	1234.0	
3.	5.0	35+	3	Ibis	Vegetarian	989.0	
4.	6.0	35+	3	Ibys	Non-Veg	1909.0	

7.0	35+	4	RedFox	Vegetarian	1000.0

9

```
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/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           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
```

```
1
2
3
4
5

6

7
8
0
1

2
```

```
3

4
5
6
7
8
9
```

```
f['Rating(1-
5)'].fillna(round(df['Rating(1-

                                    5)'].median()), inplace=True) df
```

\												
0												
1												
2		2.0	30-35	5	LemonTree	Non-Veg	2000.0	3.0	25-30	6	RedFox	Veg 1322.0

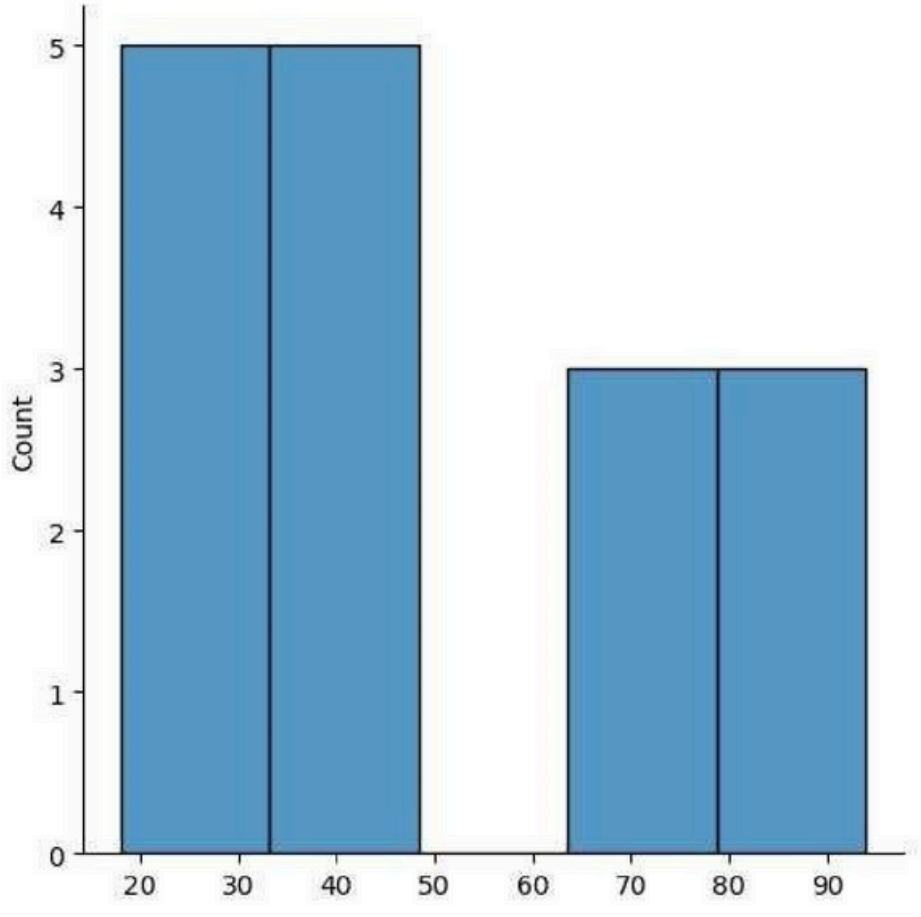
5.0	35+	3	Ibis	Veg	989.0

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

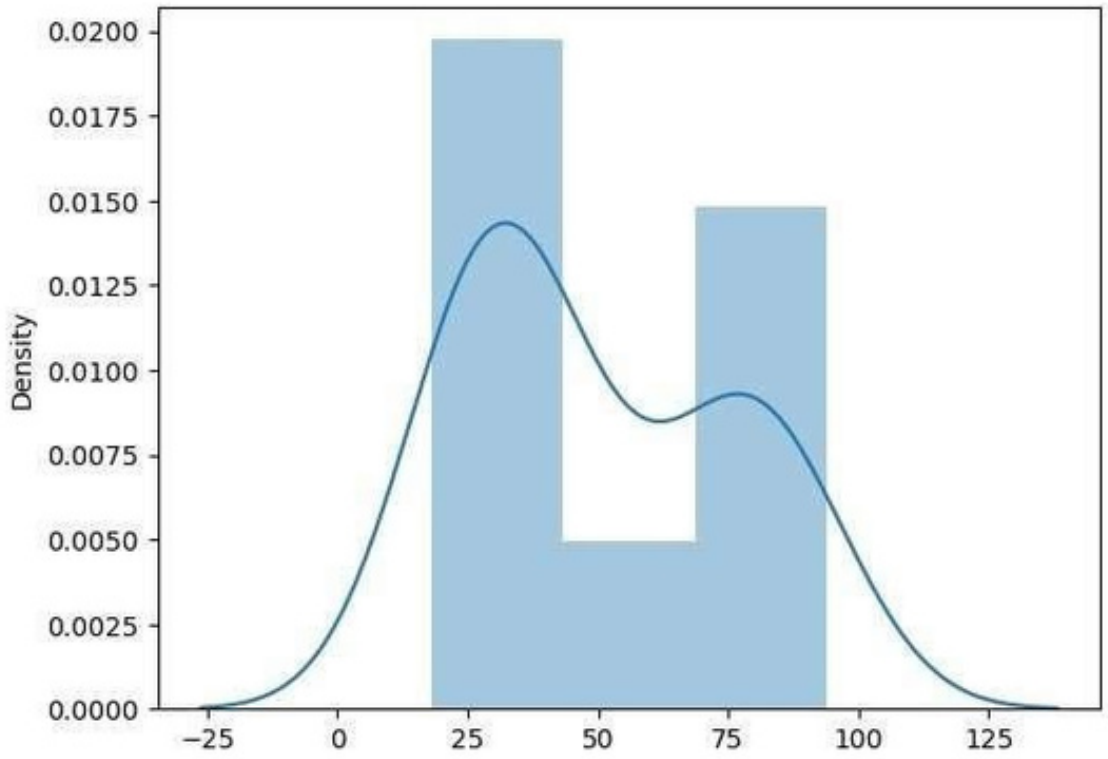
	NoOfPax	EstimatedSalary	0	2.0
40000.0				
1	3.0	59000.0		
2	2.0	30000.0		
3	2.0	120000.0		
4	2.0	45000.0		
5	2.0	122220.0		
6	2.0	21122.0	7	2.0
345673.0	8	3.0	96755.0	
9		4.0	87777.0	

Exercise 7:

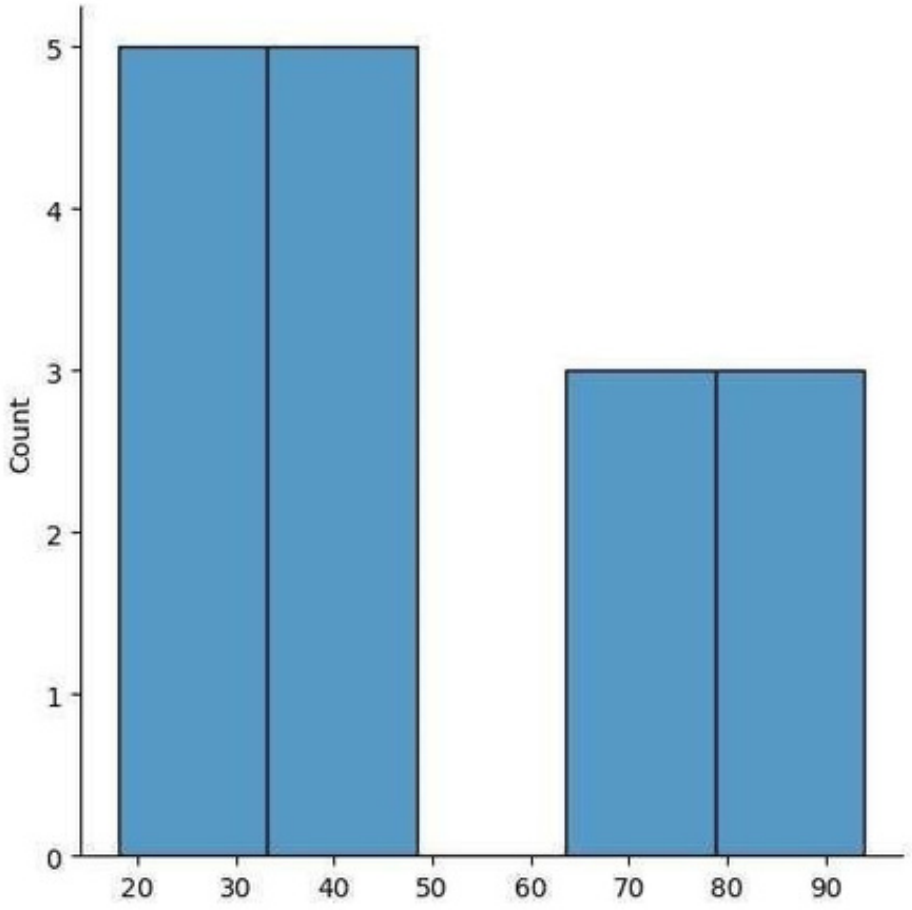
```
import numpy as np array=np.random.randint(1,100,16) # randomly generate 16 numbers between 1 to 100 array

array.mean()  np.percentile(array,25)  np.percentile(array,50)  np.percentile(array,75)

np.percentile(array,100)  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

import seaborn as sns %matplotlib inline sns.displot(array)
```




```
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

sns.displot(new_array)
```

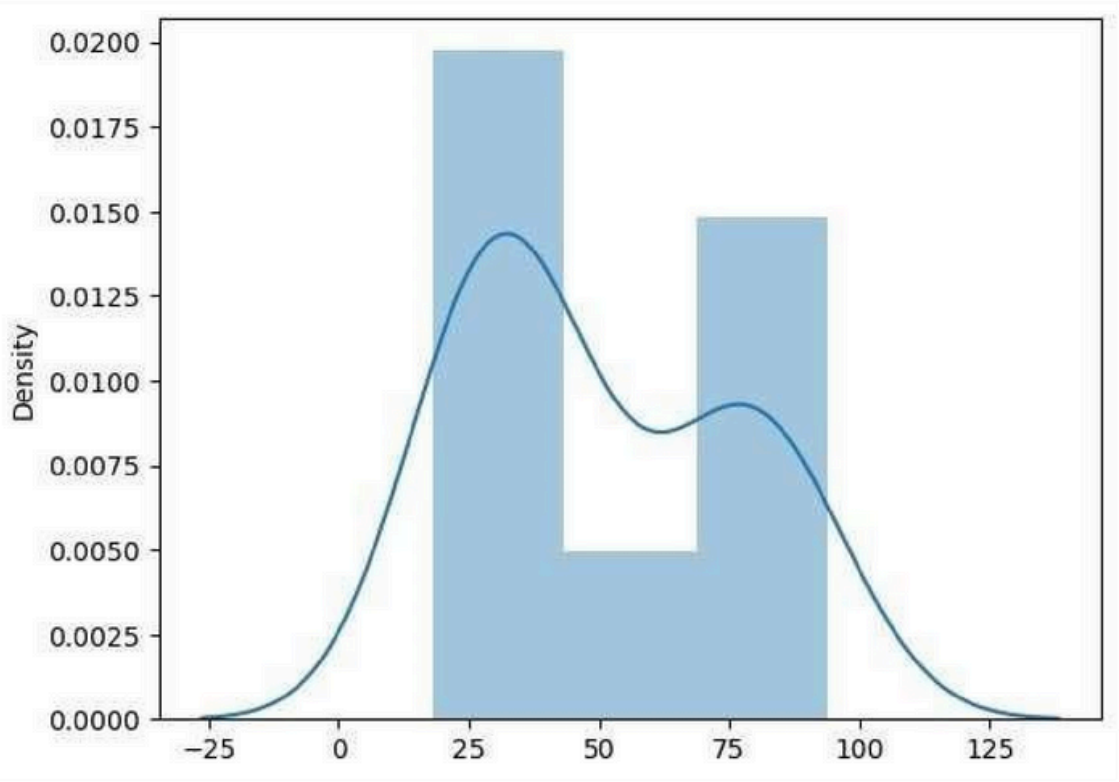



```
lr1,ur1=outDetection(new_array) lr1,ur1

final_array=new_array[(new_array>lr1) & (new_array<ur1)] final_array

sns.distplot(final_array)
```

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

df.head()

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

1].values

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()

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.]])
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,
              [-8.16496581e-01, -6.54653671e-01,  1.52752523e+00,
```

```
[-8.16496581e-01,  1.52752523e+00, -6.54653671e-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.      , 1.      , 0.      , 0.      ],

                          .      , 1.      , 0.      , 0.13043478, 0.17142857],
[0

     [0
                               , 1.      , 0.47826087, 0.37142857], [0.  , 1.      , 0.      , 0.56521739,
     [0.      , 0.             0.45079365],

[1.

[0.                       , 0.      , 0.      , 0.34782609, 0.28571429],

                          , 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]

type(df.Country.mode())

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

pd.get_dummies(df.Country)

updated_dataset=pd.concat([pd.get_dummies(df.Country),df.iloc[:,  [1,2,3]]],axis=1) updated_dataset
```

```
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

1],inplace=True)
```

0

1

0

0

1

1

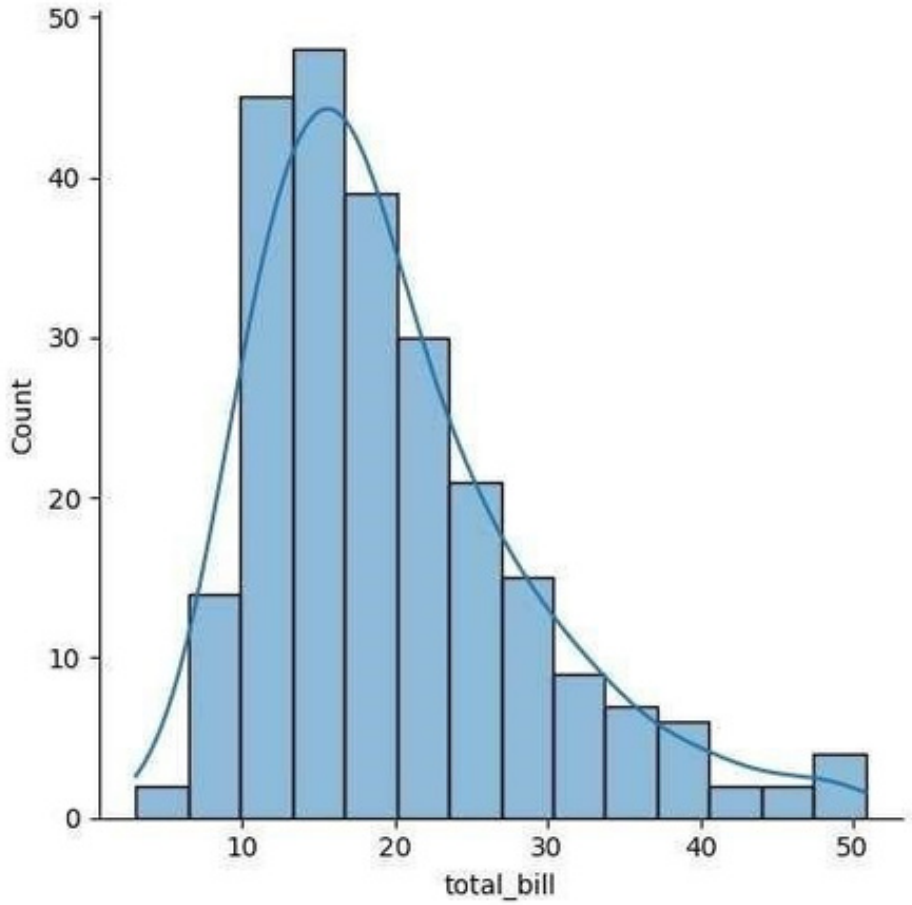
0

1

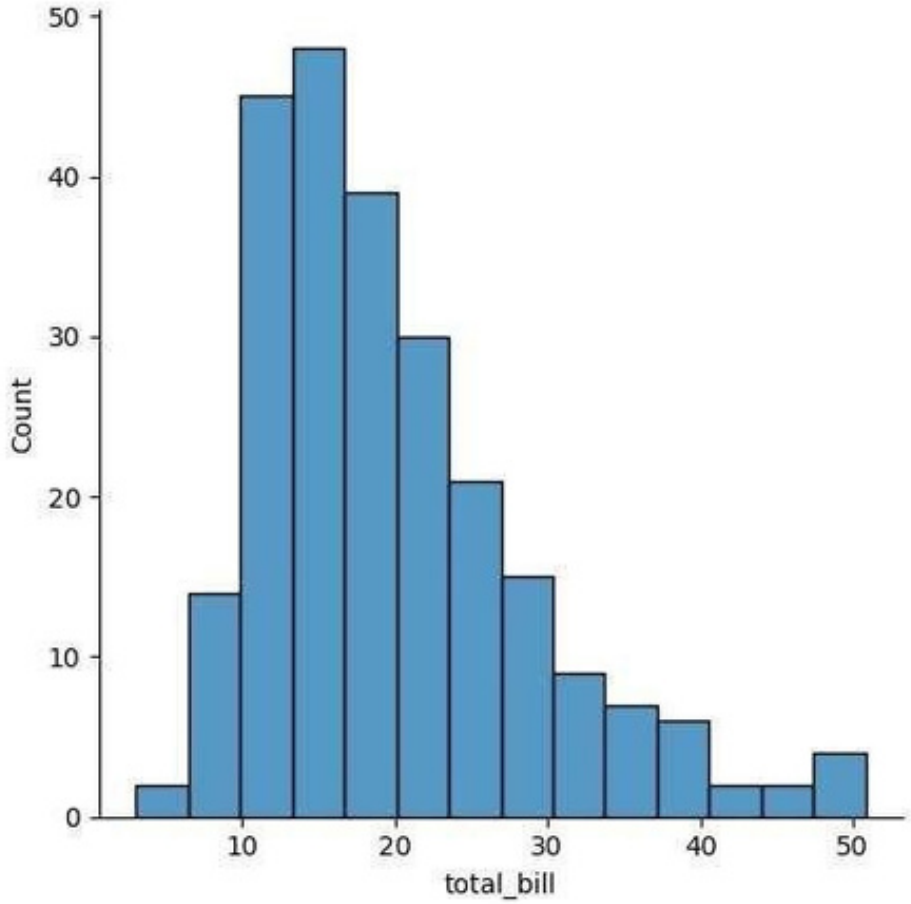
0

1

```
import seaborn as sns import pandas as pd import numpy as np import matplotlib.pyplot as plt

%matplotlib inline tips=sns.load_dataset('tips') tips.head()

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

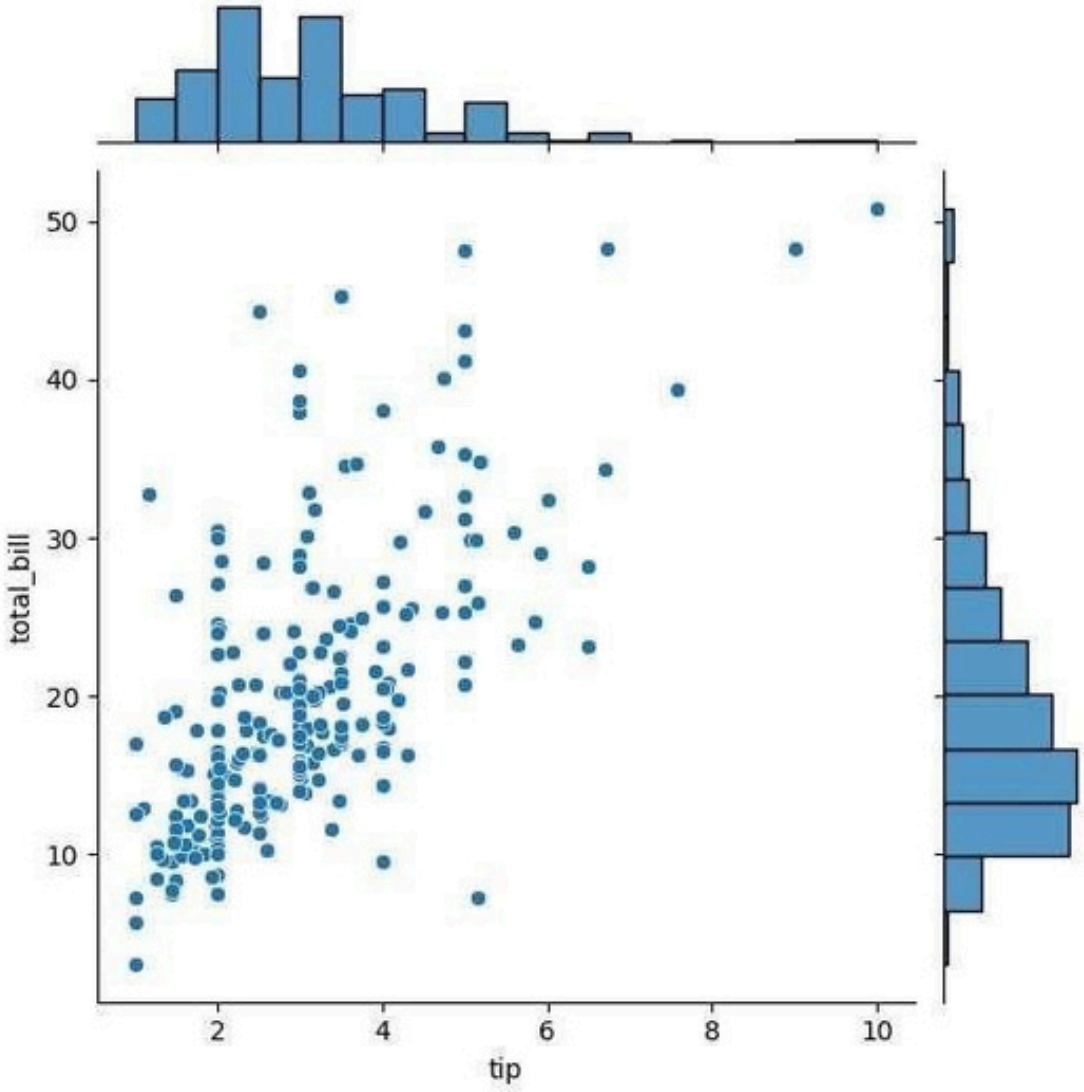



```
sns.displot(tips.total_bill,kde=False)
```



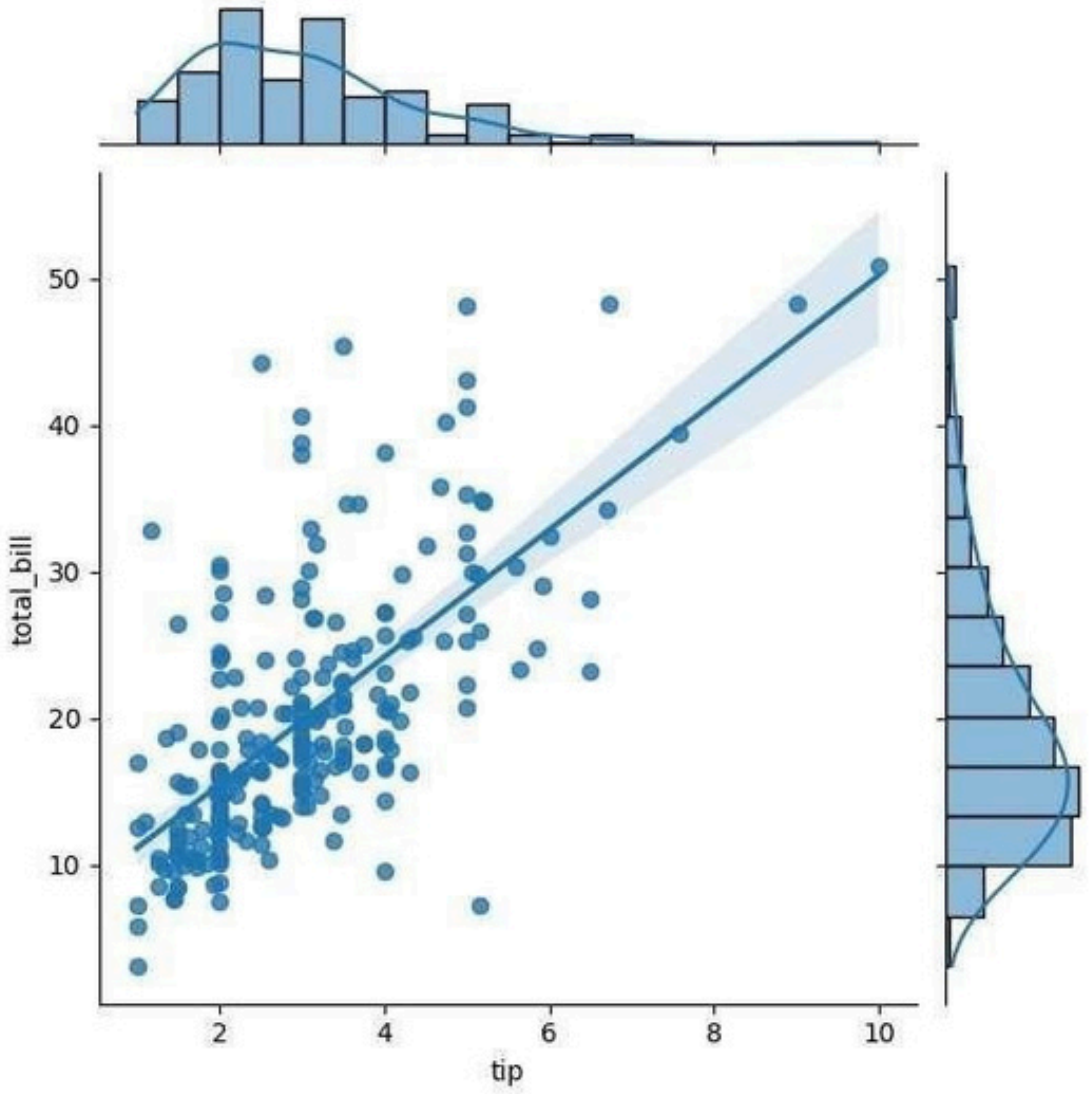

```
sns.jointplot(x=tips.tip,y=tips.total_bill)
```

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



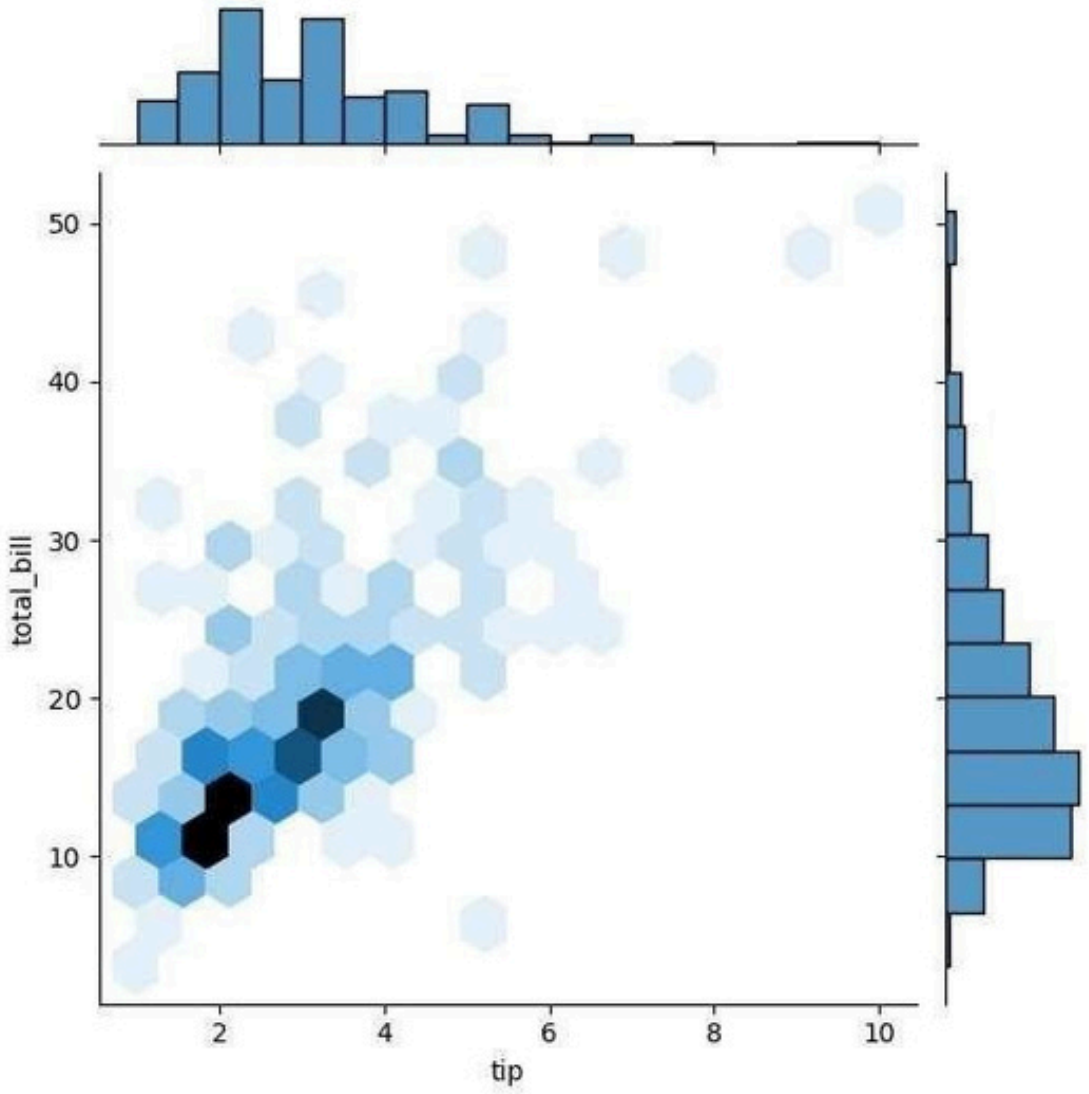

```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="reg")
```

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



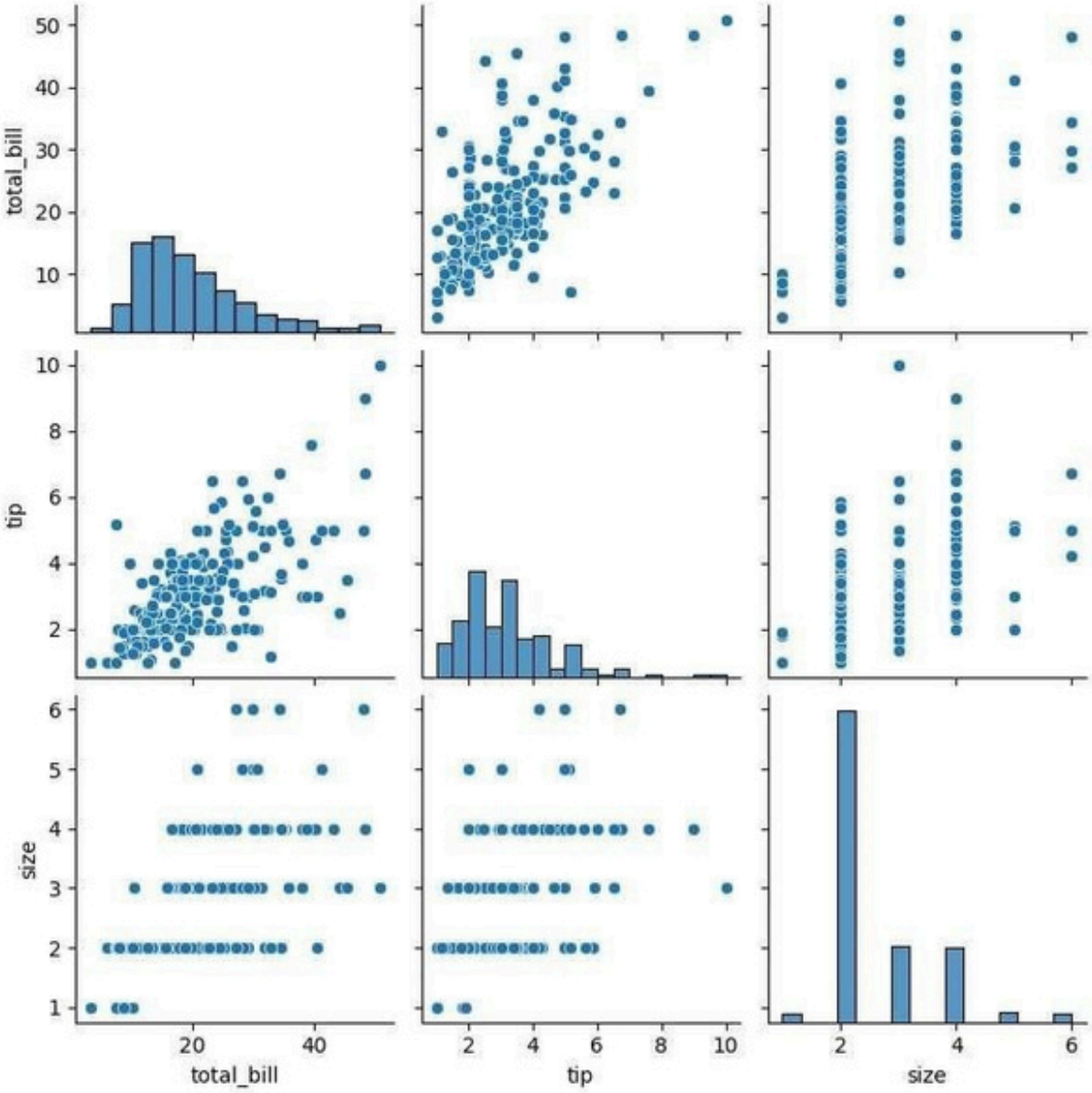

```
sns.jointplot(x=tips.tip,y=tips.total_bill,kind="hex")
```

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

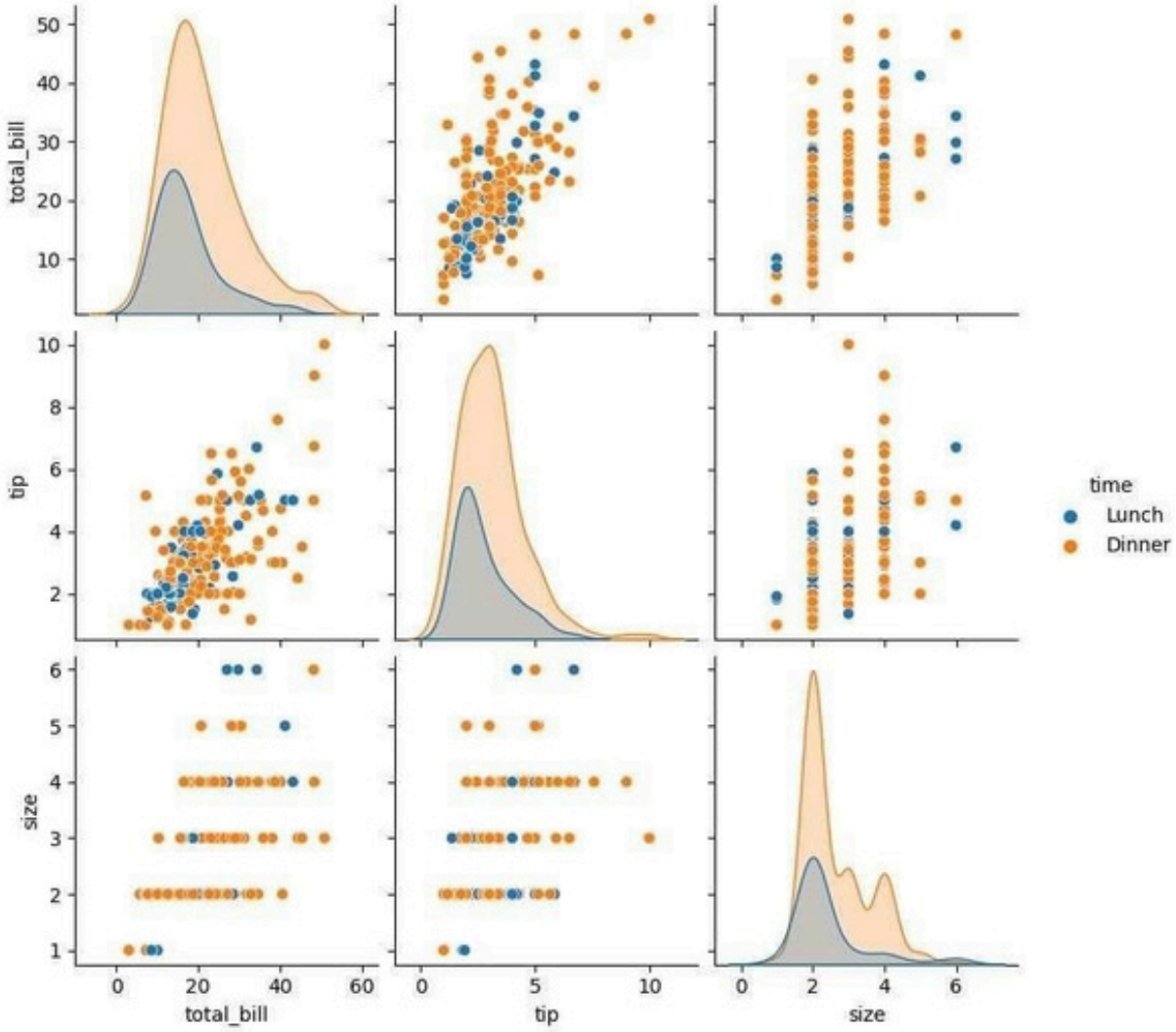



```
sns.pairplot(tips)
```

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

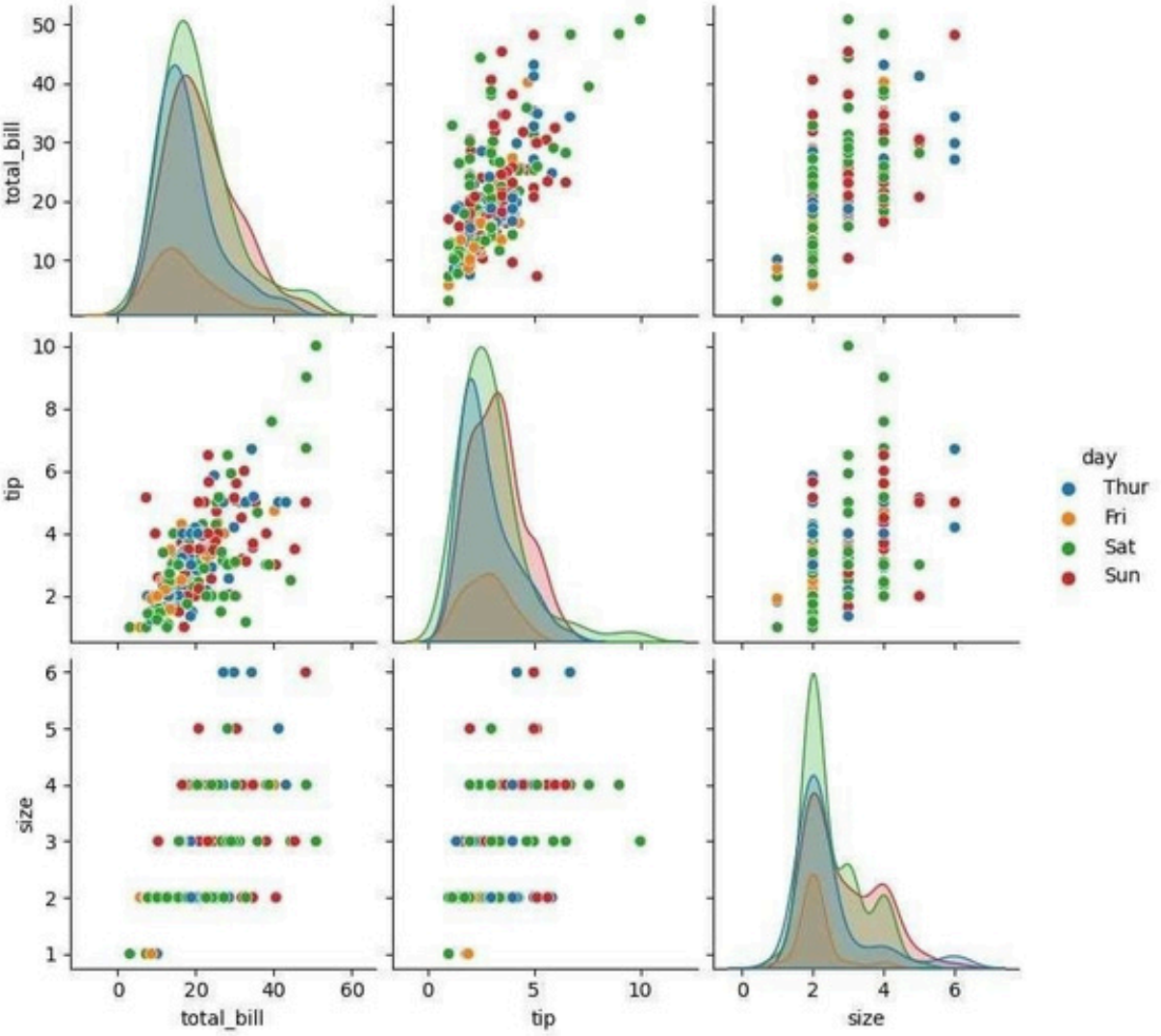



```
tips.time.value_counts()

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



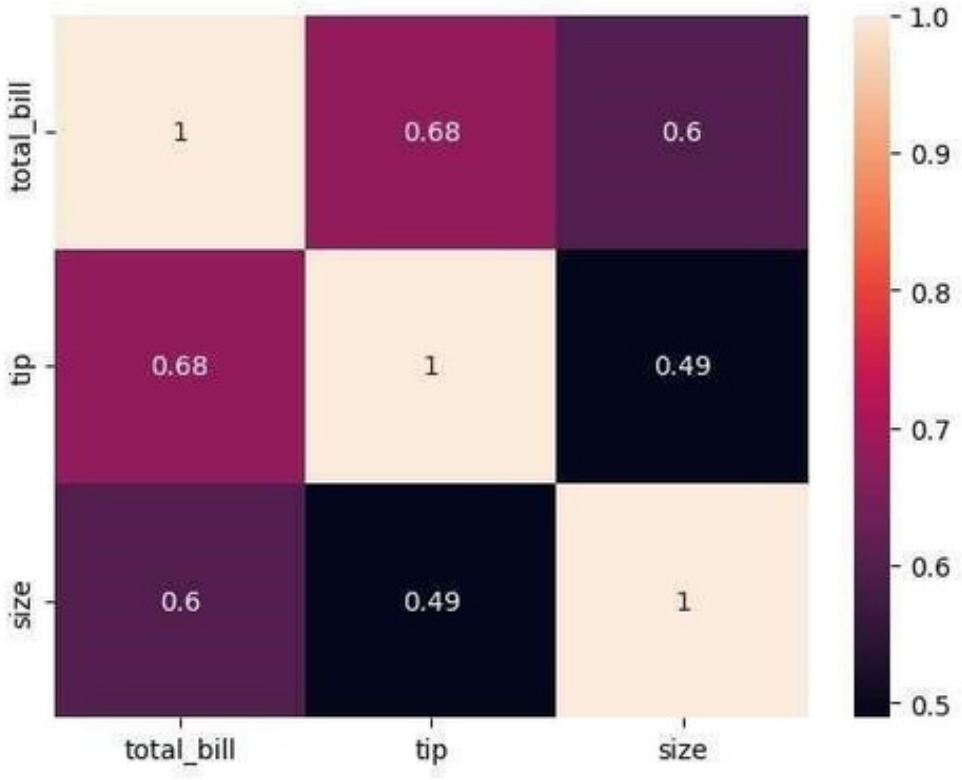

```
sns.pairplot(tips,hue='day')
```

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




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

```
<Axes:
```

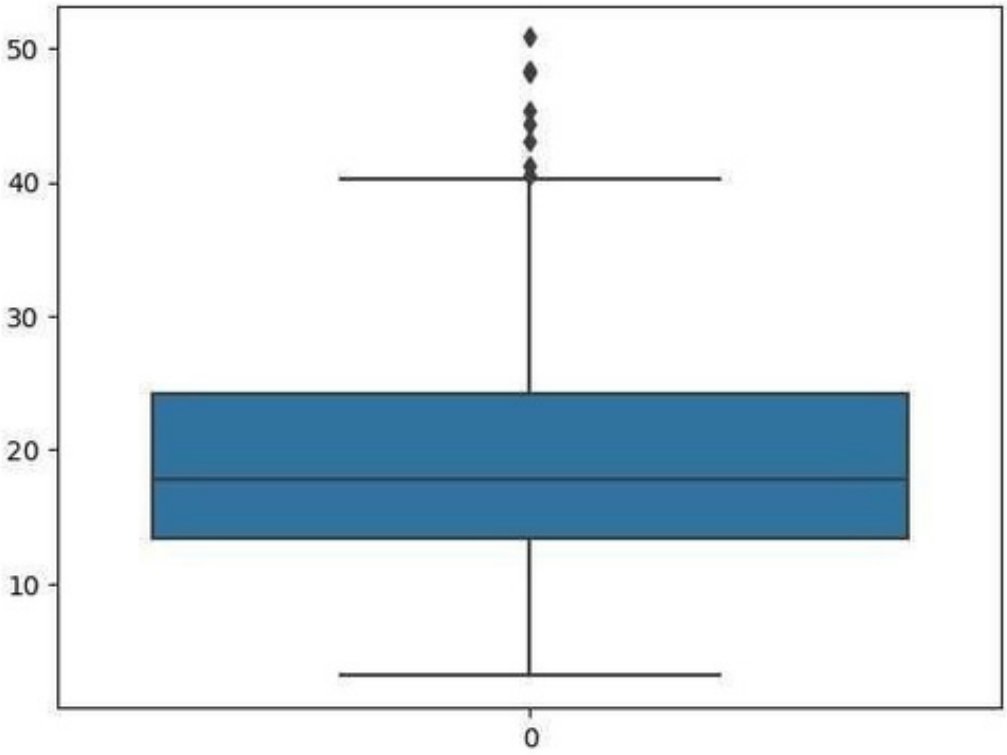


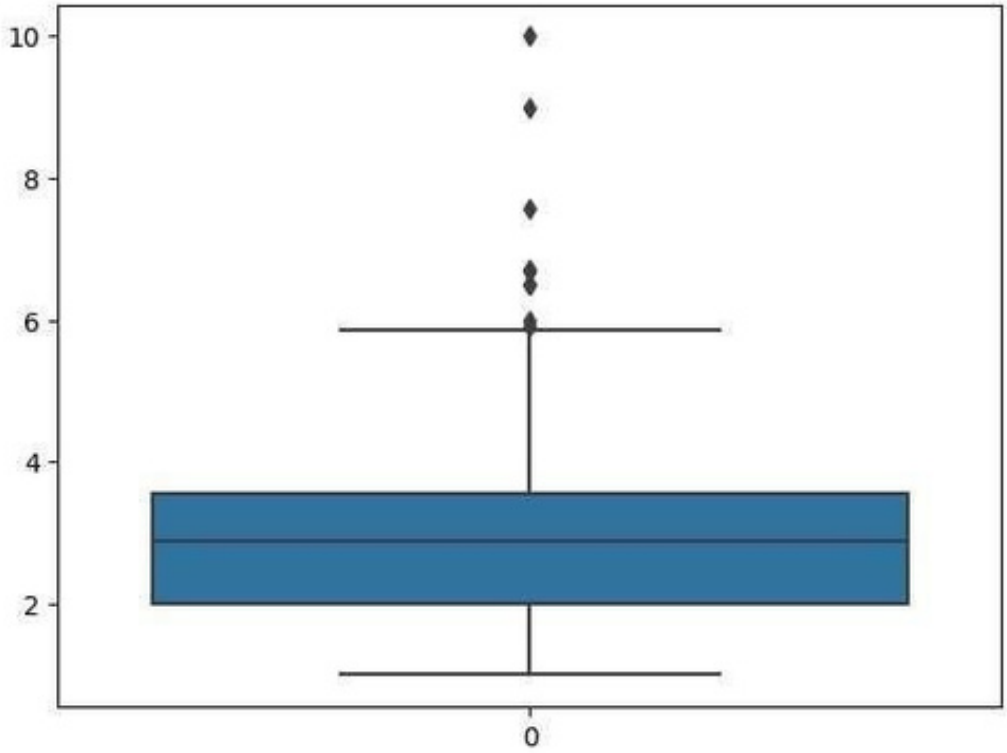
sns.boxplot(tips.total_bill)

<Axes:

sns.boxplot(tips.tip)

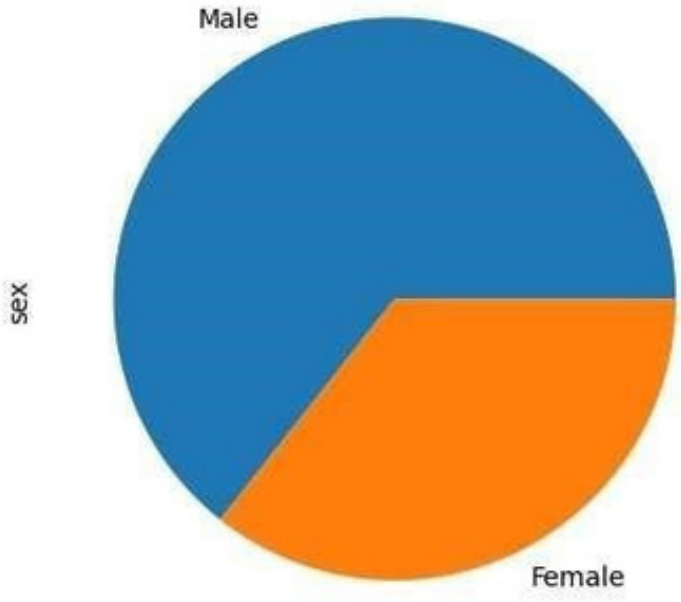
<Axes:






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

```
<Axes: ylabel='sex'
```




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

```
<Axes:
```

```
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()

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)

model.score(x_test,y_test)

model.coef_

model.intercept_
```

```
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)

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([[    19,  19000],
                        [    35,  20000],
       [    26,  43000],
       [    27,  57000],
       [    19,  76000],
       [    27,  58000],
       [    27,  84000],
       [    32, 150000],
       [    25,  33000],
       [    35,  65000],
       [    26,  80000],
       [    26,  52000],
       [    20,  86000],
       [    32,  18000],
       [    18,  82000],
       [    29,  80000],
       [    47,  25000],
```

```
[ 45, 26000],
[ 46, 28000],
[ 48, 29000],
[ 45, 22000],
[ 47, 49000],
[ 48, 41000],
[ 45, 22000],
[ 46, 23000],
[ 47, 20000],
[ 49, 28000],
[ 47, 30000],
[ 29, 43000],
[ 31, 18000],
[ 31, 74000],
[ 27, 137000],
[ 21, 16000],
[ 28, 44000],
[ 27, 90000],
[ 35, 27000],
[ 33, 28000],
[ 30, 49000],
[ 26, 72000],
[ 27, 31000],
[ 27, 17000],
[ 33, 51000],
[ 35, 108000],
[ 30, 15000],
[ 28, 84000],
[ 23, 20000],
[ 25, 79000],
[ 27, 54000],
```

```
[  30, 135000],
[  31,  89000],
[  24,  32000],
[  18,  44000],
[  29,  83000],
[  35,  23000],
[  27,  58000],
[  24,  55000],
[  23,  48000],
[  28,  79000],
[  22,  18000],
[  32, 117000],
[  27,  20000],
[  25,  87000],
```

```
[ 23, 66000],
[ 32, 120000],
[ 59, 83000],
```

```
[ 24, 58000],
```

```
    [  24,  19000],
    [  23,  82000],
    [  22,  63000],
    [  31,  68000],
    [  25,  80000],
    [  24,  27000],
    [  20,  23000],
    [  33, 113000],     [  32,
18000],
    [  34, 112000],
    [  18,  52000],
    [  22,  27000],
    [  28,  87000],
    [  26,  17000],
    [  30,  80000],
    [  39,  42000],
    [  20,  49000],
    [  35,  88000],
    [  30,  62000],
    [  31, 118000],
    [  24,  55000],
    [  28,  85000],
    [  26,  81000],
    [  35,  50000],
    [  22,  81000],
    [  30, 116000],
    [  26,  15000],
    [  29,  28000],
    [  29,  83000],
    [  35,  44000],
    [  35,  25000],
    [  28, 123000],
```

```
[   35,  73000],
[   28,  37000],
[   27,  88000],
[   28,  59000],
[   32,  86000],
[   33, 149000],
[   19,  21000],
[   21,  72000],
[   26,  35000],
[   27,  89000],
[   26,  86000],
[   38,  80000],
[   39,  71000],
```

```
[   37,  71000],
[   38,  61000],
[   37,  55000],
```

```
[   42,  80000],
```

```
[ 40, 57000],
[ 35, 75000],
[ 36, 52000],
[ 40, 59000],
[ 41, 59000],
[ 36, 75000],
[ 37, 72000],
[ 40, 75000],
[ 35, 53000],
[ 41, 51000],
[ 39, 61000],
[ 42, 65000],
[ 26, 32000],
[ 30, 17000],
[ 26, 84000],
[ 31, 58000],
[ 33, 31000],
[ 30, 87000],
[ 21, 68000],
[ 28, 55000],
[ 23, 63000],
[ 20, 82000],
[ 30, 107000],
[ 28, 59000],
[ 19, 25000],
[ 19, 85000],
[ 18, 68000],
[ 35, 59000],
[ 30, 89000],
[ 34, 25000],
[ 24, 89000],
```

```
[ 27, 96000],
[ 41, 30000],
[ 29, 61000],
[ 20, 74000],
[ 26, 15000],
[ 41, 45000],
[ 31, 76000],
[ 36, 50000],
[ 40, 47000],
[ 31, 15000],
[ 46, 59000],
[ 29, 75000],
[ 26, 30000],
[ 32, 135000],
```

```
[ 32, 100000],
[ 25, 90000],
[ 37, 33000],
```

```
[ 35, 38000],
```

```
[  33,  69000],
[  18,  86000],
[  22,  55000],
[  35,  71000],
[  29, 148000],
[  29,  47000],
[  21,  88000],
[  34, 115000],
[  26, 118000],
[  34,  43000],
[  34,  72000],
[  23,  28000],
[  35,  47000],
[  25,  22000],
[  24,  23000],
[  31,  34000],
[  26,  16000],
[  31,  71000],
[  32, 117000],
[  33,  43000],
[  33,  60000],
[  31,  66000],
[  20,  82000],
[  33,  41000],
[  35,  72000],
[  28,  32000],
[  24,  84000],
[  19,  26000],
[  29,  43000],
[  19,  70000],
[  28,  89000],
```

```
    [   34,  43000],

    [   30,  79000],

    [   20,  36000],

    [   26,  80000],

    [   35,  22000],

    [   35,  39000],

    [   49,  74000],

    [   39, 134000],      [   41,
71000],

    [   58, 101000],      [   47,
47000],

    [   55, 130000],

    [   52, 114000],

    [   40, 142000],
```

```
[ 46, 22000],
[ 48, 96000],
[ 52, 150000],
```

```
[ 59, 42000],
```

```
    [   35,  58000],
    [   47,  43000],
    [   60, 108000],
    [   49,  65000],
    [   40,  78000],
    [   46,  96000],
    [   59, 143000],
    [   41,  80000],
    [   35,  91000],
    [   37, 144000],
    [   60, 102000],
    [   35,  60000],
    [   37,  53000],
    [   36, 126000],
    [   56, 133000],
    [   40,  72000],
    [   42,  80000],
    [   35, 147000],      [   39,
42000],
    [   40, 107000],
    [   49,  86000],
    [   38, 112000],
    [   46,  79000],
    [   40,  57000],
    [   37,  80000],
    [   46,  82000],
    [   53, 143000],
    [   42, 149000],
    [   38,  59000],
    [   50,  88000],
    [   56, 104000],      [   41,
72000],
```

```
    [   51, 146000],      [   35,
50000],

    [   57, 122000],

    [   41,  52000],

    [   35,  97000],

    [   44,  39000],

    [   37,  52000],

    [   48, 134000],

    [   37, 146000],

    [   50,  44000],

    [   52,  90000],

    [   41,  72000],

    [   40,  57000],
```

```
[ 58, 95000],
[ 45, 131000],
[ 35, 77000],
```

```
[ 36, 144000],
```

```
    [   55, 125000],
    [   35,  72000],
    [   48,  90000],
    [   42, 108000],
    [   40,  75000],
    [   37,  74000],
    [   47, 144000],      [   40,
61000],
    [   43, 133000],
    [   59,  76000],
    [   60,  42000],
    [   39, 106000],
    [   57,  26000],
    [   57,  74000],
    [   38,  71000],
    [   49,  88000],
    [   52,  38000],
    [   50,  36000],
    [   59,  88000],
    [   35,  61000],
    [   37,  70000],
    [   52,  21000],
    [   48, 141000],
    [   37,  93000],
    [   37,  62000],
    [   48, 138000],
    [   41,  79000],
    [   37,  78000],
    [   39, 134000],
    [   49,  89000],
    [   55,  39000],
```

```
    [   37,  77000],

    [   35,  57000],

    [   36,  63000],

    [   42,  73000],

    [   43, 112000],      [   45,
79000],

    [   46, 117000],

    [   58,  38000],

    [   48,  74000],

    [   37, 137000],

    [   37,  79000],

    [   40,  60000],

    [   42,  54000],

    [   51, 134000],
```

```
[ 47, 113000],
[ 36, 125000],
[ 38, 50000],
```

```
[ 42, 70000],
```

```
[ 39, 96000],
[ 38, 50000],
[ 49, 141000],
[ 39, 79000],
[ 39, 75000],
[ 54, 104000],
[ 35, 55000],
[ 45, 32000],
[ 36, 60000],
[ 52, 138000],
[ 53, 82000],
[ 41, 52000],
[ 48, 30000],
[ 48, 131000],
[ 41, 60000],
[ 41, 72000],
[ 42, 75000],
[ 36, 118000],
[ 47, 107000],
[ 38, 51000],
[ 48, 119000],
[ 42, 65000],
[ 40, 65000],
[ 57, 60000],
[ 36, 54000],
[ 58, 144000],
[ 35, 79000],
[ 38, 55000],
[ 39, 122000],
[ 53, 104000],
[ 35, 75000],
```

```
[  38,  65000],
[  47,  51000],
[  47, 105000],
[  41,  63000],
[  53,  72000],
[  54, 108000],
[  39,  77000],
[  38,  61000],
[  38, 113000],
[  37,  75000],
[  42,  90000],
[  37,  57000],
[  36,  99000],
[  60,  34000],
```

```
[ 54, 70000],
[ 41, 72000],
[ 40, 71000],
```

```
[ 42, 54000],
```

```
[ 53, 34000],
[ 47, 50000],
[ 42, 79000],
[ 42, 104000],
[ 59, 29000],
[ 58, 47000],
[ 46, 88000],
[ 38, 71000],
[ 54, 26000],
[ 60, 46000],
[ 60, 83000],
[ 39, 73000],
[ 59, 130000],
[ 37, 80000],
[ 46, 32000],
[ 46, 74000],
[ 42, 53000],
[ 41, 87000],
[ 58, 23000],
[ 42, 64000],
[ 48, 33000],
[ 44, 139000],
[ 49, 28000],
[ 57, 33000],
[ 56, 60000],
[ 49, 39000],
[ 39, 71000],
[ 47, 34000],
[ 48, 35000],
```

```
    [   48,  33000],
    [   47,  23000],
    [   45,  45000],
    [   60,  42000],
    [   39,  59000],
    [   46,  41000],
    [   51,  23000],
    [   50,  20000],
    [   36,  33000],
    [   49,  36000]], dtype=int64)
```

label

```
array([0, 0, 0, 0, 0, 0, 0, 1, 0, 0
```

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

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

```
0,

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

0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,

0,

0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0,

0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,

```
0,

                0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 1,  0,

                1, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0,

                0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 0, 0,  1,
    1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 0, 0, 0, 1,

1,

    0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 0, 1,  0,

                1, 0, 1, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 0,  1,

    0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1,

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

```
from sklearn.model_selection import
train_test_split LogisticRegression

for i in range(1,401):
x_train,x_test,y_train,y_test=train_test_split(featur
es,label,test_siz e=0.2, random_state=42)
train_score=model.score(x_train,y_train)
```

```
 1, 1, 0,  1,

from sklearn.linear_model import
```

```
test_score=model.score(x_test,y_test)                    model=LogisticRegression()
test_score>train_score:      print("Test {} Train{}      model.fit(x_train,y_train)
Random State {}".format(

                                                                  if

Test 0.65 Train0.640625 Random State 1
                                                        test_score,train_score,i))
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 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

Test 0.65 Train0.640625 Random State 56

Test 0.65 Train0.640625 Random State 57

Test 0.65 Train0.640625 Random State 58

Test 0.65 Train0.640625 Random State 59

Test 0.65 Train0.640625 Random State 60

Test 0.65 Train0.640625 Random State 61

Test 0.65 Train0.640625 Random State 62

Test 0.65 Train0.640625 Random State 63

Test 0.65 Train0.640625 Random State 64

Test 0.65 Train0.640625 Random State 65

Test 0.65 Train0.640625 Random State 66

Test 0.65 Train0.640625 Random State 67

Test 0.65 Train0.640625 Random State 68

Test 0.65 Train0.640625 Random State 69

Test 0.65 Train0.640625 Random State 70

Test 0.65 Train0.640625 Random State 71

Test 0.65 Train0.640625 Random State 72

Test 0.65 Train0.640625 Random State 73

Test 0.65 Train0.640625 Random State 74

Test 0.65 Train0.640625 Random State 75

Test 0.65 Train0.640625 Random State 76

Test 0.65 Train0.640625 Random State 77

Test 0.65 Train0.640625 Random State 78

Test 0.65 Train0.640625 Random State 79

Test 0.65 Train0.640625 Random State 80

Test 0.65 Train0.640625 Random State 81

Test 0.65 Train0.640625 Random State 82

Test 0.65 Train0.640625 Random State 83

Test 0.65 Train0.640625 Random State 84

Test 0.65 Train0.640625 Random State 85

Test 0.65 Train0.640625 Random State 86

Test 0.65 Train0.640625 Random State 87

Test 0.65 Train0.640625 Random State 88

Test 0.65 Train0.640625 Random State 89

Test 0.65 Train0.640625 Random State 90

Test 0.65 Train0.640625 Random State 91

Test 0.65 Train0.640625 Random State 92

Test 0.65 Train0.640625 Random State 93

Test 0.65 Train0.640625 Random State 94

Test 0.65 Train0.640625 Random State 95

Test 0.65 Train0.640625 Random State 96

Test 0.65 Train0.640625 Random State 97

Test 0.65 Train0.640625 Random State 98

Test 0.65 Train0.640625 Random State 99

Test 0.65 Train0.640625 Random State 100

Test 0.65 Train0.640625 Random State 101

Test 0.65 Train0.640625 Random State 102

Test 0.65 Train0.640625 Random State 103

Test 0.65 Train0.640625 Random State 104

Test 0.65 Train0.640625 Random State 105

Test 0.65 Train0.640625 Random State 106

Test 0.65 Train0.640625 Random State 107

Test 0.65 Train0.640625 Random State 108

Test 0.65 Train0.640625 Random State 109

Test 0.65 Train0.640625 Random State 110

Test 0.65 Train0.640625 Random State 111

Test 0.65 Train0.640625 Random State 112

Test 0.65 Train0.640625 Random State 113

Test 0.65 Train0.640625 Random State 114

Test 0.65 Train0.640625 Random State 115

Test 0.65 Train0.640625 Random State 116

Test 0.65 Train0.640625 Random State 117

Test 0.65 Train0.640625 Random State 118

Test 0.65 Train0.640625 Random State 119

Test 0.65 Train0.640625 Random State 120

Test 0.65 Train0.640625 Random State 121

Test 0.65 Train0.640625 Random State 122

Test 0.65 Train0.640625 Random State 123

Test 0.65 Train0.640625 Random State 124

Test 0.65 Train0.640625 Random State 125

Test 0.65 Train0.640625 Random State 126

Test 0.65 Train0.640625 Random State 127

Test 0.65 Train0.640625 Random State 128

Test 0.65 Train0.640625 Random State 129

Test 0.65 Train0.640625 Random State 130

Test 0.65 Train0.640625 Random State 131

Test 0.65 Train0.640625 Random State 132

Test 0.65 Train0.640625 Random State 133

Test 0.65 Train0.640625 Random State 134

Test 0.65 Train0.640625 Random State 135

Test 0.65 Train0.640625 Random State 136

Test 0.65 Train0.640625 Random State 137

Test 0.65 Train0.640625 Random State 138

Test 0.65 Train0.640625 Random State 139

Test 0.65 Train0.640625 Random State 140

Test 0.65 Train0.640625 Random State 141

Test 0.65 Train0.640625 Random State 142

Test 0.65 Train0.640625 Random State 143

Test 0.65 Train0.640625 Random State 144

Test 0.65 Train0.640625 Random State 145

Test 0.65 Train0.640625 Random State 146

Test 0.65 Train0.640625 Random State 147

Test 0.65 Train0.640625 Random State 148

Test 0.65 Train0.640625 Random State 149

Test 0.65 Train0.640625 Random State 151

Test 0.65 Train0.640625 Random State 152

Test 0.65 Train0.640625 Random State 153

Test 0.65 Train0.640625 Random State 154

Test 0.65 Train0.640625 Random State 155

Test 0.65 Train0.640625 Random State 156

Test 0.65 Train0.640625 Random State 157

Test 0.65 Train0.640625 Random State 158

Test 0.65 Train0.640625 Random State 159

Test 0.65 Train0.640625 Random State 160

Test 0.65 Train0.640625 Random State 161

Test 0.65 Train0.640625 Random State 162

Test 0.65 Train0.640625 Random State 163

Test 0.65 Train0.640625 Random State 164

Test 0.65 Train0.640625 Random State 165

Test 0.65 Train0.640625 Random State 166

Test 0.65 Train0.640625 Random State 167

Test 0.65 Train0.640625 Random State 168

Test 0.65 Train0.640625 Random State 169

Test 0.65 Train0.640625 Random State 170

Test 0.65 Train0.640625 Random State 171

Test 0.65 Train0.640625 Random State 172

Test 0.65 Train0.640625 Random State 173

Test 0.65 Train0.640625 Random State 174

Test 0.65 Train0.640625 Random State 175

Test 0.65 Train0.640625 Random State 176

Test 0.65 Train0.640625 Random State 177

Test 0.65 Train0.640625 Random State 178

Test 0.65 Train0.640625 Random State 179

Test 0.65 Train0.640625 Random State 180

Test 0.65 Train0.640625 Random State 181

Test 0.65 Train0.640625 Random State 182

Test 0.65 Train0.640625 Random State 183

Test 0.65 Train0.640625 Random State 184

Test 0.65 Train0.640625 Random State 185

Test 0.65 Train0.640625 Random State 186

Test 0.65 Train0.640625 Random State 187

Test 0.65 Train0.640625 Random State 188

Test 0.65 Train0.640625 Random State 189

Test 0.65 Train0.640625 Random State 190

Test 0.65 Train0.640625 Random State 191

Test 0.65 Train0.640625 Random State 150

Test 0.65 Train0.640625 Random State 192

Test 0.65 Train0.640625 Random State 193

Test 0.65 Train0.640625 Random State 194

Test 0.65 Train0.640625 Random State 195 Test 0.65 Train0.640625 Random State 196

Test 0.65 Train0.640625 Random State 197

Test 0.65 Train0.640625 Random State 240

Test 0.65 Train0.640625 Random State 241

Test 0.65 Train0.640625 Random State 242

Test 0.65 Train0.640625 Random State 243

Test 0.65 Train0.640625 Random State 244 Test 0.65 Train0.640625 Random State 245

Test 0.65 Train0.640625 Random State 246

Test 0.65 Train0.640625 Random State 247

Test 0.65 Train0.640625 Random State 248

Test 0.65 Train0.640625 Random State 250

Test 0.65 Train0.640625 Random State 251

Test 0.65 Train0.640625 Random State 252

Test 0.65 Train0.640625 Random State 253

Test 0.65 Train0.640625 Random State 254

Test 0.65 Train0.640625 Random State 255

Test 0.65 Train0.640625 Random State 256

Test 0.65 Train0.640625 Random State 257

Test 0.65 Train0.640625 Random State 258

Test 0.65 Train0.640625 Random State 259

Test 0.65 Train0.640625 Random State 260

Test 0.65 Train0.640625 Random State 261

Test 0.65 Train0.640625 Random State 262

Test 0.65 Train0.640625 Random State 263

Test 0.65 Train0.640625 Random State 264

Test 0.65 Train0.640625 Random State 265

Test 0.65 Train0.640625 Random State 266

Test 0.65 Train0.640625 Random State 267

Test 0.65 Train0.640625 Random State 268

Test 0.65 Train0.640625 Random State 269

Test 0.65 Train0.640625 Random State 270

Test 0.65 Train0.640625 Random State 271

Test 0.65 Train0.640625 Random State 272

Test 0.65 Train0.640625 Random State 273 Test 0.65 Train0.640625 Random State 274 Test 0.65 Train0.640625 Random State 275 Test 0.65 Train0.640625 Random State 276 Test 0.65 Train0.640625 Random State 277 Test 0.65 Train0.640625 Random State 278 Test 0.65 Train0.640625 Random State 279 Test 0.65 Train0.640625 Random State 280 Test 0.65 Train0.640625 Random State 281 Test 0.65 Train0.64062 Random State 283 Test 0.65 Train0.640625 Random State 284 Test 0.65 Train0.640625 Random State 285 Test 0.65 Train0.640625 Random State 286 Test 0.65 Train0.640625 Random State 287 Test 0.65 Train0.640625 Random State 288 Test 0.65 Train0.640625 Random State 289 Test 0.65 Train0.640625 Random State 290 Test 0.65 Train0.640625 Random State 291 Test 0.65 Train0.640625 Random State 292 Test 0.65 Train0.640625 Random State 293 Test 0.65 Train0.640625 Random State 294	5

Test 0.65 Train0.640625 Random State 249

Test 0.65 Train0.640625 Random State 282

Test 0.65 Train0.640625 Random State 295

Test 0.65 Train0.640625 Random State 296

Test 0.65 Train0.640625 Random State 330

Test 0.65 Train0.640625 Random State 331

Test 0.65 Train0.640625 Random State 332

Test 0.65 Train0.640625 Random State 333

Test 0.65 Train0.640625 Random State 334

Test 0.65 Train0.640625 Random State 335

Test 0.65 Train0.640625 Random State 336

Test 0.65 Train0.640625 Random State 337

Test 0.65 Train0.640625 Random State 338

Test 0.65 Train0.640625 Random State 339

Test 0.65 Train0.640625 Random State 340

Test 0.65 Train0.640625 Random State 341

Test 0.65 Train0.640625 Random State 342

Test 0.65 Train0.640625 Random State 343

Test 0.65 Train0.640625 Random State 344

Test 0.65 Train0.640625 Random State 345

Test 0.65 Train0.640625 Random State 346

Test 0.65 Train0.640625 Random State 347

Test 0.65 Train0.640625 Random State 348

Test 0.65 Train0.640625 Random State 349

Test 0.65 Train0.640625 Random State 350

Test 0.65 Train0.640625 Random State 351

Test 0.65 Train0.640625 Random State 352

Test 0.65 Train0.640625 Random State 353

Test 0.65 Train0.640625 Random State 354

Test 0.65 Train0.640625 Random State 355

Test 0.65 Train0.640625 Random State 356

Test 0.65 Train0.640625 Random State 357

Test 0.65 Train0.640625 Random State 358

Test 0.65 Train0.640625 Random State 359

Test 0.65 Train0.640625 Random State 360

Test 0.65 Train0.640625 Random State 361

Test 0.65 Train0.640625 Random State 362

Test 0.65 Train0.640625 Random State 363

Test 0.65 Train0.640625 Random State 364

Test 0.65 Train0.640625 Random State 365

Test 0.65 Train0.640625 Random State 366

Test 0.65 Train0.640625 Random State 367

Test 0.65 Train0.640625 Random State 368

Test 0.65 Train0.640625 Random State 369

Test 0.65 Train0.640625 Random State 370

Test 0.65 Train0.640625 Random State 371

Test 0.65 Train0.640625 Random State 372

Test 0.65 Train0.640625 Random State 373

Test 0.65 Train0.640625 Random State 374

Test 0.65 Train0.640625 Random State 375

Test 0.65 Train0.640625 Random State 376

Test 0.65 Train0.640625 Random State 377

Test 0.65 Train0.640625 Random State 378

Test 0.65 Train0.640625 Random State 379

Test 0.65 Train0.640625 Random State 380

Test 0.65 Train0.640625 Random State 381

Test 0.65 Train0.640625 Random State 382

Test 0.65 Train0.640625 Random State 383

Test 0.65 Train0.640625 Random State 384

Test 0.65 Train0.640625 Random State 385

Test 0.65 Train0.640625 Random State 386

Test 0.65 Train0.640625 Random State 387

Test 0.65 Train0.640625 Random State 388

Test 0.65 Train0.640625 Random State 389

Test 0.65 Train0.640625 Random State 390

Test 0.65 Train0.640625 Random State 391

Test 0.65 Train0.640625 Random State 392

Test 0.65 Train0.640625 Random State 393

Test 0.65 Train0.640625 Random State 394

Test 0.65 Train0.640625 Random State 395

Test 0.65 Train0.640625 Random State 396

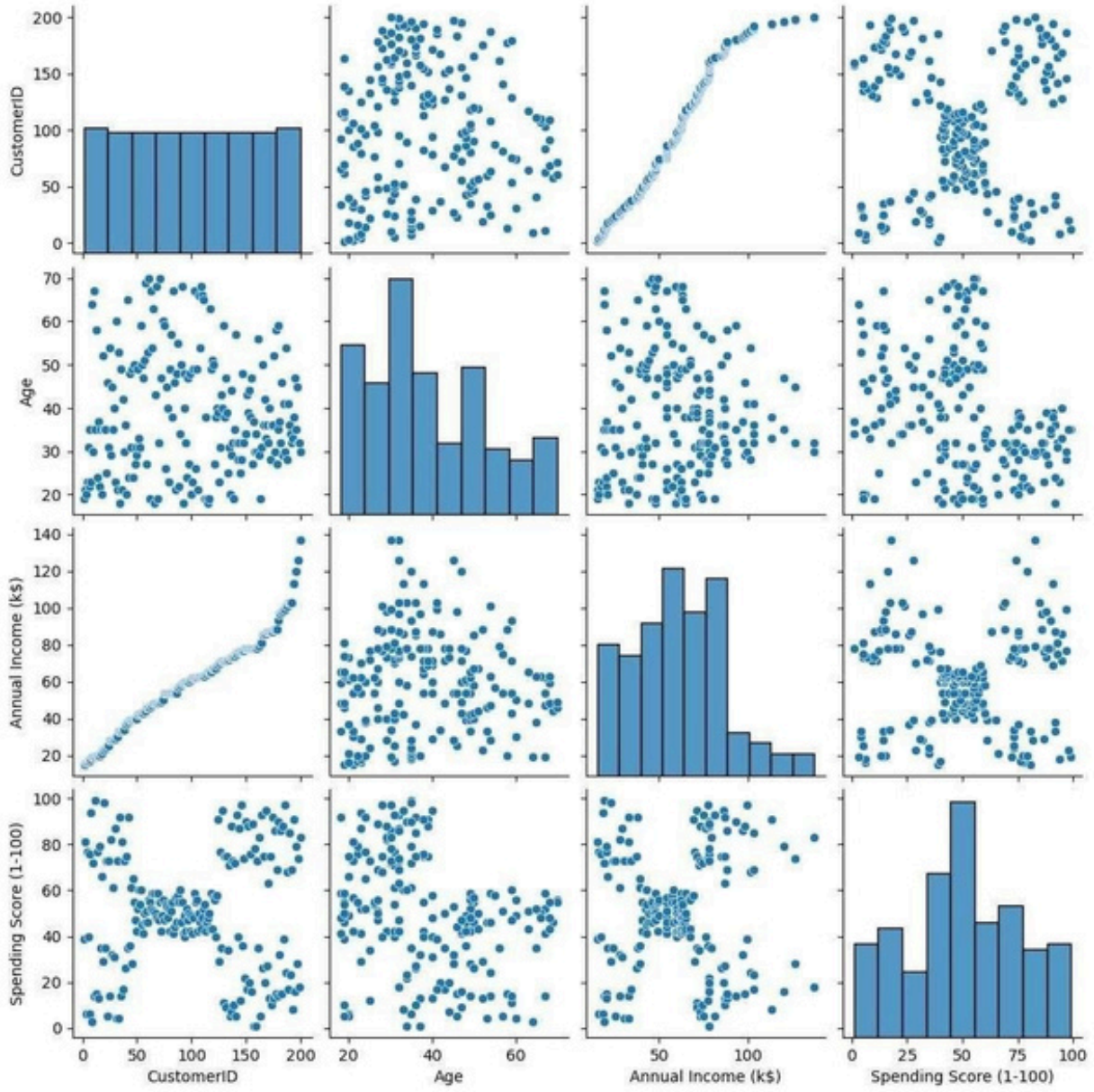
Test 0.65 Train0.640625 Random State 397

```
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)

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)))
```

```
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))
```

```
from sklearn.metrics import confusion_matrix confusion_matrix(label,model_KNN.predict(features))

from sklearn.metrics import classification_report

print(classification_report(label,model_KNN.predict(features)))
```

```
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),

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

sns.pairplot(df)
```




```
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/pandasdocs/stable/user_guide/indexing.html#  returning-a-view-versus-a-copy

                                                                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()
```

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(

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

OMP_NUM_THREADS=1.

warnings.warn(

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

OMP_NUM_THREADS=1.

warnings.warn(

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 OMP_NUM_THREADS=1.

_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(

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

OMP_NUM_THREADS=1.   warnings.warn(

```
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

                                                                                                    )

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

- = [20, 22,

23]

- = [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.
```